The Role of Housing Wealth in Financial Planning for Retirement

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The role of housing wealth in financial planning for retirement

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Housing wealth is typically the largest component of retirees' portfolios. Although economic theory predicts that retirees would benefit from using housing wealth as a source of retirement funding, the take-up of enabling products and approaches is low. This thesis addresses three key areas in the utilization of housing wealth in retirement: (i) identification of the preferred home equity release approach for different types of households; (ii) exploration of means to address behavioral impediments to the utilization of housing wealth through equity release products; (iii) investigation of potential demand for long-term care insurance (LTCI) financed through home equity release.

Chapter 3 investigates the preferred home equity release approach for retirement, given available options (i.e., downsizing, reverse mortgages, the government-offered Pension Loans Scheme, and home reversion–type schemes) and reflects the current tax, superannuation, and age pension rules in Australia. We use state-of-the-art economic and actuarial modeling to identify the preferred approach for the use of housing wealth by Australian retirees with different marital status, wealth portfolios, and preferences.

Chapter 4 uses an online experimental survey administered to a representative sample of Australian (pre-)retiree homeowners to explore whether information framing to address mental accounting and narrow choice bracketing can enhance the demand for reverse mortgages. The information framing to address mental accounting significantly increases the stated demand for reverse mortgages.

Chapter 5 presents the results of an online experimental survey administered to a representative sample of Chinese (pre-)retiree homeowners to investigate the demand for LTCI financed through home equity release. We find that access to home equity release products significantly increases the stated demand for LTCI and that the preferred approach is to use a reverse mortgage.

Overall, the findings in this thesis confirm that retirees would benefit from using housing wealth to finance retirement. The results also identify approaches to reduce the gap between theoretical and actual demand for home equity release products. The findings provide evidence that government and private providers can use to address barriers to increasing interest in and take-up of home equity release products and to develop new products to enhance the utilization of housing wealth in retirement.

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Abstract

Housing wealth is typically the largest component of retirees' portfolios. Although economic theory predicts that retirees would benefit from using housing wealth as a source of retirement funding, the take-up of enabling products and approaches is low. This thesis addresses three key areas in the utilization of housing wealth in retirement: (i) identification of the preferred home equity release approach for different types of households; (ii) exploration of means to address behavioral impediments to the utilization of housing wealth through equity release products; (iii) investigation of potential demand for long-term care insurance (LTCI) financed through home equity release.

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Chapter 4 uses an online experimental survey administered to a representative sample of Australian (pre-)retiree homeowners to explore whether information framing to address mental accounting and narrow choice bracketing can enhance the demand for reverse mortgages. The information framing to address mental accounting significantly increases the stated demand for reverse mortgages.

Chapter 5 presents the results of an online experimental survey administered to a representative sample of Chinese (pre-)retiree homeowners to investigate the demand for LTCI financed through home equity release. We find that access to home equity release products significantly increases the stated demand for LTCI and that the preferred approach is to use a reverse mortgage.

Overall, the findings in this thesis confirm that retirees would benefit from using housing wealth to finance retirement. The results also identify approaches to reduce the gap between theoretical and actual demand for home equity release products. The findings provide evidence that government and private providers can use to address barriers to increasing interest in and take-up of home equity release products and to develop new products to enhance the utilization of housing wealth in retirement.

Publications and Presentations

List of presentations

- A version of Chapter 3 "Preferred home equity release approach for retirement" has been presented to the public at the following conference:
    - **2021 All-Actuaries Virtual Summit**, "Optimal Use of Housing Wealth in Retirement", 19 May 2021.
- A version of Chapter 4 'Demand for reverse mortgages: Behavioral explanations' has been presented to the public at the following conferences:
    - **American Risk and Insurance Association Annual Meeting**, "Demand for reverse mortgages: Behavioral explanations", 6 Aug 2021.
    - **Asian-Pacific Risk and Insurance Association Annual Meeting**, "Demand for reverse mortgages: Behavioral explanations", 27 July 2021.
    - **24th International Congress on Insurance: Mathematics and Economics**, "Demand for reverse mortgages: Behavioral explanations", 27 July 2021.
    - **University of New South Wales, Ph.D. Seminar**, "Demand for reverse mortgages: Behavioral explanations", 3 December 2020.
    - **28th Colloquium on Pensions and Retirement Research**, "Demand for reverse mortgages: Behavioral explanations", 2 December 2020.
    - **20/20 All-Actuaries Virtual Summit**, "Reverse mortgage demand: The role of mental accounting and choice bracketing", 5 August 2020.

- A version of Chapter 5 "Long-term care insurance financing using home equity release: Evidence from an experimental study" has been presented to the public at the following conferences:

    - **World Risk and Insurance Economics Congress 2020**, "Long-term care insurance financing using home equity release: Evidence from an experimental study", 3 August 2020.

    - **Netspar Online International Pension Workshop 2021**, "Long-term care insurance financing using home equity release: Evidence from an experimental study", 20 January 2021.

    - **Online International Conference in Actuarial Science, Data Science and Finance**, "Long-term care insurance financing using home equity release: Evidence from an experimental study", 28 April 2020.

    - **10th Australasian Actuarial Education and Research Symposium**, "Long-term care insurance financing using home equity release: Evidence from an experimental study", 28 November 2019.

    - **5th Annual Workshop on Population Ageing and the Chinese Economy**, "Long-term care insurance financing using home equity release: Evidence from an experimental study", 15 July 2019.

    - **23rd International Congress on Insurance: Mathematics and Economics**, "Long-term care insurance financing using home equity release: Evidence from an experimental study", 10 July 2019.

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Chapter 1

Introduction

1.1 Motivation

This thesis focuses on identifying the benefits of utilizing housing wealth in retirement and investigating reasons for the low take-up rate of home equity release products and approaches. The thesis analyses data from Australia and China. Both countries are now facing a severe population aging and have policy interest in their home equity release markets. Although these countries share some similarities, the institutional settings (e.g. social insurance) and the demographic factors (e.g. wealth level) are significantly different, which lead to different behaviors in using the housing wealth.. The insights from this thesis would possibly apply to countries with similar institutional settings that are developing and enhancing home equity release products and approaches.

Notably, households in Australia and China prefer to store their wealth in housing. Overall, 76% of Australian households are homeowners, and these homeowners store more than 60% of their wealth in housing (Australian Treasury, 2020). In China, 96% of urban households are homeowners, and these homeowners store more than 74% of their wealth in housing (People's Bank of China, 2020). Additionally, the housing markets in these countries have grown substantially over the last decade, with an average annual house price growth rate of 6.6% in Australia (Chen *et al*., 2020) and 7.4% in China (Bank for International Settlements, 2021). These numbers suggest that retired homeowners can improve their retirement living standards by using housing

wealth. Hence, there is potential to develop public and private home equity release programs to enhance retirees' living standards.

Apart from the housing statistics, we are also motivated by helping retirees to improve their retirement living standards, and providing advice to key stakeholders in developing the home equity release markets. Notably, many retirees prefer to age in place (Productivity Commission, 2015; Ratcliffe *et al*., 2020). In particular, one of the most important benefits of remaining in the same home is to avoid the moving cost. The well-known home equity release method of downsizing would likely incur high moving costs even if the retirees remain in the same local community, though this method has other potential benefits (such as moving to an age-appropriate home) which are beyond the scope of the discussion in this thesis. Financial products such as reverse mortgages and home reversion can help retirees improve retirement living standards. However, most retirees are not utilizing their housing wealth through these products. This thesis aims to demonstrate the benefits of these products to retirees, explain the low demand for these products, and suggest possible ways to improve their low take-up rates.

On the other hand, product design and the sales process are also important in affecting retirees' decision-making processes in relation to using these products. Home equity release products are complex, and many retirees are very cautious about any products involving their homes. Therefore, we aim to develop and test easy-to-understand product designs and information framing to enhance potential customers' product understanding, which can also help financial advisers improve the sales process. Furthermore, we acknowledge that policymakers can play an important role in developing these markets. Complex financial products are generally heavily regulated, which may discourage the development of home equity release markets. As such, we are inspired to provide advice based on our findings in Chapter 3, Chapter 4, and Chapter 5.

A growing number of academic studies suggest using home equity release products since they are economically valuable and can increase retirement income even though retirees using these products can face extra risks. Two main types of home equity release products are discussed in the academic literature: reverse mortgages and home reversion schemes. Reverse mortgages are loan arrangements in which retirees do not have to repay any amount borrowed until they move out or die. Home reversion schemes are partial sale contracts of one's current home. Ong (2008) suggested that reverse mortgages could help single female retirees with low incomes to improve their living standards. Davidoff (2009) introduced reverse mortgages into a lifecycle model and showed that using reverse mortgages to release housing wealth can enhance retirees' living standards. Other studies, such as those of Huang *et al.* (2013), Hanewald *et al.* (2016), Nakajima and Telyukova (2017), and Shao *et al.* (2019), extended lifecycle models to incorporate different features and financial products. These studies shared a common conclusion: retirees' living standard is enhanced when housing wealth is utilized through home equity release products. Although these studies identified the benefits of using housing wealth, there remains a gap in the literature in terms of identifying the preferred home equity release approach under relevant Australia Age Pension means tests, superannuation, and tax rules.

Although home equity release products can potentially improve retirees' living standards, their take-up rate is low. For products such as reverse mortgages, this phenomenon can be described as the "reverse mortgage puzzle." This thesis investigates both reverse mortgages and home reversion. Stated demand studies, such as Davidoff *et al*. (2017) for the US, Dillingh *et al*. (2017) for the Netherlands, Fornero *et al*. (2016) for Italy, and Hanewald *et al.* (2020) for China, attempted to uncover the reasons contributing to the disparity between theoretical and actual demand, such as gender, marital status, non-housing wealth, and product knowledge. The findings of the aforementioned studies can

potentially identify the target population and resolve the reverse mortgage puzzle. However, there is little research on behavioral impediments to the utilization of home equity release products to date.

An additional benefit of developing home equity release products is the potential to improve the take-up rate of long-term care insurance. Due to population aging and a rapid increase in life expectancy, governments and retirees face higher long-term care risks and associated expenditures. Multiple studies, including Sloan and Norton (1997), Davidoff (2010), and Boyer *et al.* (2017), suggested that housing wealth crowds out long-term care insurance demand when housing wealth is illiquid. On the other hand, Davidoff (2010), Hanewald *et al.* (2016), Nakajima and Telyukova (2017), and Shao *et al.* (2019) found that retirees would enjoy utility gains when they use long-term care insurance with home equity release products. Recently, Achou (2021) built a lifecycle model to study these two products. He finds a small increase in long-term care insurance demand when home equity release products are available. While the literature has been focused on theoretical aspects, there is a lack of stated demand studies of long-term care insurance using home equity release as the funding mechanism.

1.2   Research objectives

This thesis aims to achieve the following: 1) help retirees improve retirement living standards by increasing retirement income; 2) enhance the development and awareness of the home equity release market; 3) inform policymakers about government-funded home equity release products and the private market regulations by answering the following research questions:

1. As measured by expected utility, what is the preferred approach (among downsizing, using reverse mortgages, PLS, and home reversions) for using home equity?

      a. What is the equivalent lump-sum gain compared to not utilizing housing wealth in retirement?

      b. For households with different economic situations and preferences, would the preferred approach for using home equity change?

2. What is the stated demand for reverse mortgages?

      a. Would information framing offset potential behavioral impediments on reverse mortgage demand?

      b. How does the stated demand for reverse mortgages differ for different types of retirees?

3. Will long-term care insurance demand be enhanced through access to housing wealth to finance the premium?

      a. How does the stated demand differ for different types of retirees?

      b. Which home equity release approach do retirees prefer to fund long-term care insurance premiums: reverse mortgages or home reversion?

We acknowledge that there are some concerns in using home equity release products, such as retirees facing additional risks (interest rate risks, and house price risks). However, this thesis only focuses on the issues listed in the abovementioned research questions.

1.3   Summary of the research

Chapter 3 of this thesis uses the expected utility framework to compare several approaches that involve using different home equity release products and identify the preferred approach under Australian means-tested Age Pension, superannuation, and tax rules. The approaches we considered in a multi-period simulation model are: (i) not utilizing housing wealth, (ii) downsizing, (iii) private reverse mortgages, (iv) the government-funded reverse mortgage

Pension Loans Scheme (PLS), and (v) home reversion schemes. The simulation process consists of stochastic mortality and macroeconomic variable modeling to replicate Australian households' retirement expenditure.

The results of Chapter 3 indicate that all home equity release approaches except downsizing would be beneficial to most retirees. Retirees who prefer consumption more and require more liquidity would find private reverse mortgages more attractive. However, households that are more concerned about house price growth would tend to use home reversion schemes and downsizing. This study has a similar conclusion to the previous literature on this topic (Davidoff, 2009; Hanewald *et al*., 2016; Nakajima and Telyukova, 2017; Shao *et al*., 2019). However, the preferred approach depends on retirees' preferences. Hence, this chapter confirms that home equity release approaches, especially using the PLS, would enhance retirement living standards.

Chapter 4 of this thesis investigates whether information framing can offset the behavioral impediments to the utilization of home equity release products. Per the findings in Chapter 3 and existing academic literature, it is economically valuable for retirees to use home equity release products. However, the demand for these products (e.g., reverse mortgages) is low. Although numerous studies have attempted to explain the reverse mortgage puzzle, few have focused on behavioral factors. Since there is a growing strand of literature seeking behavioral explanations for retirees' financial decisions, we designed, fielded, and analyzed an experimental survey to uncover the stated demand for reverse mortgages and determine whether behavioral factors such as *mental accounting*, *narrow choice bracketing* and *perceived product complexity* influencing reverse mortgage demand could be offset by information framing. In this thesis, mental accounting refers to the process of how individuals group their assets and expenditures to determine their budget plans. Narrow choice bracketing refers to individuals selecting the best outcome among select outcomes under their

consideration, which may not maximize their utility since the best option may not even be under consideration. Perceived product complexity refers to individuals avoiding using a product because of their subjective view of their difficulty understanding the product features or how it could be used to their benefit. We focus on these three behavioural biases as they have been found to be important in the demand for other retirement products (e.g., Bateman *et al.,* 2018, Brown *et al., 2021).*

The results presented in Chapter 4 show that 43% of Australian (pre-retiree) participants were interested in using reverse mortgages and confirm that reverse mortgage demand is higher when mental accounting is addressed through information framing. However, we found that the reverse mortgage demand is lower when the participants are prompted with information framing that aims to address narrow choice bracketing except where the participants indicate they have difficulties in financing retirement expenditures. We also found that case studies can enhance the subjective understanding of reverse mortgages. The findings of this chapter contribute to the literature by identifying mental accounting as one of the factors contributing to the reverse mortgage puzzle. This chapter establishes an industry benchmark for the sales procedures of complicated financial products (e.g., reverse mortgages) to address the impact of mental accounting and reduce the perceived product complexity.

Chapter 5 analyses whether long-term care insurance demand can be enhanced when housing wealth is available as a source of funding. Davidoff (2010), Hanewald *et al.* (2016), and Shao *et al.* (2019) have demonstrated the complementary nature of home equity release products and long-term care insurance from the theoretical perspective. Using an experimental survey in China, this chapter fills a gap in the literature by demonstrating the change in stated demand when housing wealth is available to finance long-term care insurance.

The findings of Chapter 5 state that the demand for long-term care insurance would increase when retirees can use housing wealth as a means of financing. Retirees use 5% of their total wealth for long-term care insurance when they can only use their savings. However, they would use 15% of their total wealth for long-term care insurance when a reverse mortgage is available and 12% when a home reversion is available. This result further justifies the benefit of developing the home equity release market and encourages the public and private sector to develop programs and products to help individuals to access housing wealth for long-term care insurance.

The remainder of this thesis is organized as follows. Chapter 2 provides background information and reviews the relevant academic literature. Chapter 3 presents "Preferred home equity release approach for retirement," Chapter 4 presents "Demand for reverse mortgages: Behavioral explanations," and Chapter 5 presents "Long-term care insurance financing using home equity release: Evidence from an experimental study." Chapter 6 presents the conclusions of this thesis.

Chapter 2

Background and literature review

This Ph.D. thesis aims to help retirees improve their retirement living standards through the use of home equity release. This background and literature review is structured into four subsections and a summary. Section 2.1 discusses the current home equity release markets in Australia and China. Section 2.2 summarizes previous literature on the design and pricing of long-term care insurance and home equity release products. Section 2.3 reviews the literature on the stated demand for LTCI and home equity release products. Section 2.4 focuses on the optimal demand for LTCI literature, while Section 2.5 summarizes the literature discussion.

2.1   Home equity release products

"Home equity release products" is the collective name for reverse mortgages (administrated by governments or as commercialized products) and home reversion and related products. These financial products aim to help retirees extract their wealth from housing for spending without moving from their current homes. This subsection outlines the similarities and differences between these two products and summarizes the institutional settings of Australia and China that relate to the remaining chapters of this thesis.

A reverse mortgage is a financial contract that allows retirees to borrow using their homes as collateral. The loan can be taken out as a lump-sum, a regular income stream, a line of credit, or a combination thereof. Unlike conventional mortgages, retirees do not have to repay any of the principal or interest of the loan throughout the life of the reverse mortgage contract until termination, which

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occurs when the retirees sell the property or die. Usually, a right called "no-negative equity guarantee" (NNEG) is embedded in the reverse mortgage contract, in which the borrowers are only required to repay the minimum of the outstanding loan balance and the value of the home when sold. This can protect the borrowers and their heirs from paying any outstanding loan that is more than the value of the home at termination.

In contrast, a home reversion is the partial sale of one's current home. In this context, the retirees sell a proportion (relinquish a proportion of ownership) of their current home to receive a discounted lump-sum. The discounted component includes the fees and the lease-for-life agreement, which is the expected present value of the rent of the proportion sold. Similar to reverse mortgages, homeowners do not need to repay anything when they are still living on the property. When the homeowners sell the property or pass away, the proceeds are split according to the agreed division.

The remainder of this subsection is divided into describing the home equity release market in Australia and China.

2.1.1 Home equity release markets in Australia

The Australian reverse mortgage market is dominated by private providers. The first reverse mortgage product was developed and sold in the 1990s. Since then, the market developed and grew substantially until the Global Financial Crisis in 2008. Tightened regulations and higher capital costs have forced several financial institutions to leave the reverse mortgage market. In particular, the Australian National Consumer Credit Protection Act was implemented in 2012, which included five key requirements that led to a strict regulatory environment. These requirements included the following: 1) introducing a mandatory NNEG for commercialized reverse mortgages; 2) lending amount is capped at the loan-to-value ratio ceiling; 3) lenders to align with responsible lending requirements;

4) service providers to disclose cash flow projections to borrowers; 5) restricting lenders to commence the enforcement proceedings before communicating with borrowers.

Additionally, the Australian Securities & Investments Commission (ASIC) (2018) issued a review of the Australian reverse mortgage market and cited seven major findings for lenders to take on more responsibilities in lending out reverse mortgage loans. Moreover, BASEL III implementations have put banks in difficult positions since they need to have more required capital if they offer these products. As a result, big banks in Australia have left the reverse mortgage market (Eyres, 2018; Hughes, 2018), while non-bank lenders have become major players in offering new contracts (Yeoh, 2021).

The size of the reverse mortgage market remains relatively small. Recently, Deloitte estimated that there was over A$1 trillion in housing wealth owned by those aged 65 or above, while the size of the reverse mortgage market (excluding the PLS) was only A$3.6 billion (Simpkins, 2021). Hence, there is great potential for expanding the reverse mortgage market.

Apart from the commercial reverse mortgage market, the Australian Government offers a government-provided reverse mortgage scheme known as the PLS. It is offered to age pensioners and self-funded retirees, where applicants meet the residential and age requirements. The PLS accepts properties other than the family home (e.g., farms and other properties) as collateral, while the commercial products mainly deal with residential properties. Despite the PLS having more flexibility in terms of the asset types used as collateral, there are more restrictions on the extraction of liquidity. For example, the current scheme applies a cap on PLS payments. Moreover, the sum of Age Pension and PLS payments is limited to 150% of the maximum Age Pension payments. An additional constraint is a cap on outstanding loan balances, which is linked to a formula-driven calculation based on the age of a retiree. Once the maximum

outstanding loan balance has been reached, no further payments can be extracted from the PLS. Additionally, while the current scheme does not have the NNEG feature, the maximum outstanding loan balance is capped and has already largely reduced the chance of the retirees owing more than their property is worth.

In the 2021–22 Federal Budget, the Australian Government announced two major changes to the PLS: introducing a NNEG and allowing lump-sum withdrawal. The introduction of the NNEG further protects retirees and their estates, while introducing the lump-sum withdrawal (a one-off payment of up to 50% of the maximum annual Age Pension) provides more flexibility to retirees in planning for their retirement. By the end of March 2021, there were 4,000 outstanding PLS contracts (Hanewald *et al.*, 2021). For more details about the key reverse mortgage market participants in Australia, please refer to Section 3.2.2.3.

On the other hand, no financial institutions offer textbook home reversions in Australia. However, Homesafe Solutions (which is associated with Bendigo Bank) offers a debt-free product to help retirees to finance their retirement by purchasing a proportion (up to 65%) of the future proceeds from the property sale. The lump-sum is paid at a discount with consideration to the house price risk and the liquidity premium. Currently, Homesafe only transacts with senior homeowners who live in the Sydney and Melbourne metropolitan areas, and not those who reside in apartments.

2.1.2 Home equity release markets in China

In China, there is no home reversion market. Notably, reverse mortgage market development only began in 2013. Before 2013, the sale of housing assets was the only way to liquidate housing wealth. In 2013, the Chinese government released a policy document encouraging a pilot product in the reverse mortgage market (General Office of the State Council of PRC, 2013). In the section

entitled "Improve investment and financing policies", the government strongly recommended that financial institutions should develop new financial products to help retirees to improve their retirement living standards. Furthermore, the government stipulated that it would support financial institutions in piloting a reverse mortgage program for retirees.

In 2014, the China Insurance Regulatory Commission announced the "Guiding Opinions of the China Insurance Regulatory Commission on Carrying out the Pilot Program of the Elderly Housing Reverse Mortgage Pension Insurance" (China Insurance Regulatory Commission, 2014). In this statement, the Chinese government outlined the aims and requirements of the operation of the reverse mortgage pilot program for two years in four major cities (Beijing, Shanghai, Guangzhou, and Wuhan). Four fundamental goals were included in this reverse mortgage pilot program: 1) enhancing sustainable social security systems for retirees; 2) liquidating wealth stored in housing assets; 3) providing more options to retirees for financial planning; 4) involving the insurance industry in managing the risks of retirement financial products. As a result, several firms were selected to pilot the reverse mortgage program, including Ping An Insurance, New China Life Insurance, and Metlife. However, only Happy Life Insurance issued a reverse mortgage product in July 2014. However, by the end of June 2021, less than 200 households had signed up for the reverse mortgage product issued by Happy Life Insurance. Although this product garnered some attention, the participation rate was extremely low. The product is relatively complex and inflexible since it provides fixed monthly payments for life that are partly structured as a deferred annuity (Hanewald *et al.*, 2020a). For more details regarding the reverse mortgage product introduced by Happy Life Insurance, please refer to Section 5.7.1.

2.2 Optimal portfolio choice involving home equity release products in a lifecycle model

A wealth of existing literature has attempted to use economic value and utility maximization to demonstrate the potential benefits of using home equity release products. Existing studies have generally suggested that using home equity release products can improve the retirement living standards of retirees.

Ong (2008) estimated the economic gain for retirees that use reverse mortgages to plan for their retirement by using a sinking fund formula to determine their lifetime monthly payments. The results showed that single females gained the most benefit, with 95% of those previously under the Henderson poverty line no longer doing so. Davidoff (2010) introduced the decomposition of housing wealth into consumption commitment and asset commitment. By using home equity release products, the retirees would release the asset commitment for them to plan for their retirements, such as purchasing annuities and long-term care insurance. Hanewald *et al*. (2016) and Shao *et al*. (2019) further extended Davidoff's (2010) model and incorporated more complex models to evaluate the benefit of using home equity release products. The aforementioned studies all agree that using home equity release products is beneficial. Hanewald *et al.* (2016) further pointed out that using reverse mortgages is more beneficial than home reversions. These papers also included long-term care insurance in the optimal portfolio choice under the lifecycle modeling, which will be further discussed in Section 2.4.

Huang *et al*. (2013) use a three-period model to analyze the optimal asset allocation of Chinese retirees if a reverse mortgage product were to be introduced in the Chinese market. The authors utilized the Cobb-Douglas formula to model the utility of an individual and allow for bequest motives. The results indicate that a reverse mortgage can improve an individual's utility if the

bequest motive is mild by smoothing lifetime consumption. Nakajima and Telyukova (2017) also showed that individuals experience welfare gain when a reverse mortgage is available on the market. This model focuses on how the availability of a reverse mortgage affects individuals with different wealth, income, and health levels.

Although Yogo (2016) did not involve reverse mortgages or any other home equity release products in his research, the authors showed that the percentage of the housing asset within the entire portfolio is negatively correlated with the health of retirees. This demonstrates that housing wealth is used as part of precautionary savings and indirectly suggests that having home equity release products would be beneficial to retirees since their family members would not need to move and sell their properties for spending on health shocks. Andréasson *et al*. (2017) also did not involve any home equity release products in lifecycle modeling; however, it adopted a simplified Age Pension means test to determine the optimal portfolio choice of Australian retirees.

While the aforementioned studies stated that the optimal portfolio choice for retirees is to utilize their housing wealth through using home equity release products, these studies did not consider the rules and practical costs of using those products in Australia. Additionally, despite downsizing being the traditional method of consuming housing wealth for retirees, the aforementioned studies did not include other home equity release approaches for comparison. Chapter 3 of this thesis presents a model that incorporates the Australian retirement system, tax rules, and various approaches to evaluating the benefits provided by different home equity release approaches for different types of households. The result of the chapter can help retirees to achieve the preferred retirement outcomes among different home equity utilizing approaches.

2.3 Stated demand for home equity release products

Although the literature has highlighted the benefits of using home equity release products, their actual take-up rate remains low. Hence, stated demand studies were developed to understand and explore various reasons to explain this phenomenon. Several authors, including Ong *et al.* (2015) in Australia, Davidoff *et al.* (2017) in the US, Dillingh *et al.* (2017) in the Netherlands, Fornero *et al.* (2017) in Italy, Jefferson *et al.* (2017) in Australia, Moulton *et al.* (2017) in the US, Hanewald *et al.* (2020) in China, and Fong *et al.* (2021) in Singapore, have attempted to address the reasons for this disparity.

These studies have investigated determinants such as demographic, financial, and personal preferences as the explanations that impact reverse mortgage demand.

2.3.1 Demographic factors

Fornero *et al.* (2017) and Fong *et al.* (2021) identified that older individuals are less interested in using reverse mortgages. Hanewald *et al.* (2020) performed two surveys, one for the older retirees and one for the children of the older retirees. For the children group, the authors found that age is negatively correlated with the demand, while the retiree group identified a positive correlation between age and the reverse mortgage demand. Ong *et al.* (2015) also identified the positive correlation between ages and the demand. This is because older individuals would be less interested in innovative financial products, while some younger retirees do not yet need to seek financial products to maintain their retirement living standards. Ong *et al.* (2015) and Hanewald *et al.* (2020) also found that retirees who did not have children stated that they have less interest in using reverse mortgages. This shows that retirees could use the funds extracted from reverse mortgages to help their children. Ong *et al.* (2015), Dillingh *et al.* (2017), and Moulton *et al.* (2017) stated that single retirees are less interested in

using this home equity release product, while Fornero *et al.* (2017) had the opposite finding. Most of these studies found that the retirement status and highest education attained did not impact the stated demand.

2.3.2 Financial and economic factors

Moulton *et al.* (2017) and Hanewald *et al.* (2020) found that retirees with more non-housing wealth would have less interest in using reverse mortgages. Davidoff *et al.* (2017) and Moulton *et al.* (2017) identified retirees with higher income would demand fewer reverse mortgages, while Ong *et al.* (2015) and Fong *et al.* (2021) stated that retirees with higher income would demand more reverse mortgages. It is because the survey sample of Davidoff *et al.* (2017) and Moulton *et al.* (2017) were older than Ong *et al.* (2015) and Fong *et al.* (2021), which is more reflective of the income level of retirees. Participants in Ong *et al.* (2015) and Fong *et al.* (2021) who have higher income would want more reverse mortgage as they have high working income at the time of participating in the survey, which would need extra funding (such as reverse mortgages) to maintain the same living standard. More importantly, most studies, including Davidoff *et al.* (2017), Dillingh *et al.* (2017), Jefferson *et al.* (2017), Moulton *et al.* (2017), Hanewald *et al.* (2020), and Fong *et al.* (2021), identified that the less conventional mortgages the retirees have, the lower their interest in using reverse mortgages.

2.3.3 Personal preferences, characteristics, and financial capability

Jefferson *et al.* (2017), Davidoff *et al.* (2017), and Moulton *et al.* (2017) demonstrated that retirees with higher bequest motives were less likely to be interested in reverse mortgages. This is because retirees preserve housing wealth as the major component of their bequest. All studies that mentioned subjective understanding and reverse mortgage familiarity stated that low understanding and product awareness would lead to lower demand. This shows that promoting

the products would improve demand and educate retirees about the product being essential to developing the home equity release market.

Regarding debt aversion, Jefferson *et al.* (2017) and Fornero *et al.* (2017) noted a negative relationship with stated demand. Moreover, Hanewald *et al.* (2020) expressed that less risk-averse individuals would tend to express less interest in reverse mortgages. However, Davidoff *et al.* (2017), Fornero *et al.* (2017), and Moulton *et al.* (2017) indicated that more risk-averse retirees would have lower interest. On the other hand, personal preferences and characteristics would also lead to a low take-up rate of home equity release products. Notably, Davidoff *et al.* (2017) and Fornero *et al.* (2017) identified that retirees with better financial literacy scores would express less interest in reverse mortgages, while Fong *et al.* (2021) showed a different conclusion. These inconclusive findings show that while retirees with higher financial literacy are more capable of understanding the product, they possibly have a good plan for their retirement before understanding reverse mortgages, which leads to lower demand for the product.

The aforementioned studies have identified numerous demographic and financial factors that impact reverse mortgage demand, which provides a good starting point for addressing the low actual take-up rate among retirees. However, none of these studies considered the role of behavioral impediments to explain the low actual take-up rate of home equity release products. Therefore, this thesis addresses these behavioral aspects in Chapter 4.

2.4 Combining home equity release products with long-term care insurance

The existing literature has suggested that combining home equity release products with other financial products would improve and potentially resolve part of the home equity release puzzle. For example, Benejam (1987) discussed

the source of financing for health care costs based on Home Equity Conversion Mortgages (HECM) (launched in the early 1980s) and suggested that retirees use the amount obtained to purchase private health insurance to hedge future health risks. Jacobs and Weissert (1987) examined the feasibility of long-term care insurance bundled with home equity release products to address the financing issue of long-term care insurance. The authors also used HECM (reverse mortgage type) as the source of financing for long-term care insurance, wherein the premium is paid by extracting a lump-sum from the reverse mortgage.

A stream of studies then began to investigate how these products should be priced. Xiao (2011) developed a pricing method based on the utility indifference of the provider. This author used a three-state Markov process to model the health states of individuals, while the house price process was assumed to be a geometric Brownian motion with a constant interest rate. However, there are many limitations to this pricing framework. Alai *et al.* (2014) enhanced the pricing framework by using a vector autoregressive model to estimate several parameters. The authors also included reverse mortgages interest rate pricing as part of the findings. Ma *et al.* (2011) extended Xiao's (2011) model by modeling couple households. Mayhew *et al.* (2017) developed an approach that involves calculating the expected present value of the long-term care insurance premium and then backsolving the home reversion components that need to be sold by deducting the lease-for-life components.

Another stream of the literature studies optimal portfolio choice under the utility framework, including home equity release products and long-term care insurance. Davidoff (2009) built a two-period model to examine decisions regarding long-term care insurance and the amount of wealth stored in housing wealth. His results revealed that the relationship between long-term care insurance and home equity is complementary if a reverse mortgage is available to an individual. Hanewald *et al.* (2016) then extended the model proposed by

Davidoff (2009) to include more financial products, including a reverse mortgage, home reversion scheme, long-term care insurance, and life annuity. These results are consistent with the aforementioned research, wherein individuals experience a higher utility if they have access to home equity release products. Moreover, the authors concluded that individuals have a higher utility gain if they choose to use a reverse mortgage instead of a home reversion scheme. This result—in addition to those of Alai *et al.* (2014)—explains the empirical phenomenon in which the reverse mortgage dominates the market share of the home equity release market in the US (Ma and Deng, 2006). Nevertheless, the results show that the higher the amount individuals obtain from home equity release products, the higher the premium they will pay for long-term care insurance. This illustrates that home equity release products and long-term care insurance are complementary but not substitutes.

Additionally, Shao *et al.* (2019) further improved the model suggested by Hanewald *et al.* (2016) by applying a more realistic house price model (ARMA-GARCH). Although the aforementioned studies demonstrated the benefits of using both home equity release products and long-term care insurance, Achou (2021) stated that the complementary effect is limited despite the author demonstrating the maximum increment of long-term care insurance demand is 3.2% of total wealth.

Overall, the literature has focused on the theoretical perspective, involving both pricing and the maximization of retirees' utility. Chapter 5 investigates this topic from a different point of view. Notably, we are the first researchers to examine the stated demand for long-term care insurance when home equity release products are available. This aims to fill a gap in the literature since we are the first to examine this demand using an experimental survey.

2.5 Literature review summary

In this chapter, we introduced the background of the home equity release markets in Australia and China. Moreover, we reviewed the literature related to home equity release products. From a theoretical perspective, there is consensus that using home equity release products would be beneficial for retirees, especially for those who are asset rich but cash poor. However, none of the existing studies included the Australian context or incorporated Age Pension means tests, tax, or PLS rules to identify the preferred home equity release approaches for different household types.

To fill this gap, this thesis involved performing an analysis (see Chapter 3) to incorporate these features under the expected utility framework. Despite the literature being focused on demographic, financial, and personal characteristics factors in explaining the low actual take-up rate on reverse mortgages from the stated demand perspective, no studies have focused on behavioral impediments to explain the gap between the actual demand and the theoretical prediction. Thus, to further enhance market development by identifying behavioral factors that contribute to the home equity release puzzle, we designed and administrated an experimental survey to examine the impact of multiple behavioral factors on the reverse mortgage demand (see Chapter 4). We also reviewed the literature on the benefits of using long-term care insurance when home equity release products are available. Since existing studies have focused on the theoretical demand and benefits, we extended the literature by investigating the stated demand for bundling long-term care insurance and home equity release products using an experimental survey (see Chapter 5).

By filling multiple gaps that we have identified in the literature, the results of our research can (i) help retirees improve their retirement living standard through increasing their liquid wealth and (ii) support the development of home equity

release markets by informing the product design, marketing and sales process of home equity release products.

Chapter 3

Preferred home equity release approach for retirement

Abstract

This chapter investigates the preferred home equity release approach for retirement, given available options (downsizing, the government-offered Pension Loans Scheme, commercial reverse mortgages, and home reversion–type schemes) and reflecting current tax, superannuation, and age pension rules in Australia. We use state-of-the-art economic and actuarial modeling to identify the preferred approach for the use of housing wealth by Australian retiree households with different marital status, wealth portfolios, and preferences. The Pension Loans Scheme is found to be most beneficial if households only need to boost retirement income by a limited amount. Private reverse mortgages are more attractive if households prefer a large lump-sum at retirement age. Households with lower house price growth expectations should use home reversion schemes. When households have strong bequest motives, they should not downsize or use home equity release. Our results can help policymakers, financial advisers, and individuals to improve retirement outcomes.

3.1 Introduction

Australian households hold a large proportion of their wealth in the form of housing. There are several ways to spend down housing wealth, including downsizing, using the PLS to top up one's retirement income, as well as commercial reverse mortgages and home reversion–type schemes. However, despite the availability of these different options, the final report of the Retirement Income Review (The Australian Government Treasury, 2020) reported that retired households underutilize their housing wealth. This underutilization distorts debates about the adequacy of superannuation and has the potential to increase the financial burden of the Age Pension on the Australian Government. Previous research has analyzed factors that impact retirees' decision to use reverse mortgages to fund retirement (e.g., Hanewald *et al.*, 2020; Bateman *et al.*, 2020; Jefferson *et al.*, 2017; Ong *et al.*, 2015) as well as downsizing choices (Whelan *et al.*, 2019). These studies have focused on retirees' economic circumstances, personal characteristics, and behavioral factors. One important factor that is less commonly studied is the complicated interaction between tax, Age Pension means tests, and superannuation rules and how these rules prevent retirees from making the preferred decisions regarding the use of their housing wealth.

In this chapter, we investigate the preferred approach to use housing wealth in Australia given the available options while accounting for current Australian tax, superannuation, and Age Pension means test rules. We use scenario analysis to determine the preferred home equity release approach for older Australian households with different wealth portfolios. To understand the benefits of each utilizing approach, we compare the following approaches for the use of housing wealth to increase retirement income: 1) downsizing the residential home; 2) using commercial reverse mortgages; 3) using the PLS; 4) using a home reversion–type scheme against the approach of not utilizing housing wealth. We

model the impact of different systems that interact with the retirement income system, including the tax system, means tests, and superannuation rules.

Downsizing is perhaps the most common way to release home equity. Homeowners can sell their current home and move to a new place, which they may choose to buy or rent. The new home does not have to be smaller in size. It is the difference in value that allows the release of liquidity.

A reverse mortgage is a financial contract that allows retirees to extract their housing wealth without leaving their current homes. Retirees do not have to repay the loan throughout the life of the contract until termination, which happens when the retirees sell the property or die. Reverse mortgage borrowers in Australia are protected by a no negative equity guarantee (NNEG), which ensures that the borrowers are only required to repay the minimum of the outstanding loan balance and the sale proceeds of the property.[1] This can protect borrowers and their heirs from paying any outstanding loan that is more than the value of the home at termination. Reverse mortgages in Australia are charging the borrower a variable interest rate to cover the cost of the contract.

In Australia, homeowners can choose between government-provided and commercial reverse mortgages. The Pension Loans Scheme (PLS) is a government-funded reverse mortgage scheme offered to Australians. Currently, borrowers are only allowed to receive loan payments on a fortnightly basis. In the 2021–2022 Federal Budget, the government proposed two main changes to the PLS: allowing restricted lump-sum withdrawal and introducing the NNEG (effective from 1 July 2022). Similar to reverse mortgages, the PLS is also charging the borrower with a variable interest rate.

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[1] All commercial reverse mortgages are now protected by the NNEG. Current government-funded reverse mortgage PLS is not. The introduction of NNEG to the PLS is effective from 1 July 2022.

A home reversion scheme is the partial sale of one's current home. Under this scheme, homeowners sell a proportion (i.e., relinquish a proportion of ownership) of their current home to receive a discounted lump-sum. The discounted component includes the fees and a lease-for-life agreement, which is the expected present value of the rent of the proportion sold. When the homeowners sell the property or pass away, the proceeds are split according to the agreed division.

In this paper, we develop a new multi-period stochastic simulation model that incorporates relevant Australian Age Pension means tests, superannuation, and tax rules to analyze the impact of the different approaches for utilizing housing wealth on retired homeowner portfolios. This analysis can assist retired homeowners in identifying the most preferred equity release approach. Using an expected utility framework, we calculated the equivalent lump-sum gain/loss compared to not utilizing housing wealth for one of the following four home equity release approaches: (i) downsizing of current home; (ii) using the private reverse mortgages; (iii) using the PLS; (iv) using the home reversion–type schemes.

The new model comprises the following components. Following Andréasson *et al.* (2017), we assume that allows retired homeowners to derive utility from consumption, housing, and bequest. We simulate individuals' lifespans using the Cairns-Blake-Dowd (CBD) model (Cairns *et al.*, 2016), a stochastic mortality model that has been widely adopted by actuaries. Please note that other life events such as moving into a nursing home are not considered in this study. They could be considered as an extension of this study in future research. We generate economic scenarios based on the simulation of uncertainty for pension analysis (SUPA) model (Chen *et al.*, 2020). We model the product features of the different home equity release approaches based on products available in the Australian market. Using data from the Household, Income, and Labour

Dynamics in Australia (HILDA) Survey, we calculate several typical Australian retiree portfolios and asset allocations as the starting wealth statistics in the simulations. We use the simulation model to calculate the expected utility of each approach. We convert the expected utility to equivalent lump-sum gains or losses, which we calculate as the additional positive or negative financial wealth required to make a household indifferent between a given approach and the assumed base case where housing wealth is not released.

Our results show that for retirees who want to increase their retirement income by about 1% of their housing wealth, the PLS is the preferred approach to utilize housing wealth. For retirees who require more annual income or a large lump-sum at retirement age, private reverse mortgages are the most suitable product. If homeowners have lower house price growth expectations, they should use a home reversion scheme. Retirees with strong bequest motives will not release their housing wealth. We also find that households with less liquid wealth and more housing wealth (i.e., more asset-rich and cash-poor households) derive a larger equivalent lump-sum gain. When the retirees have a stronger preference to stay at their current home, the lump-sum loss of downsizing is greater. We also find that retirees with a greater preference for future consumption would experience smaller lump-sum gains for all home equity release approaches.

We contribute to the literature by introducing a new model that interacts with the Australian tax rules, the means-tested Age Pension, and superannuation rules. The results of this study align with the theoretical literature, which maximizes the retirees' utility in a lifecycle model without incorporating tax rules and means-tested Age Pension (Hanewald *et al.,* 2016; Shao *et al.*, 2019). Our study compares approaches to using housing wealth for households with different marital statuses, wealth statistics, and preferences and quantifies the equivalent lump-sum gain for different home equity release approaches.

We provide results that can help Australian households (and their financial advisers) to make better financial planning decisions for retirement. Our findings can also allow policymakers to assess the effectiveness of different systems that impact the retirement financial planning of retirees.

The remainder of this chapter is organized as follows. Section 3.2 outlines the current Australian retirement system and existing ways to use housing wealth. It also contains the literature review. Section 3.3 describes the model specification (including the assumptions and simulation processes), while Section 3.4 and Section 3.5 present and discuss the results, Section 3.6 summarizes the main results and sensitivity analysis, and Section 3.7 concludes.

3.2 Background

3.2.1 Retirement income system in Australia

Australia's three-pillar retirement income system includes the means-tested Age Pension, compulsory superannuation, and voluntary savings (including homeownership) (Retirement Income Review (Australian Treasury, 2020)).

The Age Pension acts as the safety net of the retirement income system. The government uses tax revenue to fund fortnightly payments supporting retirement expenditures. The means-tested nature of the Age Pension aims to encourage retirees to maximize their overall income but not rely solely on income support from the government. Notably, one's primary residential property is exempt from the means tests. The details of the means tests are listed in Section 3.3.7.

Compulsory superannuation requires that employers contribute a specific rate of their employee's salary to an approved superannuation fund, which employees

can only access after reaching 60 years of age.[2] The current contribution rate is 10%, which will progressively increase to 12% by July 2025. The contribution (which is less than a cap on concessional contributions) from employers and its earnings are always taxed at 15%, which is a concession rate for most taxpayers.

The Retirement Income Review (Australian Treasury, 2020) reported that voluntary savings are usually the largest component of retirees' portfolios. Voluntary savings include owning shares, owner-occupied housing, investment properties, voluntary superannuation contributions, and private businesses. However, apart from the wealthiest 10% of retirees, the largest component of voluntary savings is owner-occupied housing. The middle-wealth group of Australian retirees (those in the 40–70 percentiles of the wealth distribution) holds approximately 60–72% of their total wealth as housing (Australian Treasury, 2020).

The 2021–2022 Federal Budget announced that the First Home Super Saver Scheme was extended, allowing individuals to access their voluntary contribution of superannuation wealth (up to A$50,000) to use as part of a first-home deposit. Government incentives and the exemption of one's primary residential property[3] under the means-tested Age Pension are part of the explanations of why retirees save more towards housing wealth. In summary, the Australian policy settings indirectly encourage retirees to put their savings into housing wealth, which leads to an over-investment in this type of wealth. As a result, there is a potential for many retirees to utilize housing wealth in retirement.

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[2] Employees are not allowed to access their superannuation under 60 except using the First Home Super Saver Scheme. Also, in 2020, the government allowed early access to superannuation via the COVID-19 early release of superscheme.

[3] In 2019, the estimated median value of the primary residence is $560,000, whereas the effective value of the primary residence is $210,500, which is calculated by taking the difference of the assets test free areas for homeowners and non-homeowners.

3.2.2 Options for using housing wealth in retirement

Retirees in Australia have five main options for the use of their home equity, which are: 1) not utilizing housing wealth; 2) downsizing their home; 3) using a commercial reverse mortgage; 4) using the PLS; 5) using a home reversion.

3.2.2.1   *Not utilizing housing wealth*

Many retirees do not use their housing wealth and instead rely on the Age Pension, their superannuation, and other financial wealth. In this study, we use this approach as the benchmark to understand the benefits and disadvantages of different home equity release approaches. From an individual perspective, there are multiple reasons for them not spending down their housing wealth. Survey-based research in different countries found that retirees with high non-housing wealth, higher income, stronger bequest motives, and greater emotional attachment to their current home are less interested in using their housing wealth in retirement (Dillingh *et al.*, 2017; Fornero *et al.*, 2017; Davidoff *et al.*, 2017; Hanewald *et al.*, 2020). In Chapter 4, we will examine behavioral factors that impede the use of reverse mortgages in the Australian context.

3.2.2.2   *Downsizing*

Downsizing is a straightforward method used to extract liquidity from housing wealth. We define downsizing in this thesis as selling the current property and purchasing a property of lesser value. The sale proceeds can be used in multiple ways. Often, they are used to pay off the original mortgage, improve financial independence, and purchase a more age-friendly home. The federal government introduced downsizing contributions into superannuation (the downsizer scheme) in the 2018–2019 Federal Budget to provide an additional incentive for households to downsize. Individuals aged 65 years old or older who meet the eligibility requirements can contribute a maximum of A\$300,000 of the sale to their superannuation account. In the decumulation phase, the earnings of the

superannuation are not taxed. However, households are still required to pay a transfer duty if they purchase a new property. While some states provide extra support by discounting the transfer duty, the Government of New South Wales does not provide such an incentive to its residents. The Retirement Income Review (Australian Treasury, 2020) reported that more than 9,000 participants have used the downsizer scheme as of January 2020. Although the take-up is low, downsizing is far more popular than the PLS (introduced below) as a method for extracting liquidity from housing in retirement.

3.2.2.3   *Private reverse mortgages*

Multiple private providers are operating in Australia, such as Heartland Australia and Household Capital, which offer reverse mortgages with variable interest rates of 4.98 to 5.62% p.a. Reverse mortgages provide extra funds from releasing housing wealth equity and allow older homeowners to remain in their current home, which makes this a good option for Australian households that prefer to age in place (Productivity Commission, 2015; Ratcliffe *et al.*, 2020). However, reverse mortgage rates are usually higher than conventional mortgage rates due to the underlying risks, and the accumulated debt can be a substantial proportion of home equity at termination.

Figure *3.1* presents the key players in the current reverse mortgage market in Australia based on data provided by Yeoh (2021). The current market share is still driven by existing contracts issued by the major banks. However, most contracts issued recently were signed by non-bank lenders.

Deloitte estimates that only A$3.6 billion of housing wealth is utilized through commercial reverse mortgages, while Australian retirees own more than $1 trillion of housing wealth (Simpkins, 2021). Hence, there is seems to be a large potential for growth in the reverse mortgage market in Australia. Australian reverse mortgage borrowers are guaranteed two main rights: guaranteed

occupancy and the NNEG. Guaranteed occupancy protects borrowers from being evicted from their homes; hence, as long as the borrowers want to remain in the same home, lenders cannot force them to move. Moreover, the NNEG protects borrowers from owing more money than the collateralized home worth. To further protect borrowers, under the Australian National Consumer Credit Protection Act, the minimum age for using a reverse mortgage is 55. The maximum initial LVR depends on the borrower's age. If the borrower is age 55 at the start of the contract, the maximum initial LVR is 15%. If the borrower is age 56 at the start of the contract, the maximum initial LVR is 16%, and so on.

ASIC issued a report that summarized the findings and recommendations of the Australian reverse mortgage market in 2018. The report has noted that reverse mortgage lenders must improve regarding lender responsibility, particularly by increasing borrower awareness of equity erosion, meeting long-term expenditure targets, reducing the risk of financial elder abuse, protecting other residents in the collateral, and improving sales procedures (ASIC, 2018).

Figure 3.1: Australia's reverse mortgage market share breakdown – Based on data from Yeoh (2021).
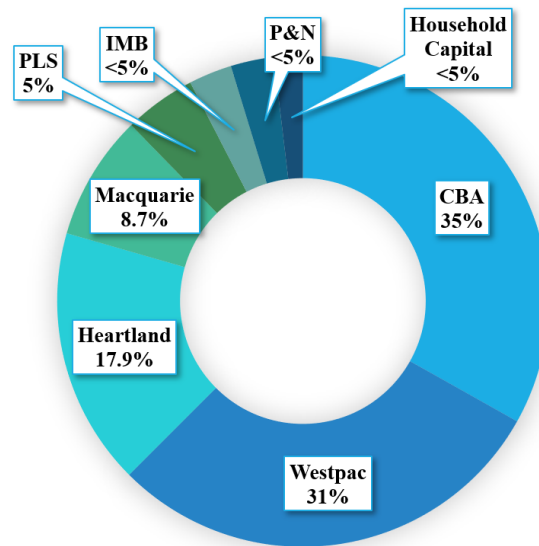
Reverse mortgage products are taken as a line of credit, lump-sum, income stream, or a combination thereof. Line of credit withdrawal is the most popular among borrowers, followed by a lump-sum and then an income stream (Yeoh, 2021). Thomas *et al*. (2020) studied the characteristics, loan purposes, and attitudes of Heartland Seniors Finance borrowers. Their results showed that, on average, borrowers extract A$60,000 the first time at age 70 using a collateral value of approximately A$500,000. The authors identified that the main purpose of taking out a loan is to establish a contingency plan that allows borrowers to pay for day-to-day expenses during downturns in the household's financial situation. Hospital bills and family support are also common reasons to take out reverse mortgages. Lump-sum borrowers tend to take out such loans for home renovations, debt repayment (including mortgages), and car purchases. Only 30% of borrowers choose the income stream approach to boost retirement income for daily expenditures.

3.2.2.4 Pension Loans Scheme

The PLS is a government-provided reverse mortgage. It is available to anyone owning property who meets the age and residency requirements of the Age Pension. The current PLS only allows borrowers to receive fortnightly payments, with 4.5% p.a. interest rate compounding every two weeks. This interest rate is lower than those charged in the private reverse mortgage market. These payments are capped so that the combination of the PLS payments and any Age Pension cannot exceed 150% of the maximum Age Pension. The collateral accepted by the PLS is not limited to the primary residence, with vacant land, commercial property, and farms also eligible.

The proposed enhancement of the PLS in the 2021–2022 Federal Budget includes an NNEG and introduces an "advances" feature. "Advances" are similar to lump-sum withdrawals and can be taken as a one-off payment of up to 50% of the maximum annual Age Pension. However, the cap of the annual payment (i.e., 150% of the maximum Age Pension) remains applicable to this lump-sum withdrawal. The lump-sum withdrawal is also subject to the maximum loan amount, which is based on age. A detailed calculation of the maximum loan amount is reported in Section 3.3. The current take-up rate of the PLS is low despite substantial growth during the COVID period. The number of participants was approximately 1,600 as of December 2019, and this number grew to 4,000 by March 2021 (Hanewald *et al.*, 2021). Additionally, the Federal Budget has also promoted the message that they will invest to "improve public messaging and branding."

3.2.2.5 Home reversion–type schemes

In Australia, there is no financial institution offering a 'textbook' home reversion product. However, Homesafe Solutions (which is associated with Bendigo Bank) offers a debt-free solution for elderly homeowners in which Homesafe pays a

lump-sum in exchange for a proportion (up to 65%) of the future proceeds from the property sale. The lump-sum is paid at a discount. To secure future rights, Homesafe registers a mortgage (but without debt) with a caveat. Homesafe provides the following system of rebates: if the homeowners sell/die shortly after the start of the contract, Homesafe will rebate a percentage of the discount. Homesafe only transacts with senior homeowners who live in the Sydney and Melbourne metropolitan areas and not those who reside in apartments. Additionally, the land value must be greater than 60% of the total property value. Similar to reverse mortgages, this contract is only completed when the homeowners sell the property or pass away.

3.2.3 The potential benefit in using equity release products and the expected utility framework

An established body of literature has examined the potential benefits of equity release products for households. Most of the literature focuses on the use of home equity release products to maximize household utility under complex utility models. The conclusions of these studies generally suggest that households should use home equity release products to enhance living standards in retirement.

Ong (2008) has determined the economic gain of reverse mortgage users in Australia through the net income gain and poverty rate relative to the Henderson poverty line using a sinking fund formula. The results show that reverse mortgages are most beneficial for single women, and 95% of those under the Henderson poverty line (if the income is below the poverty line, the households are considered as poverty, see Melbourne Institute of Applied Economic and Social Research (2021) for more details) would no longer be in poverty after using a reverse mortgage.

Davidoff (2010) developed a lifecycle model and noted that the value of home equity should be decomposed into two parts: consumption commitment (i.e., the right of the individual to occupy the property until death) and asset commitment (i.e., the right to occupy the property after the death of the individual). Without a home equity release product, retirees cannot freely spend the asset commitment component. Retirees' utility can only be maximized if they can utilize this component. Thus, reverse mortgages and other home equity release products would derive extra utility and help retirees increase retirement income.

Hanewald *et al*. (2016) extended the model proposed by Davidoff (2010) to encompass more financial products, including a reverse mortgage, a home reversion scheme, long-term care insurance, and a life annuity. Hanewald *et al*. (2016) simulated three scenarios (using no home equity release product, using a reverse mortgage, and using home reversion) subject to the change in initial home value, risk aversion parameters, bequest motives, the subjective discount factor, and the impact of the public long-term care insurance. This is a two-period lifecycle model, and the Cobb-Douglas form function was applied to model an individual's utility. The results indicated that individuals experience higher utility if they have access to home equity release products. The authors also found that individuals prefer to use home equity release products in the earlier stages of their retirement. Moreover, the authors concluded that individuals have a higher utility gain if they choose a reverse mortgage when compared to the home reversion scheme. This result, in addition to those of Alai *et al*. (2014), explains the empirical phenomenon in which reverse mortgages dominate the market share of the US home equity release market, namely that reverse mortgages are more popular than home reversion schemes.

Shao *et al*. (2019) developed a multi-period lifecycle to examine the impact of allowing for the reverse mortgage. By applying a more realistic house price model (ARMA-GARCH), Shao *et al*. (2019) achieved a house price growth rate

that was more realistic than the model which used normally distributed i.i.d. random variables assumption. Furthermore, Nakajima and Telyukova (2017) used a lifecycle model to examine the welfare gains of individuals when a reverse mortgage is available in the market. Their model focused on how reverse mortgage availability affects individuals with different wealth, income, and health levels. Additionally, the authors examined how the macroeconomic environment impacts the demand for reverse mortgages. The individual's utility was modeled using the Cobb-Douglas form function. The model also includes the risk of moving to residential care, house price risks, and bequest motives. The results indicated that individuals with low income, low wealth, and poor health have a higher take-up rate of the reverse mortgage. Significantly, individuals who employ the reverse mortgage enjoy additional welfare gains. Therefore, the model supports the efficacy of the reverse mortgage as a primary funding method in retirement.

Several other studies analyze the role of housing wealth in the retirees' portfolio in a lifecycle or utility framework without considering reverse mortgages or other home equity release products. Yogo (2016) used a lifecycle model to analyze consumption and portfolio selections when American retirees face health risks. The author suggested treating the health status of an individual as an asset called "health capital." If an individual becomes less healthy, they must give up other assets to improve their health. The author showed that the proportion of housing wealth within an entire portfolio is negatively correlated with retiree health. Based on Yogo's (2016) finding, we believe the use of reverse mortgage products can assist retirees in extracting cash to pay for health expenditures, thereby improving their utility. Andréasson *et al.* (2017) designed a model for the Australian context and examined the optimal retirement consumption and investment strategies for Australian retirees during the decumulation period regarding consumption, housing, investment, bequest, and

a simplified means-tested Age Pension. The authors concluded that Australians allocate more liquid wealth to housing to avoid Age Pension payments being impacted by the amount of liquid wealth that households have.

3.2.4 Summary

Housing wealth is an important component of a retiree's portfolio. Retirees can use equity release products to use their housing wealth to improve their living standards and boost their income in retirement. Notably, the studies mentioned above have various limitations. Some studies included equity release products but simplified the modeling assumptions for house price growth rates, interest rates, and inflation while ignoring the tax on investment gains and the means-tested Age Pension (Davidoff, 2010; Hanewald *et al.*, 2016).

In the study reported in this chapter, we identify the preferred approach for households to use their housing wealth to support their retirement. The model generates future scenarios for stochastic mortality using the CBD model (Cairns *et al*., 2006), and for house price growth, inflation, and other macroeconomic indicators using the SUPA model (Chen *et al*., 2020). We use household statistics from the HILDA survey and reflect means-tested Age Pension, tax rules, and equity release product rules to simulate the expected utility of alternative approaches to using housing wealth (details listed in Section 3.3.6). Hence, this represents the first study to incorporate these characteristics in the Australian context. The study compares four different ways to extract equity from housing wealth—i.e., downsizing, private reverse mortgage products, the PLS, and home reversion–type schemes —to not utilizing housing wealth. Using simulations, we calculate the expected utility of each approach and identify the preferred approach for different types of households.

3.3 Model

3.3.1 Overview

We assumed that retirees select the approach that maximizes the expected value of utility while accounting for bequest motives, consumption, housing, financial wealth, and superannuation. We measured utility using a time-separable, additive CRRA utility function, which is a special case of the hyperbolic absolute risk aversion utility function. We assumed that retirees could choose one of the following approaches at the beginning of retirement at age 67: not using their housing wealth, downsizing, the PLS, a reverse mortgage, or home reversion. To reduce model complexity, we made the simplifying assumption that retirees cannot revise their choice in the subsequent years. We simulated a retired household's expected utility with each of these approaches at age 67. Simulating the expected utility required five different model components (see Figure 3.2):

- Approaches for using housing wealth (including hypothetical product features).
- Simulations of economic scenarios.
- Simulations of mortality scenarios.
- Means-tested Age Pension eligibility, tax treatment, and superannuation drawdown.
- Household wealth summary statistics from the HILDA survey.

In the remainder of this section, we will describe these model components and discuss the simulation process.

Figure 3.2: Structure of the utility model.
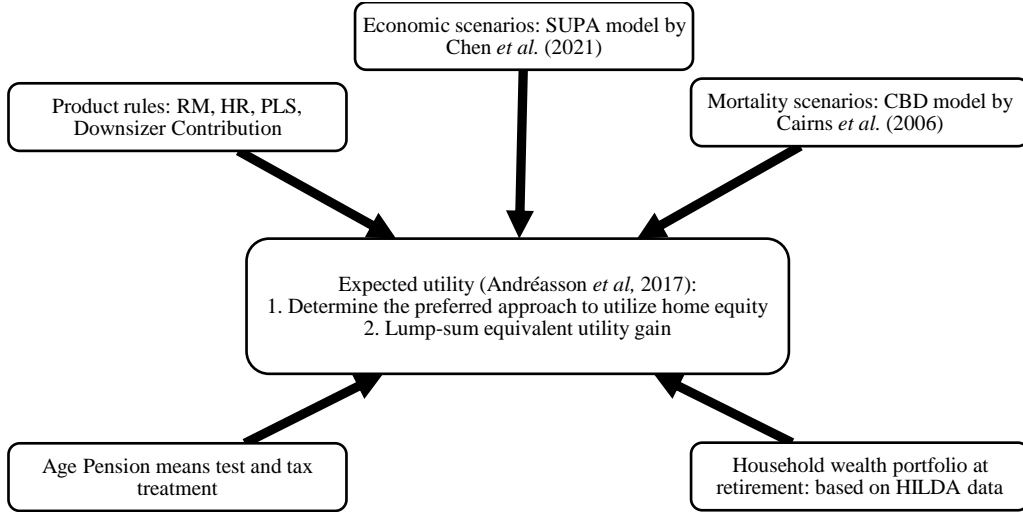
3.3.2 Assumptions about the households

In this study, we focused on identifying the preferred approach for utilizing housing wealth. We considered single female and couple households. At the beginning of the simulation, all individuals were assumed to be aged 67, fully retired, and not receiving any labor income.[4] Retirees were assumed to retire and live in New South Wales (NSW) since this is the most populous state in Australia. Hence, the transfer duty (previously known as stamp duty) is based on Revenue NSW rules. Children were assumed to live in different households and be financially independent. Children receive the inheritance when the last member of the retiree household dies. Apart from the case of downsizing, we assumed that the retirees do not move from their current home unless they move into another home that gives them the same utility and has the same value.

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[4] The current Age Pension age is 66 and 6 months (see: https://www.servicesaustralia.gov.au/who-can-get-age-pension?context=22526). We round this number to 67.

Moreover, we assumed that the retirees spend all of their income, including the Age Pension, returns from financial assets, the minimum drawdown from superannuation, and any extra income from utilizing the housing wealth. There is no labor income since we assumed the households are fully retired. In the base scenario, retirees only spend their financial wealth and superannuation if the aforementioned income is insufficient to cover a modest retirement lifestyle. We assumed that a modest retirement lifestyle requires A\$28,254 for a single person and A\$40,829 for a couple in 2021 (ASFA, 2021) and indexed these numbers using the simulated inflation rate for the subsequent years. When they use a reverse mortgage, home reversion, or the PLS, they receive extra annual income or a lump-sum payment at the beginning of retirement. We assumed that when retirees downsize, they receive a lump-sum at the beginning of retirement, which they add to their superannuation balance through the downsizer contribution scheme.

Throughout this study, we denote S_t as the superannuation amount in year t, H_t as the housing wealth in year t, and W_t as the financial and other wealth of the household in year t.

Future housing wealth, H_t, can be decomposed as follows:

$$H_t = H_0 \times \prod_{s=1}^{t}(1 + g_s), \tag{3.1}$$

where g_t is the house price growth. The modeling details of g_t are listed in Section 3.3.6.

At the beginning of the simulation process, we had to input the household wealth statistics as the simulation starting point. We used data from the 2018 HILDA survey to determine the financial wealth, superannuation, and housing wealth

(net of debt and mortgage) at age 67 for typical households. We then applied the following filters in the HILDA dataset to construct our estimation sample:

- Age: 63 to 70 (with a median age of 67)
- Location: New South Wales
- Gender (for single households)
- Marital status: We assumed that participants who are either married or never married but living with a partner to be couples and the other relationships to be single.[5]

We calculated the median for net wealth within each quantile and used the corresponding asset allocation as the representative components of the household wealth at the beginning of the simulation. Table 3.1 summarizes the wealth characteristic of the illustrative households by decile.

Since the level of consumption is heavily dependent on the number of household members, we also made assumptions about household status. We assumed that do not live with their children, retiree households do not live with their children, are financially independent of their children, and the only interaction with children is to receive an inheritance. That means we assume the single household retirees live alone, and the couple household retirees do not live with their children. We defined G_t as the household status at the end of year t.

$$
G_t = \begin{cases} 2 \text{ if there are two household members alive at the end of the year } t \\ 1 \text{ if there is only one household member alive at the end of the year } t \\ \quad 0 \text{ if the last household member died within year } t \\ \Delta \text{ if the last household member died before the beginning of year } t \end{cases}.
$$

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[5] HILDA survey participants can select one of the following in the marital status question: a) Married (in a registered marriage); b) Separated, but not divorced; c) Divorced; d) Widowed; e) Never married but living with someone in a relationship; f) Never married and not living with someone in a relationship; g) Refused; h) Don't know.

Table 3.1: Summary of wealth statistics of single female and couple households, used as inputs for the simulation process.

Decile median	Housing wealth (H_t)	Superannuation (S_t)	Financial and other wealth (W_t)	Total wealth
		Single female		
1	216,200	0	25,200	241,400
2	392,600	13,000	21,600	427,200
3	505,900	25,000	49,800	580,700
4	672,400	32,000	25,500	729,900
5	708,300	2,000	158,200	868,500
6	940,000	13,000	56,300	1,009,300
7	945,100	135,400	100,900	1,181,400
8	986,200	217,900	348,500	1,552,600
9	1,292,800	242,900	485,100	2,020,800
10	1,842,900	445,600	1,075,900	3,364,400
		Couple		
1	310,800	0	31,800	342,601
2	409,800	32,000	76,900	518,702
3	559,200	34,000	78,700	671,903
4	702,000	61,000	87,000	850,004
5	760,000	47,800	205,100	1,012,905
6	911,000	128,700	200,800	1,240,506
7	1,135,500	163,000	199,800	1,498,307
8	1,193,900	181,000	495,700	1,870,608
9	1,612,300	250,700	645,500	2,508,509
10	1,887,100	967,000	2,043,800	4,897,910

Notes: These statistics are calculated based on the HILDA Wave 2018 dataset by applying the following filters: 1) age from 63-70; 2) resides in NSW; 3) Female (for single households only) and; 4) marital status.

Notably, $G_t = 2$ only when we considered the couple scenario. We assumed that G_t is a monotonic decreasing function of t (i.e., we did not consider that a single retiree household would marry). If one partner in a couple household died, the household was treated as a single household in the remaining simulated years. Additionally, we did not consider divorce. As a result, changes in the household status (G_t) were only impacted by the mortality of household members.

3.3.3 Home equity release approaches

In this study, we compare four approaches for using housing wealth in retirement 1) downsizing; 2) a commercial reverse mortgage; 3) the PLS; 4) partially selling the current home (i.e., using home reversion–type schemes). We compared each of the approaches against a base case (not utilizing housing wealth) in which retirees do not use any housing wealth. We compare these approaches under two types of household structures 1) single female households; 2) couple households extracting an income stream. In addition, for single female households, we compare the home equity releasing approaches by extracting a lump-sum. To ensure the approaches are comparable, the total extraction present value should be actuarially equivalent. The details are listed in the following sections.

3.3.3.1 Not utilizing housing wealth

Most retirees do not utilize their housing wealth during retirement. In this study, we used this approach as the benchmark to evaluate the equivalent lump-sum gain for each of the home equity release approaches. Under this scenario, we assumed that retirees remain in their current homes throughout retirement. We also assumed that they would spend all of their retirement income each year and evaluated their consumption utility based on the consumption utility function outlined in Section 3.3.4.

3.3.3.2 Downsize the current home

Downsizing differs substantially from the remaining approaches. Under this approach, a household must vacate their current home and move to the new home they purchase. This will impact their housing utility, whereas by using the other approaches, housing utility remains constant since the household remains in their current home and "ages in place".

We assumed that households move out of their current property at age 67 and purchase another property of a lower value. In Australia, one's primary residence is exempt from capital gains tax and land tax. However, households must still pay the transfer duty to NSW Revenue. We calculate the transfer duty based on Table 3.2.

Table 3.2: Transfer duty in New South Wales.

Property value	Transfer duty rate
A$0 to A$14,000	A$1.25 for every A$100 (the minimum is A$10)
A$14,000 to A$32,000	A$175 plus A$1.50 for every A$100 over A$14,000
A$32,000 to A$85,000	A$445 plus A$1.75 for every A$100 over A$32,000
A$85,000 to A$319,000	A$1,372 plus A$3.50 for every A$100 over A$85,000
A$319,000 to A$1,064,000	A$9,562 plus A$4.50 for every A$100 over A$319,000
Over A$1,064,000	A$43,087 plus A$5.50 for every A$100 over A$1,064,000

Notes: This information is extracted from the NSW Revenue (2021).

After downsizing from the current property and purchasing a new property, the remaining amount (after deducting the transfer duty) is added to superannuation through the Downsizer Contribution Scheme. There is a contribution cap of A$300,000, for this scheme and in our model, any amount exceeding this cap is assumed to be allocated to financial assets.

The downsizing amount is the value difference between the current home and downsized home. This amount gives the retirees extra liquidity for retirement expenditure. The downsizing amount under the income stream scenario is calculated as an actuarial equivalent value of the total withdrawal amount from the reverse mortgage approach. The actuarially equivalent value is calculated as the annuity factor multiplied by the annual payment received by the households under the reverse mortgage approach.

$$Downsizing\ amount = a_{67:\overline{33|}} \cdot annual\ payment\ from\ reverse\ mortgage. \quad (3.2)$$

$a_{67:\overline{33|}}$ is an actuarial notation defined as the present value of the series of A\$1 payable when an individual at age 67 is alive at the beginning of each year, with a maximum period payable of 33 years since we set the age limit as 100 (please refer to Section 3.3.3.3 for details regarding the annual payment from the reverse mortgage). The downsizing amount must cover the transfer duty, while the remaining amount contributes to the superannuation fund.

Under the lump-sum scenario, the downsizing amount is defined as $\alpha^{lump\ sum} \cdot H_0$, where $\alpha^{lump\ sum}$ is the scenario pre-defined extraction percentage. This downsizing amount must also cover the transfer duty.

The household owns 100% of its downsized home, which becomes part of the inheritance when the last member of the household dies. Notably, if the downsizing amount is less than the transfer duty, the retired household will not undertake to downsize and will have no lump-sum gain/loss. This is because it would not be a rational approach since there is no additional liquidity extracted with the housing utility reduced after downsizing.

3.3.3.3 Reverse mortgage

Using this approach, we assumed that retirees take out a reverse mortgage loan from a private company. We focused on two scenarios: 1) an income stream payout where the retirees borrow a certain percentage of initial housing wealth each year and 2) a lump-sum payout where the retirees borrow a large lump-sum amount at age 67. Yeoh (2021) reported that the main approach of reverse mortgage borrowers in Australia currently is to take out a line of credit to use as a contingency plan. For simplicity, we did not include the line of credit as an option in this study as the line of credit involves unplanned events, which cannot be observed at the retirement age.

A reverse mortgage involves using one's primary home as collateral to extract liquidity from housing wealth, while homeowners retain full ownership and remain in the property. Notably, owners do not need to repay the loan while they still live on the same property. The amount extracted from the reverse mortgage is used to increase consumable wealth (C_t). A debt account is established and the withdrawal amount and interest accrued are added to this account each year. The balance at the beginning of each year is charged a variable interest rate under this arrangement. Following Chen *et al*. (2010) and Shao *et al*. (2015), we define the variable interest rate charged on the reverse mortgage, r_t^{RM}, as:

$$r_t^{RM} = r_t + \kappa + \pi, \tag{3.3}$$

where r_t is the return on cash with the modeling details outlined in Section 3.3.6, κ is the lender's spread margin, and π is the reverse mortgage premium rate. The lender's spread margin is the spread between the conventional mortgage rates and the risk-free rate. The reverse mortgage premium rate π aims to cover the cost of the NNEG. Under the National Consumer Credit Protection Act 2009, reverse mortgage products provided in Australia are required to include the NNEG feature, which ensures that the loan balance never exceeds the house price at the time of loan repayment. In this study, we assume the lender's spread margin and the reverse mortgage premium rate remain constant over time.

The current cash rate (at September 2021) in Australia is 0.1% p.a., while the mortgage lending rate is currently around 2.9% p.a. [6]; hence, the current lending margin is 2.8% p.a. in the Australian market. Private reverse mortgage providers

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[6] The Commonwealth Bank of Australia (CBA), Westpac Banking Corporation (Westpac), National Australia Bank (NAB), and Australia and New Zealand Banking Group (ANZ) account for about 78% of Australian residential mortgages market share (Rosanes, 2021). The current owner-occupied home loan variable rates are 2.7% p.a., 2.72% p.a., 2.69% p.a., and 3.42% p.a. as of July 2021.

in the Australian market charge their customers a variable interest rate ranging from 4.98 to 5.62% p.a., with an average of 5.30% p.a. Deducting the average reverse mortgage interest rate from the current cash rate r_t and the lending margin κ from the average variable interest rate, we calculated a reverse mortgage premium rate π of 2.4% p.a. While this rate is slightly higher than the reverse mortgage premium rate from Shao *et al.* (2015), it can be justified due to a change in the economic environment due to current low interest rates.

Apart from the interest rate, private reverse mortgage providers usually charge fees at the beginning of a contract. Heartland Reverse Mortgages and P&N Bank (a division of Police and Nurses Ltd) offer reverse mortgages with different types of fees, including a valuation fee and registration fee, for a total of up to A\$3,000 per reverse mortgage contract. For simplicity, we adapted Household Capital's fee structure in this study, in which borrowers are charged a 1.5% establishment fee with no other ongoing and settlement fees[7].

Notably, the household will not repay the debt while they are living at the property. Instead, we assumed the total loan balance will be repaid at the end of the year when the last member of the household dies (i.e., $G_t = 0$). As a result, the loan amount is subtracted from the inheritance and will impact the bequest utility (see details in Section 3.3.4).

In this study, we investigated income stream and lump-sum withdrawal scenarios. For a lump-sum withdrawal, the percentage of housing wealth of the one-off extraction is defined as $\alpha^{lump\ sum} \cdot H_0$. For the income stream, α^{income} is the percentage of housing wealth withdrawn each year under the income

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[7] This is calculated at the time when the research conducts. Household Capital has now changed the fee structure to a flat fee of \$900.

stream scenario. α^{income} remains constant throughout the retirement years. Hence, the annual payment from the reverse mortgage in year t is:

$$annual\ payment\ from\ reverse\ mortgage = \alpha^{income} \cdot H_0. \qquad (3.4)$$

We apply the maximum initial LVR for this approach. Through benchmarking to the current Australian National Consumer Credit Protection Act, we set the maximum initial LVR is set at 27% for retirees aged 67.

3.3.3.4 Pension Loans Scheme

As previously discussed, the PLS is a reverse mortgage provided by the Australian Government. Similar to the private reverse mortgage, the PLS allows retirees to use their housing wealth as collateral to extract liquidity for extra retirement income and has the same repayment structure as the private reverse mortgage. However, the PLS is less flexible than a private reverse mortgage in exchange for a lower interest rate. The current interest rate charged by the PLS is 4.5% p.a. (down from 5.25% p.a., which had applied between December 1997 and December 2019). The interest rate charged by PLS is not transparent and there are no published rules about how the interest rates are set. Thus, we make similar assumptions to those for private reverse mortgage products regarding the interest rate charged by the PLS. Let the variable interest rate charged on the PLS be is r_t^{PLS}, we obtain the following relationship :

$$r_t^{PLS} = r_t + \kappa^{PLS}, \qquad (3.5)$$

where r_t is the return on cash using the modeling details outlined in Section 3.3.6, and κ^{PLS} is the margin of the PLS. The current cash rate is 0.1% p.a., with the current variable rate charged by the PLS being 4.5% p.a. Thus, κ^{PLS} is 4.4% p.a. As a result, we defined the interest rate charged by the PLS as the return on cash defined in Section 3.3.6 plus 4.4% p.a.

For the income stream approach under the PLS, several conditions apply that will reduce the amount extracted. First, there is an ongoing maximum loan amount constraint under the PLS (commercial reverse mortgages only have the maximum initial LVR, but not ongoing). To calculate the maximum loan amount throughout the PLS arrangement, Services Australia introduced an Age Component in the calculation. At any given time, the accumulated loan amount (including the interest) cannot exceed the maximum loan amount. The maximum loan amount is calculated as follows:

$$Max\ loan_t = round\ down\left(\frac{Estimated\ house\ price_t}{10,000}\right) \times Age\ component_t. \qquad (3.6)$$

The age component amount is outlined in Table 3.3**Table *3.3***.

Table 3.3: Age component of the Pension Loans Scheme.

Age	Age Component amount	Age	Age Component amount	Age	Age Component amount	Age	Age Component amount
67	A$2,740	73	A$3,460	79	A$4,380	85	A$5,550
68	A$2,850	74	A$3,600	80	A$4,560	86	A$5,770
69	A$2,960	75	A$3,750	81	A$4,740	87	A$6,000
70	A$3,080	76	A$3,900	82	A$4,930	88	A$6,240
71	A$3,200	77	A$4,050	83	A$5,130	89	A$6,490
72	A$3,330	78	A$4,210	84	A$5,330	90+	A$6,750

Notes: This information is extracted from Services Australia (2021).

The withdrawal amount is capped based on the maximum loan amount. Additionally, the combined PLS payment and Age Pension payment are capped at 150% of the full Age Pension rate. We applied these current rules to our simulation process. Hence, the maximum PLS payment in year t (PLS_t^{max}) is:

$$PLS_t^{max} = \min\left(Max\ loan_t - accumulated\ loan_{t-1}, 150\% \times AP_t^{full} - P_t^{Age\ Pension}\right), \qquad (3.7)$$

where $P_t^{Age\ Pension}$ is the Age Pension received by the household in year t and AP_t^{full} is the full Age Pension rate. The final withdrawal amount is the same as the reverse mortgage amount, capped by the maximum PLS payment (i.e., $\min\left(PLS_t^{\max}, \alpha^{income} \cdot H_0\right)$).

According to the 2021–2022 Federal Budget, there are two main changes to the PLS: allowing lump-sum withdrawal and introducing the NNEG (effective from July 2022). The introduction of the lump-sum withdrawal allows eligible households to withdraw up to 50% of the maximum annual Age Pension. We also performed a lump-sum withdrawal analysis separately from the income stream analysis. Therefore, the lump-sum withdrawal under the PLS is:

$$\min\left(Max\ loan_t, 50\% \cdot AP_t^{full}, \alpha^{lump\ sum} \cdot H_0\right). \tag{3.8}$$

3.3.3.5   Home reversion

Homesafe Solutions offers a product that has home reversion features. The debt-free equity release product offered by Homesafe Solutions pays a discounted lump-sum to retiree households in exchange for a proportion of the proceeds when the property is sold, and the contract terminates. The contract only terminates when the retiree households decide to sell their property or die. Additionally, Homesafe offers a rebate system in which the homeowners or their heirs will receive a rebate in the event of the contract being completed in the early years. In this study, we simplified the product by pricing the discounted lump-sum under the actuarial fair value method.

The home reversion approach in this study involves selling a proportion κ of home equity to the product provider. In exchange, the retired households receive a series of annual payments for the rest of their lives. A lease-for-life component is embedded in the home reversion, which reflects the rent of the proportion of

the home that is sold. Therefore, using the assumptions of Alai *et al.* (2014), the proceeds of the sale consist of two components: the lease-for-life agreement and the amount that can be used for the annual payments. Thus, the following relationship holds:

$$\kappa H_0 = LL + a_{67:\overline{33|}} \cdot \alpha^{income} \cdot H_0, \tag{3.9}$$

where LL is the lease-for-life agreement component, H_0 is the house price at the beginning of the arrangement, $a_{67:\overline{33|}}$ is the actuarial notation defined in an earlier portion of this section, and α^{income} is the percentage of housing wealth withdrawn each year under the income stream scenario. Moreover, y_t is the rental yield.

Hence, the expected present value of the lease-for-life agreement is as follows:

$$LL = \kappa \times \sum_{t=1}^{100-67} D_t \times y_t \times H_0 \times \prod_{s=1}^{t}(1 + g_s) \times \text{Pr (stay in the home}_t). \tag{3.10}$$

D_t is the discount factor, for which we use the return on cash simulated in Section 3.3.6. Pr (stay in the home$_t$) is the probability that a household will stay on their property for t years, which we calculated as:

$$\text{Pr(stay in the home}_t) = \text{Pr(at least one member of household alive}_t). \tag{3.11}$$

For a single household, the following formula applies:

$$\text{Pr(stay in the home}_t) = {}_tP_{67}. \tag{3.12}$$

In the simulations, the probabilities are gender-specific.

For a couple household, the following formula applies:

$$\text{Pr(stay in the home}_t) = {}_tP_{67}^{male} + {}_tP_{67}^{female} - {}_tP_{67}^{male} \times {}_tP_{67}^{female}. \qquad (3.13)$$

By rearranging the formula, the proportion of the property to sell under the income stream approach is:

$$\kappa = \frac{\alpha^{income} \cdot a_{67:\overline{33|}}}{(1 - \sum_{t=1}^{\omega} D_t \times y_t \times \prod_{s=1}^{t}(1 + g_s) \times \text{Pr(stay in the home}_t))}. \qquad (3.14)$$

After calculating the proportion to sell κ, the home equity amount will be reduced. This does not impact the housing utility because the household members are still living in the same place. However, the bequest component is impacted; when the property is sold, the inheritance will only consist of the remaining financial wealth, superannuation, and the retained component of housing wealth.

Using similar logic, the proportion to sell under the lump-sum scenario is:

$$\kappa = \frac{\alpha^{lump\ sum}}{(1 - \sum_{t=1}^{\omega} D_t \times y_t \times \prod_{s=1}^{t}(1 + g_s) \times \text{Pr(stay in the home}_t))}. \qquad (3.15)$$

3.3.4 Utility functions

We assumed that the retirees derive utility from consumption, housing, and bequests. We modeled single and couple households. If one partner in a couple household dies, the household was treated as a single household in the remaining simulated years. We describe the stochastic mortality model in Section 3.3.5.

In each year, the household utility is defined as follows:

$$U(C_t, W_t, S_t, H_t, G_t) = \begin{cases} U_C(C_t, G_t) + U_H(H_t), & \text{if } G_t \geq 1 \\ U_B(W_t, H_t, S_t), & \text{if } G_t = 0 \\ 0, & \text{if } G_t = \Delta \end{cases} \quad (3.16)$$

When $G_t \geq 1$, at least one household member is alive at the end of year t, and the household enjoys utility from consumption and housing. When $G_t = 0$, the last household member has died in year t, and the household derives a final bequest utility by leaving assets to their children. Thereafter, the household derives no further utility gain. C_t is the consumable wealth of the household in year t, H_t is the market price of the housing wealth at the end of year t, W_t is the financial wealth at the end of year t, and S_t is the superannuation balance at the end of year t.

The total utility of a simulation path i is:

$$U_i = \sum_{t=1}^{\omega-67} \beta^t \cdot U(C_t, W_t, S_t, H_t, G_t). \quad (3.17)$$

where β is the subjective discount factor, and ω is the limiting age of the household (see Section 3.3.5).

We generated 5,000 simulation paths and took the average of these simulations to obtain the expected utility for different households and different retirement approaches.

3.3.4.1 Consumption utility function

We assumed that the household's utility of consumption exceeding the consumption floor follows a CRRA function. We used a generalized CRRA model to include a time-dependent consumption floor (Thorp *et al.*, 2007; Iskhakov *et al.*, 2015); in other words, the consumption utility increases only

when the consumption is above the consumption floor. Retirees derive utility when they have satisfied a basic and modest living standard. The consumption utility function is defined as:

$$U_C(C_t, G_t) = \frac{\left(C_t - \bar{C}(t, G_t)\right)^{1-\gamma_C}}{1 - \gamma_C}, \tag{3.18}$$

where $\gamma_c > 1$ is the risk aversion parameter for consumption. The higher the value of γ_c, the more risk-averse retirees are with respect to their consumption. $\bar{C}(t, G_t)$ is the consumption floor, which depends on the number of household members and is indexed to inflation over time. C_t is the consumable wealth of the household in year t. The consumable wealth of the household in year t is given by:

$$C_t = \max(0, W_t \times r_t) - T_t + S_t \times m_t + P_t^{Age\ Pension} + P_t^{RM} + P_t^{PLS} + P_t^{HR}, \tag{3.19}$$

where W_t denotes the financial wealth of the household in year t, P_t is the Age Pension received in year t, S_t is the superannuation account balance in year t, T_t is the income tax payable in year t, m_t is the minimum superannuation drawdown rate, and r_t is the return of financial wealth. The modeling assumption for r_t is explained in detail in Section 3.3.6. P_t^{DS}, P_t^{RM}, P_t^{PLS}, and P_t^{HR} are the payments from downsizing, the reverse mortgage, the PLS, and the home reversion, respectively. For a given approach to utilize housing wealth, only one of P_t^{RM}, P_t^{PLS}, and P_t^{HR} would be greater than 0. The first component of consumable wealth is the dollar return from financial wealth. If the return is negative, it does not contribute to consumable wealth. The second part is the income tax, which is based on the earnings from financial wealth. If income is negative, there is no tax payable in that year. The third component is the drawdown from superannuation (the minimum drawdown is assumed), while the

last component is the eligible Age Pension amount in year t. The minimum drawdown rates from superannuation are listed in Table 3.4.

Table 3.4: Minimum superannuation withdrawal rate.

Age	Minimum withdrawal rate
65-74	5%
75-79	6%
80-84	7%
85-89	9%
90-94	11%
95 or above	14%

We assumed that a household spends down its financial wealth only when the consumable wealth C_t is insufficient to cover the consumption floor $\bar{C}(t, G_t)$. Hence, we have the following financial wealth process:

$$W_{t+1} = \max\big(0, \min(W_t, W_t \times (1 + r_t)) + \min(0, C_t - \bar{C}(t, G_t))\big). \quad (3.20)$$

The first component indicates that any earnings from financial wealth will be consumed, while any loss incurred will reduce financial wealth. The second component is the withdrawal from financial wealth if the consumable wealth of that year is less than the consumption floor. Notably, the consumption floor is based on household status and will become the consumption floor of a single household if G_t is reduced from 2 to 1.

The superannuation process is defined as follows:

$$\begin{aligned}
S_{t+1} = \max\Big(0, \big((1 - m_t) \times S_t \times (1 + r_t^S \cdot (1 - p.fee \cdot \mathbb{1}(r_t^S > 0)))\big) \\
- management\ fee \\
+ \min(0, C_t - \bar{C}(t, G_t) + \min(W_t, W_t \times (1 + r_t)))\Big),
\end{aligned} \quad (3.21)$$

where r_t^S is the return of superannuation (see Section 3.3.6). Superannuation is assumed to be reduced by the minimum drawdown rate at the beginning of the

year since retirees are required to withdraw from their superannuation annually, according to the schedule listed in Table 3.4. $p.fee$ is the performance fee, which is assumed to be 0.6% on the return of superannuation if the return is positive. The second component, $management\ fee$, is assumed to be A\$100 plus 0.05% of S_{t+1}. These amounts are benchmarked to Australia's largest superannuation fund, Australian Super[8]. The third component is the additional withdrawal from superannuation if the households' financial wealth is insufficient to cover the minimum consumption level for that year. If the retirees spend all of their financial wealth and superannuation, they must rely on the Age Pension for the remainder of their retirement.

3.3.4.2 Bequest utility function

Following Lockwood (2018) and Andréasson *et al.* (2017), we adopted the following bequest utility function:

$$U_B(W_t, H_t, S_t) = \left(\frac{\theta}{1-\theta}\right)^{\gamma_b} \times \frac{1}{1-\gamma_b}$$
$$\times \left(\frac{\theta}{1-\theta} \times a + S_t + H_t + W_t\right)^{1-\gamma_b}, \tag{3.22}$$

where θ is the degree of altruism, $\gamma_b > 1$ is the bequest risk aversion parameter, and a is the threshold for the luxury bequest. The degree of altruism controls the preference of bequest against consumption. Following Andréasson *et al.* (2017) and Ding (2014), we set θ as a fixed number of 0.96. For the bequest risk aversion parameter, like the consumption risk aversion parameter, a higher value of γ_b indicates that the household is more risk-averse in leaving a bequest for their children. A bequest is treated as luxury goods; hence, the households only

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[8] Australian Super charges their member 0.6% performance fee, and A\$2.25 + 0.04% of account balance are charged as administration fee. For more details, please visit www.australiansuper.com/campaigns/feechanges.

derive utility when the inheritance is above a certain threshold. B_t denotes bequest wealth, which is defined as $B_t = S_t + H_t + W_t$ and is the sum of the superannuation, housing, and financial wealth of a household at the end of year t. We assumed that the household leaves all of their remaining wealth to their children as an inheritance.

3.3.4.3 Housing utility function

Housing wealth is typically the largest asset for retiree households. Under the means-tested Age Pension, the primary home is exempt from the asset test. Hence, housing wealth is important for households to store their wealth and still receive Age Pension payments. The home also provides a place of residence for households without paying rent. Therefore, we assume that housing wealth generates a separate utility for the household. Following Cho and Sane (2013) and Andréasson *et al.* (2017), we define the utility of owning the primary home as:

$$U_H(H_t) = \frac{\gamma_H}{1 - \gamma_H} \times (\lambda \times H_t)^{1 - \gamma_H},$$

$$(3.23)$$

where $\gamma_H > 1$ is the risk aversion parameter for housing, λ is the equivalent rental yield, and H_t is the market price of the housing wealth at the end of year t. γ_H—similar to γ_C and γ_B—is defined such that the higher its value, the more risk-averse the household is regarding their housing wealth. The equivalent rental yield λ is the rental yield that the household would need to pay if they rent a home that is as satisfying as their current home. The market price of the home will grow each year (see Section 3.3.6). We assume the utility from housing is unchanged if the household size decreases from two individuals to one in any year.

3.3.4.4   Characteristics of the utility functions

The final utility (U_i) of each path i is a decreasing function of the risk aversion parameters γ_c, γ_b, and γ_h. As such, the curvature of the utility function is increased when the risk aversion parameters are reduced. Hence, while keeping other parameters unchanged, decreasing the consumption risk aversion parameter γ_c indicates that the individuals would experience more utility gain for the same amount of dollar increment as the utility curvative increases. More utility gain (or loss) would be derived from consumption relative to housing utility and bequest utility, while a similar impact applies to other risk aversion parameters. In this study, we performed a sensitivity analysis around the risk aversion parameters to understand the impact on utility and thus the equivalent lump-sum gain.

Additionally, the shape of the final utility—as a function of liquid wealth (sum of superannuation and financial wealth)—is similar to a cubic function with two turning points. Assuming that a household is entitled to the full Age Pension amount, the extra liquid wealth given to the household would increase the final utility, given that the extra liquid wealth does not impact the entitled Age Pension payments. If the Age Pension payments are reduced because of the extra liquid wealth, the utility function would become a decreasing function. The final utility function would again become an increasing function of the liquid wealth when the liquid wealth is well above the eligibility threshold to receive the Age Pension.

3.3.5 Stochastic mortality model

In this study, we simplify the model by only considering the mortality of retirees. We adopted the popular CBD model proposed by Cairns *et al*. (2006) to generate mortality scenarios. The model has two age-period terms without any static age

function and cohort effect. The predictor function of the CBD model is defined as:

$$\ln\left(\frac{q_{x,t}}{1 - q_{x,t}}\right) = \kappa_t^{(1)} + (x - \bar{x})\kappa_t^{(2)}, \tag{3.24}$$

where $\bar{x}$ is the average age in the dataset, x is the input age, $q_{x,t}$ is the mortality of age x in year t, $\kappa_t^{(1)}$ is the level of the mortality curve after the logit transformation, and $\kappa_t^{(2)}$ is the slope between the logit-transformed mortality and age.

Figure 3.3: Australian female and male simulated survival probability.
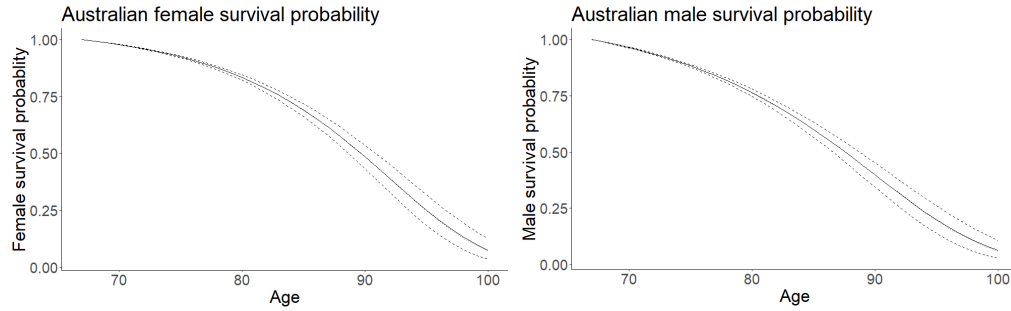
We estimated the CBD model using Australian year-age data from the Human Mortality Database for ages 60 to 100 between 1990 and 2018. We then used the R package StMoMo (Villegas *et al.*, 2018) to fit and estimate the model. We generated 5,000 simulated paths for female and male retirees as the sample paths of G_t from the CBD model. Figure 3.3 presents the forecasted male and female survival probabilities $_tP_{67}$. Figure 3.4 shows the residual plots of mortality. This figure demonstrates that the modeled mortality fits fairly well for most ages and years, with a relative error of less than 10%.

Figure 3.4: Residual plots of female and male mortality.
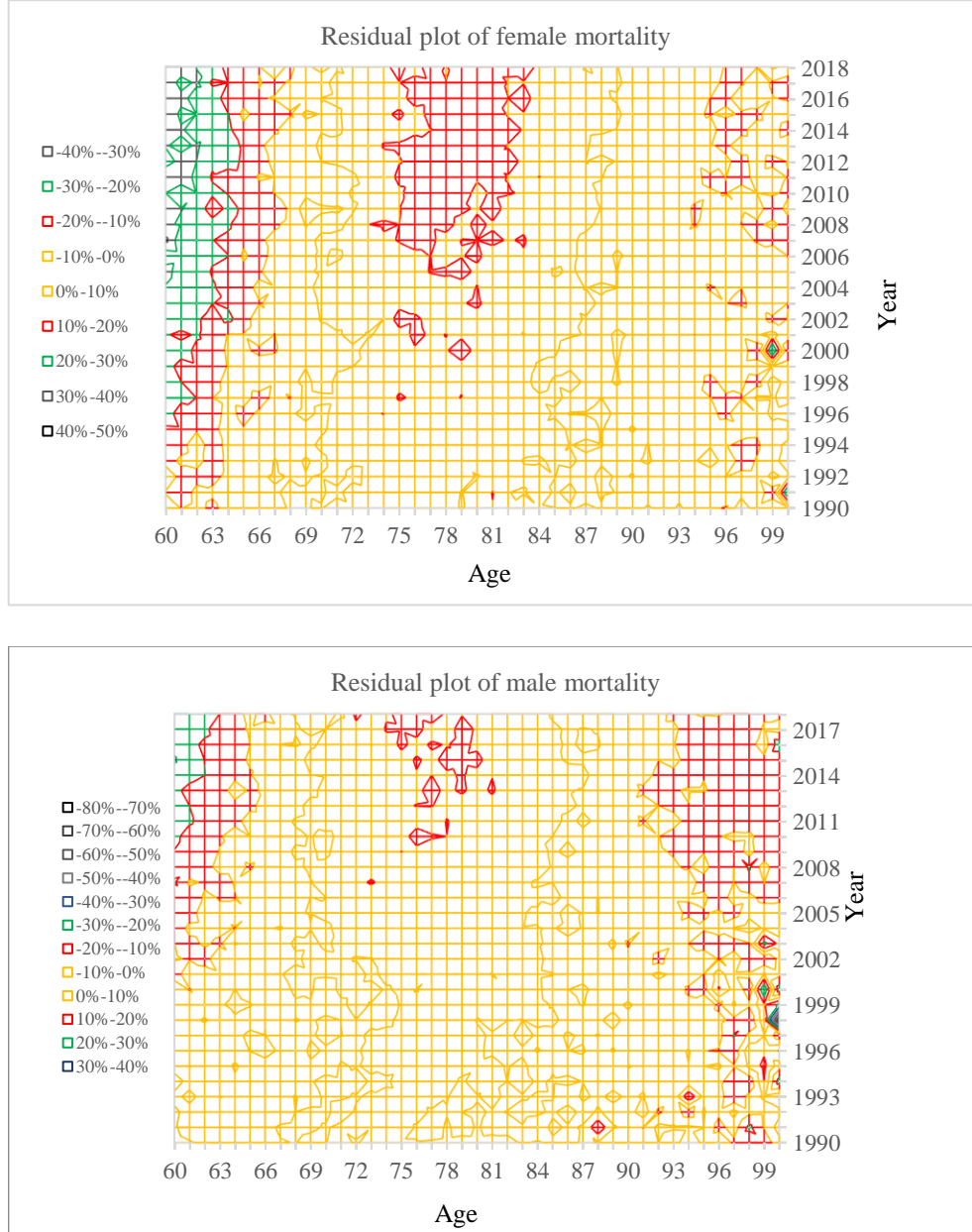
We generated 5,000 simulated paths for female and male retirees as the sample paths of G_t from the CBD model. We assumed that there is no correlation between male and female mortality rates and the macroeconomics variables. Additionally, we assumed the limiting age of an individual to be 100.

3.3.6 Economic scenarios

We used the SUPA model developed by Chen *et al.* (2020) to generate economic scenarios. The SUPA model is a multi-factor stochastic investment model based on the Monte Carlo method, which was developed using Australian data from Bloomberg Terminal, the Australian Bureau of Statistics, and the Reserve Bank of Australia. We used the model to generate scenarios for the possible outcomes of economic variables including inflation, the unemployment rate, equity returns, fixed-income returns, wage growth, and house price growth. We used the calibrated model by Chen *et al.* (2020) to simulate the SUPA model 5,000 times and obtained the necessary variables for our simulations.

Chen *et al.* (2020) described the SUPA model as follow:

Inflation at time t: $q(t)$

$$q(t) = \left(1 - \phi_q\right) \times \mu_q + \phi_q \times q(t-1) + \epsilon_q(t), \qquad (3.25)$$

Wage growth at time t: $w(t)$

$$w(t) = \psi_w \times q(t-1) + \mu_w + \epsilon_w(t), \qquad (3.26)$$

Long-term interest rate at time t: $l(t)$

$$L(t) = (1 - \kappa_L) \times L(t-1) + \kappa_L \times \left(\mu_L - \mu_q\right) + \epsilon_L(t) \qquad (3.27)$$

$$l(t) = L(t) + q(t) \qquad (3.28)$$

Short-term interest rate at time t: $s(t)$

$$S(t) = S(t-1) + \kappa_S \times \left(L(t-1) - S(t-1)\right) + \epsilon_S(t) \qquad (3.29)$$

$$s(t) = S(t) + q(t) \tag{3.30}$$

Cash rate at time t: $c(t)$

$$c(t) = \frac{S(t) + S(t-1)}{2} \tag{3.31}$$

Domestic equity dividend yield at time t: $y(t)$

$$\ln(y(t)) = \ln(\mu_y) + X_y(t) \tag{3.32}$$

$$X_y(t) = \phi_y \times X_y(t-1) + \epsilon_y(t) \tag{3.33}$$

Domestic dividend growth rate at time t: $d(t)$

$$d(t) = q(t) + \mu_d + \tau_{d,1} \times \epsilon_y(t) + \tau_{d,2} \times \epsilon_y(t-1) + \epsilon_d(t) \\ + \theta_d \times \epsilon_d(t-1) \tag{3.34}$$

Domestic asset dividend index at time t: $d(t)$

$$D(t) = D(t-1) \times \exp(d(t)) \tag{3.35}$$

Domestic asset price return at time t: $p(t)$

$$p(t) = \ln(D(t)) - \ln(ln(1 + y(t))) - \ln(P(t)) \tag{3.36}$$

Domestic asset price at time t: $P(t)$

$$P(t) = P(t-1) \times \exp(p(t)) \tag{3.37}$$

Domestic equities total return at time t: $e(t)$

$$e(t) = p(t) + \ln\left(1 + \ln(1 + y(t-1)) \times \exp\left(\frac{p(t-1)}{2}\right)\right) \tag{3.38}$$

International equity total return at time t: $n(t)$

$$n(t) = \mu_n + \psi_n \times e(t) + \epsilon_n(t) \tag{3.39}$$

Domestic bond at time t: $b(t)$

$$b(t) = \psi_{b,1} \times l(t) + \psi_{b,2} \times l(t-1) + \psi_{b,3} \times s(t) \\ + \psi_{b,4} \times s(t-1) + \epsilon_b(t) \tag{3.40}$$

International bond at time t: $o(t)$

$$o(t) = \mu_o + \psi_o \times b(t) + \tau_o \times \epsilon_q(t) + \epsilon_o(t) \tag{3.41}$$

House price growth at time t: $h(t)$

$$h(t) = \alpha_h \times h(t-1) + \alpha_q \times q(t-1) + \epsilon_h(t) \tag{3.42}$$

Unemployment rate at time t: $u(t)$

$$u(t) = u(t-1) + \kappa_u \times \left(\mu_u - u(t-1)\right) \\ + \alpha_q \times \left(q(t) - q(t-1)\right) + \alpha_S \times \left(S(t) - S(t-1)\right) \\ + \epsilon_u(t) \tag{3.43}$$

We simulated the whole SUPA model using the parameters listed in Appendix A.1 of Chen *et al.* (2020). Then we use the simulated results of the following variables for further calculations:

1. Inflation ($q(t)$): impacts the consumption floor, tax brackets, Age Pension amount, and thresholds of the Age Pension.

2. House price ($h(t)$): impacts housing wealth.

3. Wage growth ($w(t)$): impacts the Age Pension amount.

4. Australian share market (equity) return ($e(t)$): impacts the financial wealth growth and superannuation growth.

5. International shares (equity) return ($n(t)$): impacts superannuation growth.

6. Return on cash ($c(t)$): impacts the return of non-risky assets.

7. Domestic bond return ($b(t)$): impacts superannuation growth.

We estimated the return of the superannuation balance by using the return estimate of international shares, Australian shares, cash, and domestic bonds. There are multiple asset classes listed by ASFA (2021) and APRA (2021), such as hedge funds, unlisted equity, infrastructure, listed and unlisted properties, and others that are not estimated in the SUPA model. These asset classes account for 29% of MySuper asset allocation. By removing these asset classes and rescaling those remaining, we estimated the asset allocation as shown in Table 3.5.

Financial and other wealth is assumed to be split into 25% Australian share market and 75% cash (which is the standard transaction account that generates interest at the cash rate listed in this section). This is estimated using the HILDA Survey data, by adding up shares and trusts divided by the total non-primary housing wealth.

Table 3.5: Asset allocation of superannuation.

Asset class	Asset allocation in ASFA (2021)	Asset allocation (post rescale)
Cash	6%	8.5%
Australian listed shares	20%	28%
Bond	16%	22.5%
Listed property	2%	N/A
Unlisted property	6%	N/A
International shares	29%	41%
Infrastructure	8%	N/A
Hedge funds	0%	N/A
Unlisted equity	5%	N/A
Other	8%	N/A

Notes: Information for the column "Asset allocation in ASFA" is extracted from ASFA (2021) and the column "Asset allocation (post rescale)" is calculated based on ASFA (2021) information.

The following graphs present the mean, median, and 90% confidence interval of the forecast variables (joint with historical data when applicable). Where the historical data was observed from the Australian Bureau of Statistics (ABS) (2021a), inflation was forecasted as being relatively stable in the upcoming years at 1% to 4% p.a., with a mean of approximately 2.5% p.a. For the NSW house price index, we obtained historical data from the ABS (2021b). The simulated results show a continuous trend of house price growth over the next 30 years, with an expected average annual growth rate of 4.95% p.a. Since historical data demonstrated substantial volatility of house price movement, the 90% confidence interval is quite large for this simulation.

The Australian wage levels were obtained from the ABS (2021c) and historical data showed relatively low volatility, which led to a stable forecast and a rather narrow 90% confidence interval. The Australian share market, for which we used the ASX 200 as a proxy for performance, showed volatile performance over the past 20 years. Hence, the simulated result demonstrates a wide 90% confidence interval. For return on cash, we used the target cash rate from the Reserve Bank of Australia (2021) as the historical data. Despite Australia currently experiencing a low interest rate, the simulation shows a rebound in the cash rate

target in 2021 and 2022 back to the pre-COVID level and its decreasing trend continues into the future. For return on international shares and bonds, we plotted the simulation result using the base of 100 for the year 2020.

Figure 3.5: Median, mean, and 90% confidence intervals of the simulated variables.
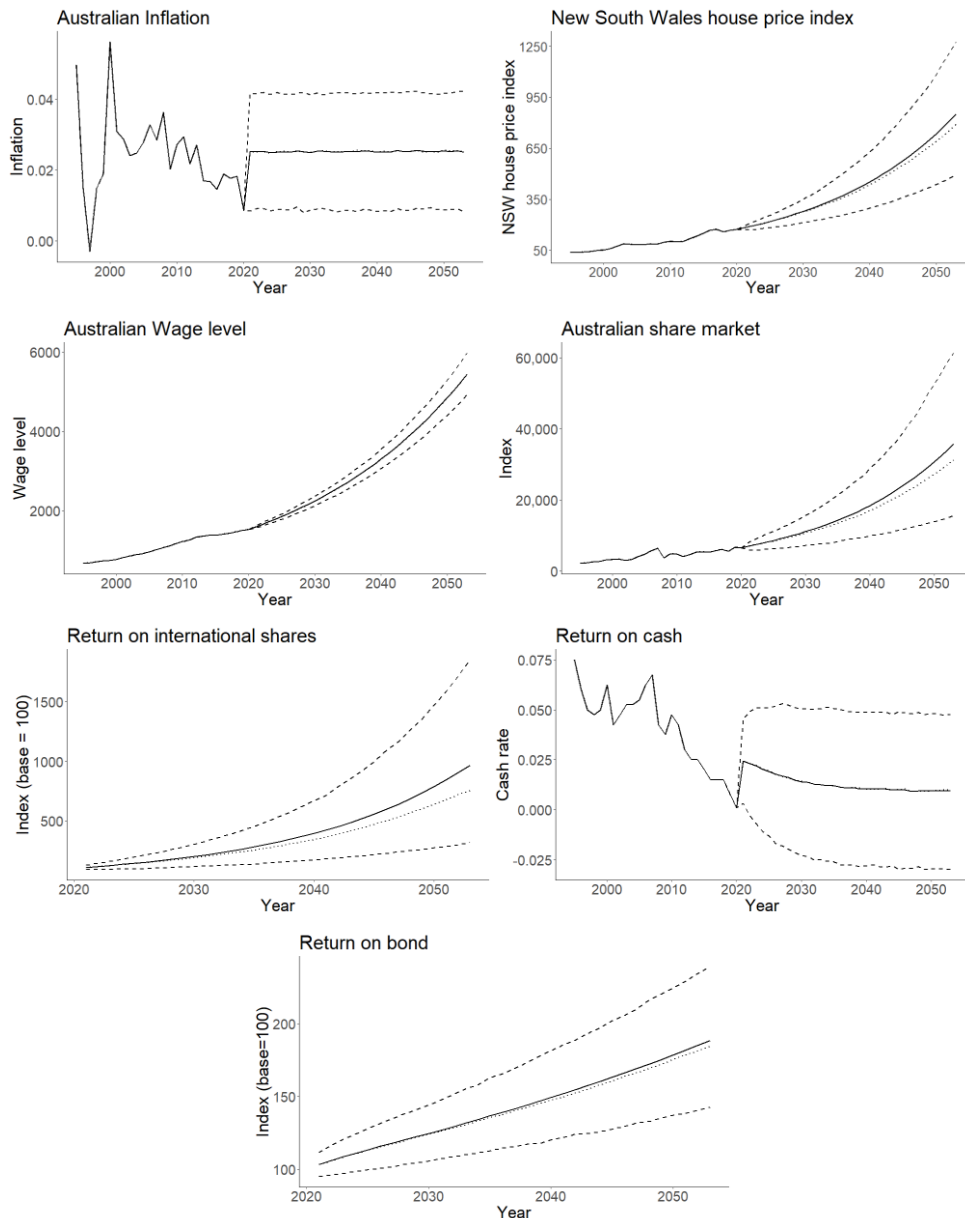
Table 3.6 compares the simulated and historical distributions for all of the aforementioned variables.

Table 3.6: Descriptive statistics for 5,000 simulations of the macroeconomic variables vs the historical average.

Summary statistics of simulations					
Variables	Min	Max	Median	Mean	Standard deviation
Inflation	1.54%	3.48%	2.52%	2.53%	0.86%
House price growth	0.17%	8.62%	4.72%	4.95%	4.33%
Wage growth	3.05%	4.68%	3.92%	3.93%	0.81%
Australian shares return	-1.30%	10.28%	4.83%	5.25%	7.37%
International equity return	-1.46%	14.58%	6.32%	7.11%	12.75%
Return on cash	-5.01%	6.68%	1.28%	1.67%	1.06%
Bond return	-0.28%	4.11%	1.87%	1.94%	6.76%
Summary statistics for the historical data					
Variables	Min	Max	Median	Mean	Standard deviation
Inflation	0.30%	6.13%	2.44%	2.59%	1.32%
House price growth	-2.69%	18.88%	5.66%	6.62%	6.00%
Wage growth	1.75%	6.14%	3.96%	4.05%	1.35%
Australian shares return	-24.17%	23.67%	8.52%	5.39%	12.13%
International equity return	-23.50%	42.16%	7.21%	7.86%	21.61%
Return on cash	1.72%	7.81%	5.07%	5.00%	1.75%
Bond return	-41.87%	15.16%	7.68%	4.93%	10.84%

Note: For historical data, we used the data listed in Chen *et al.* (2020), for which the primary data source was from the Reserve Bank of Australia, the Australian Bureau of Statistics, and Bloomberg Terminal. We used the data reported in Chen *et al.*(2020) in Table A.1 to calculate the historical estimates.

3.3.7 Age Pension and tax rules

3.3.7.1 Age Pension

The Age Pension is a means-tested age pension that is paid subject to asset and income means tests in addition to age and residency requirements. We assumed that the households met the age and residency requirements. Hence, in calculating the Age Pension in this study, we only focused on the means tests. Additionally, we assumed that retired households were homeowners; thus, we only applied the homeowner asset and income test thresholds. Each test produced a receivable Age Pension amount, while the minimum receivable Age

Pension amount from the tests was the entitled Age Pension amount. The tests were conducted on an annual basis in the simulation process.

To calculate the entitled Age Pension amount, the starting point was the maximum Age Pension amount, which was reduced by the rules outlined in each of the tests. Table 3.7 summarizes the asset test thresholds for single and couple households as of July 2021.

Table 3.7: Age Pension payments under the asset test (homeowners).

Marital Status	Threshold of total asset value to be eligible for full Age Pension	Threshold of total asset value to be eligible for partial Age Pension	Full Age Pension amount per fortnight (as of July 2021)
Single	Up to $270,500	Up to $588,250	$952.7
Couple	Up to $405,000	Up to $884,000	$1,436.20

There are three scenarios for each marital status. If the total assessable asset value exceeds the threshold of total asset value to be eligible for the partial Age Pension—i.e., A\$588,250 for single households (A\$884,000 for couple households)—both single and couple households are not eligible to receive any Age Pension payments under the asset test. If the total assessable asset value is less than the threshold of total asset value to be eligible for the full Age Pension (single: A\$270,500; couple: A\$405,000), then the single (couple) households are eligible for the full Age Pension, which is A\$952.70 (A\$1,436.20) per fortnight (as of July 2021). In the final scenario, in which the total assessable asset value is between these two thresholds, the Age Pension payment is reduced by A\$3 per fortnight for every A\$1,000 over the threshold of the total asset value eligible for the full Age Pension (A\$270,500 for single individuals and A\$405,000 for couples). Let AP_t^{asset} be the entitled Age Pension under the asset test in year t, AP_t^{full} be the full Age Pension amount in year t, and T_t^{asset} be the threshold of total asset value to be eligible for the full Age Pension.

$$AP_t^{asset} = \max\left(0, AP_t^{full} - 0.003 \cdot (W_t + S_t - T_t^{asset})\right). \qquad (3.44)$$

The total assessable asset value is the sum of all asset types, including financial investments, personal assets, and private businesses. However, the primary home was not included as part of the total assessable assets.

In the simulation, as per the current Age Pension rules, we indexed the full Age Pension amount using the simulated wage growth or simulated inflation, whichever was greater. On the other hand, we indexed the threshold of total assessable value using simulated inflation.

For the income test, household income was separated into two parts: earnings from financial assets and other earnings. In this study, we assumed that retirees received earnings from financial assets, as stated in Section 3.3.6 that the liquid wealth is stored in cash and equities, and the remaining wealth is placed in the superannuation account. We assume that the earnings from 'other assets' are calculated in the same way as for financial assets. For earnings from savings assets and equities, the deeming rule was applied rather than counting the realized earnings in total assessable income. This was intended to simplify the means-testing calculation and encourage retired households to hold more high-yielding assets. Hence, the realized earnings from financial assets do not impact the Age Pension. The deeming rules also depend on marital status, as summarized in Table 3.8.

Table 3.8: Age Pension deeming rule.

Marital Status	Thresholds for deeming rule	Deeming rate 1	Deeming rate 2
Single	$53,000	0.25%	2.25%
Couple	$88,000	0.25%	2.25%

If the total financial asset value is below the deeming rule threshold of A\$53,000 for single households and A\$88,000 for couples, the total assessable income per

annum is calculated as the deeming rate 1 multiplied by the total financial asset value. If the total financial asset value is above the deeming rule threshold, the total assessable income per annum is calculated as A\$132.50 (A\$220 for couples), plus 2.25 cents for every dollar over the deeming rule threshold. The total financial asset value includes the financial assets and superannuation. Let $I_t^{deeming}$ be the total assessable income per annum under the deeming rule in year t, $T_t^{deeming}$ be the threshold for the deeming rule in year t, DR_1 be the deeming rate 1 and DR_2 be the deeming rate 2. Hence, the total assessable income per annum under the deeming rule is:

$$I_t^{deeming} = \begin{cases} (S_t + W_t) \cdot DR_1 & \text{if } (S_t + W_t) \leq T_t^{deeming} \\ T_t^{deeming} \cdot DR_1 + (S_t + W_t - T_t^{deeming}) \cdot DR_2 & \text{if } (S_t + W_t) > T_t^{deeming}. \end{cases} \quad (3.45)$$

Under the current rule, the thresholds for the deeming rule are indexed with inflation, and we will apply the same rule in the simulation.

Since we assumed that retired households earn income from their financial and other assets at deeming rate, the total assessable income per annum calculated under the deeming rule is the only source that contributes to the total assessable income under the income test. By converting the income per annum to the income per fortnight, we could use the threshold presented in Table 3.9 to calculate the entitled Age Pension amount under the income test.

Table 3.9: Age Pension income test thresholds.

Marital Status	Income thresholds under the income test
Single	180
Couple	320

If the income per fortnight is less than the income threshold, the household is entitled to the full Age Pension amount under the income test. If the income per fortnight is above the income threshold, the entitled Age Pension is reduced by

50 cents for every dollar above the income threshold of the full Age Pension amount. Notably, under the current income test rule, if a household spends the liquid wealth extracted from reverse mortgages/PLS/home reversion within 90 days of the extraction, these payments do not count as part of the income. T_t^{income} denotes the income thresholds under the income test in year t, while AP_t^{income} is the entitled Age Pension under the income test in year t; hence, we have:

$$AP_t^{income} = \begin{cases} AP_t^{full} & \text{if } I_t^{deeming} \leq T_t^{income} \\ \max\left(0, AP_t^{full} - 0.5 \cdot \left(I_t^{deeming} \cdot \dfrac{14}{365} - T_t^{income}\right)\right. & \text{if } I_t^{deeming} > T_t^{income} \end{cases}. \quad (3.46)$$

In the simulation, the income thresholds under the income test were indexed to inflation.

The Age Pension amount under the income test was then compared to the Age Pension amount under the asset test. The lesser amount is the entitled Age Pension amount of the household in that year. With $P_t^{Age\ Pension}$ as the entitled Age Pension in year t, we have:

$$P_t^{Age\ Pension} = \min\left(AP_t^{asset}, AP_t^{income}\right). \quad (3.47)$$

3.3.7.2   Tax treatment

The income of households is taxed depending on marital status and income received. Tax bracket details can be found in "Schedule 9 – Tax table for seniors and pensioners" (ATO, 2020). For the simulations, all earnings were calculated for the households and divided by the number of household members. The tax amount was then calculated on an individual basis and aggregated for each

household[9, 10]. During the decumulation stage of superannuation, the growth of the superannuation balance of retired individuals is not taxed; hence, we also did not apply any tax on the growth of superannuation in our simulation. We assumed that the superannuation balance is a concessional contribution taxed at 15% at the beginning of the simulation. We also included the tax offset for seniors and pensioners, which is summarized in Table 3.10.

Table 3.10: Tax offset table.

Marital Status	Annual income eligible for full offset	Annual income eligible for partial offset	Max tax offset amount
Single	Up to $32,279	50,119	2,230
Couple (each member)	Up to $28,974	41,790	1,602

The tax offset amount is reduced by A$0.125 for each A$1 above the annual income eligible for full offset. The net tax amount is deducted from the actual consumable asset (C_t).

3.3.8 Simulation process and equivalent lump-sum gain/loss calculation

At the beginning of the simulation process, we input the households' wealth statistics, number of household members, simulated results of the household status (G_t), and macroeconomic variables. The households can only choose one of the home equity release approaches – downsize the current home, using the private reverse mortgage, using the PLS, or using the home reversion. Once the

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[9] In this study, we ignore the Medicare levy and Medicare levy surcharge, which fund part of the cost of the Australian public health system. The Medicare levy should not impact the choice of strategy in utilizing housing wealth; hence, we have decided not to incorporate the Medicare levy and Medicare levy surcharge.

[10] We acknowledge that the intra-household division of wealth and income may not be equal between males and females. However, for couple households, we consider the income movement as households, but not each individual. In addition, due to the tax calculation, it will be the most tax-efficient if the income is divided between the couple equally. As a result, we assume the income is divided equally between a couple in this chapter.

households use one of these approaches, they cannot revert this in the simulation process.

Using the simulated macroeconomic variables, the means-tested Age Pension and tax rules, and the corresponding equity release product rules, we calculated consumption in each year, year-end financial wealth, superannuation balance, and housing wealth based on the simulated survival probabilities and economic scenarios. These are the inputs of the utility functions. Thus, we obtained the average of the total utility of every path i, while the expected utility of each set of inputs is the sum of utility of all paths (U_i) divided by the number of paths we simulated, which was 5,000.

The expected utility of each set of inputs (wealth statistics, household status, and risk aversion parameters) can assist in identifying the ranking of approaches.

To calculate the equivalent lump-sum gain/loss, we calculated the expected utility for each approach. Using a root-finding method, we calculated the amount of additional financial wealth that gives the same utility under the base case (not utilizing housing wealth for retirement) for each approach. The addition/reduction of financial wealth that can bring the base case utility to the same level as that of the housing wealth-utilizing approaches is referred to as the equivalent lump-sum gain/loss of each approach. The higher the utility, the higher the lump-sum gain of the approach when compared to the base approach.

We used the wealth distributions by decile reported in Section 3.3.2 to undertake the simulation analysis for single female and couple households. We assumed the preference parameters shown in Table 3.11. This set of input parameters formed the base parameters. We set γ_c, γ_b, and γ_h as equal (following Ameriks *et al.* (2011) by setting the values as 3) to indicate that the illustrative households do not have any preference between consumption, housing, and bequest. λ of 0.03 represents the implied rental yield to live in the current home. As mentioned

in Section 3.3.4, we set θ equal to 0.96 as a fixed parameter based on Andréasson *et al*. (2017) and Ding (2014).

Let α^{income} be the proportion of housing wealth extracted per annum under the reverse mortgage approach. α^{income} is set as 0.01, indicating that the retired households extract 1% of their housing wealth on an annual basis under the private reverse mortgage approach. The equivalent amounts for home reversion and downsizing were calculated according to Section 3.3.3. We compared the equivalent lump-sum gain/loss and identified the approaches' rankings (determined by the amount of the equivalent lump-sum gain/loss) under different portfolios.

Table 3.11: Baseline parameters.

Input parameters	γ_c	γ_b	γ_h	θ	λ	β	α^{income}
Value	3	3	3	0.96	0.03	0.96	0.01

3.4   Main results

In this section, we present the simulation results (the ranking and equivalent lump-sum gain/loss) for different households with different levels of wealth. Since previous theoretical and stated demand studies have shown that single females would be more interested in and benefit more from using home equity release approaches, we present our main results for a single female household. Home equity release approaches can provide an income stream or lump-sum to help retirees achieve improves retirement living standards. Hence, we will first present the results for single females using home equity release approaches to boost their retirement income, followed by lump-sum extraction at the beginning of retirement.

In addition to single female households, we also investigated how different approaches impact couple households' portfolios. As such, we present the result

of couple households using different home equity release approaches to boost their retirement income.

We are also interested in the impact of different preference parameters on the ranking and equivalent lump-sum gain of household portfolios. Hence, Section 3.5 reports the results of detailed sensitivity analyses where we vary different preference parameters and consider alternative house price growth assumptions.

3.4.1 Single female households extract housing wealth for an income stream

Figure 3.6 shows the lump-sum gains/losses for each housing wealth approach against the base approach (not utilizing housing wealth). Using the PLS consistently produces the highest lump-sum gain, followed by private reverse mortgage and home reversion, with the least gain attributed to downsizing. Using the PLS, private reverse mortgages, and home reversion to release equity from housing wealth resulted in lump-sum gains in all scenarios when compared to the base approach. The PLS has the advantage of a lower interest rate in comparison to the private reverse mortgage, which leads to a higher bequest amount under the PLS and results in higher bequest utility. The consumption and housing utility for the PLS, private reverse mortgages, and home reversion were identical since the extracted housing wealth was the same for every year under the baseline parameters. We assumed the households remain in the same property under these approaches. Their key difference is in the bequest utility.

The interest rate charged by the PLS is lower than that of the private reverse mortgage. Given that the principal is the same, the total loan amount, including interest under the PLS is less than that of a private reverse mortgage; thus, the bequest utility is higher for the PLS. Home reversion reduces household housing market exposure when compared to the PLS and private reverse mortgages. As

indicated in Section 3.3.6, the simulated house price grew rapidly, while less exposure to the housing market led to less growth in household portfolios. Hence, the bequest amount is smaller than in the PLS and reverse mortgage.

Cash-poor portfolios—portfolios of households in wealth deciles 1 to 6—enjoyed utility gains in all four approaches when compared to the base approach. This finding demonstrates that these households will enjoy a better retirement life if they can access their housing wealth. We can see that using the PLS is equivalent to providing an extra A\$34,175, A\$50,313, A\$56,839, A\$74,343, \$73,904, and A\$102,062 to households in wealth deciles 1 to 6, respectively. These amounts are equivalent to around 12% of their total wealth. Therefore, it is rational for single female households to utilize their housing wealth through the PLS when they have limited liquid wealth. On the other hand, the equivalent lump-sum gain is greatly increased for households in wealth decile 7. As mentioned in Section 3.3.4, the final utility is similar to a cubic function with two critical points; hence, the great discrepancy is due to the fact that households in wealth decile 7 received an amount of the Age Pension, while additional liquid wealth will reduce the entitled Age Pension amount until it reaches the asset test threshold. For the base approach to reach the same final utility as the PLS approach, the equivalent lump-sum gain (i.e., the extra liquid wealth) provided must increase to an amount that can overcome the loss of utility due to the reduced Age Pension. As a result, a significant discrepancy exists between the utility gains of households in wealth deciles 6 and 7 and those of the other portfolios. Notably, households in wealth deciles 8, 9, and 10 are wealthier retiree households. For these portfolios, less additional wealth is required to overcome the loss of utility due to the reduced Age Pension.

For downsizing, the loss of housing utility and bequest utility leads to the equivalent lump-sum loss in the wealthier portfolios. This is because the downsized amount has three components: transfer duty, downsizing

contributions into superannuation, and the remaining amount being placed into financial wealth (only when the downsizing amount is greater than the sum of the transfer duty and the downsizing contribution threshold). The first component is lost during the downsizing process. The second and third components become the liquid wealth of the households' portfolios, which reduced the entitled Age Pension amount received for households in wealth deciles 6 to 10. Hence, the resulting final utility was reduced since the increment of the final utility derived from the increased liquid wealth was not sufficient to cover the loss of the final utility by the transfer duty cost, reduced Age Pension payments, reduced housing, and reduced bequest utility.

Figure 3.6: Equivalent lump-sum gain/loss for single female households by household wealth decile using different approaches ($\gamma_c=3$, $\gamma_b=3$, $\gamma_h=3$, $\theta=0.96$, $\beta=0.96$, $\alpha^{income}=0.01$).

Portfolios	1	2	3	4	5	6	7	8	9	10
Financial wealth	25,200	21,600	49,800	25,500	158,200	56,300	100,900	348,500	485,100	1,075,900
Superannuation	0	13,000	25,000	32,000	2,000	13,000	135,400	217,900	242,900	445,600
Housing wealth	216,200	392,600	505,900	672,400	708,300	940,000	945,100	986,200	1,292,800	1,842,900
Total Wealth	241,400	427,200	580,700	729,900	868,500	1,009,300	1,181,400	1,552,600	2,020,800	3,364,400
Equivalent lump sum gain/loss										
Downsize	$3,172	$19,336	$15,290	$21,581	$13,749	$30,951	-$470,264	-$252,200	-$129,837	-$13,165
RM	$32,204	$50,313	$56,839	$74,343	$73,904	$102,062	$519,054	$362,069	$265,627	$198,778
PLS	$34,175	$54,202	$63,238	$82,996	$83,704	$114,373	$545,878	$381,112	$288,648	$226,650
HR	$21,936	$34,411	$29,554	$37,429	$31,942	$50,134	$270,345	$255,867	$134,300	$67,844

Note: RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach. Portfolios 1- 10 represent the single female households' wealth decile 1-10.

3.4.2 Single female households extract housing wealth for lump-sum extraction

At the beginning of their retirement, retiree households may wish to receive a lump-sum for various purposes, such as renovating their current home to be more age-friendly or as a gift to their children. Therefore, we repeated the same analysis presented in Section 3.4.1 with a lump-sum extraction instead of income stream extraction. We used the baseline parameter, except we changed α^{income} to $\alpha^{lump\,sum}$ since the housing wealth extraction is a one-off instead of an annual extraction. We examined the cases in which a retired household extracted 1% and 3% of their housing wealth at age 67 as the only lump-sum withdrawal. The results are presented in Figure 3.7 and Figure 3.8.

In Figure 3.7, we can see that the ranking remains the same as in Figure 3.5 for most portfolios, except for households in wealth decile 10. Using the PLS gives the highest equivalent lump-sum gain, followed by the private reverse mortgage and home reversion. This is because private reverse mortgage products charge higher interest rates than the PLS, which impacts the bequest amount and thus reduces the bequest utility. Similar to the argument proposed in 3.4.1, the home reversion approach reduces housing market exposure; hence, it impacts the growth of the entire portfolio, as the simulated house-price growth is substantial.

The downsizing approach results in a A\$0 lump-sum gain because the transfer duty to purchase a lower-value property exceeds the downsized amount. Hence, rational households would not downsize. Thus, there is neither a lump-sum gain nor loss in the downsizing approach.

Households in wealth decile 10 have a different result – the use of private reverse mortgage products ranks first, followed by home reversion and then the PLS. Under the current PLS rule, this approach has a capped amount of lump-sum withdrawal which cannot exceed 50% of the maximum Age Pension rate. Under

such a cap, retired households cannot extract as much as with the private reverse mortgage products, which is A$18,400[11]. Hence, the consumption utility of using the PLS is less than using private reverse mortgages and home reversion. The increase of consumption utility in home equity release approaches outweighs the utility loss from the bequest utility. This result can be confirmed when we increase the borrowing percentage from 1% to 3% (see Figure 3.7 and Figure 3.8).

The results presented in Figure 3.8 also demonstrate that even if the downsized amount is greater than the transfer duty, there is an equivalent lump-sum loss for the downsizing approach (households in wealth decile 1). This is because the transfer duty consumes a high proportion of the downsized amount. Additionally, there are housing and bequest utility losses in the downsizing approach resulting from the lower value of the property and decreased exposure to the housing market. The housing and bequest utility loss is greater than the consumption utility gain of the liquid wealth extracted through downsizing. We also observed that more portfolios experienced high lump-sum gain for reverse mortgages in comparison to the PLS since higher $\alpha^{lump\,sum}$ values indicate a higher extraction amount, with more portfolios hitting the cap under the PLS.

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[11] The current full Age Pension is A$952.70 per fortnight, which is approximately A$24,838.25 per annum. Hence, the lump-sum cap of the PLS is A$12,419.13 in the current year.

Figure 3.7: Equivalent lump-sum gain/loss for single female households by household wealth decile using different approaches (γ_c=3, γ_h=3, γ_h=3, θ=0.96, β=0.96, $\alpha^{lump\ sum}$=0.01).

Portfolios	1	2	3	4	5	6	7	8	9	10
Financial wealth	25,200	21,600	49,800	25,500	158,200	56,300	100,900	348,500	485,100	1,075,900
Superannuation	0	13,000	25,000	32,000	2,000	13,000	135,400	217,900	242,900	445,600
Housing wealth	216,200	392,600	505,900	672,400	708,300	940,000	945,100	986,200	1,292,800	1,842,900
Total Wealth	241,400	427,200	580,700	729,900	868,500	1,009,300	1,181,400	1,552,600	2,020,800	3,364,400
Equivalent lump sum gain/loss										
Downsize	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
RM	$595	$8,307	$8,763	$11,030	$9,740	$13,837	$8,466	$39,244	$22,492	$35,493
PLS	$3,236	$11,771	$12,440	$15,035	$15,992	$19,213	$18,807	$42,678	$25,751	$27,430
HR	$204	$7,790	$8,232	$10,446	$8,833	$13,055	$6,972	$38,540	$21,983	$32,376
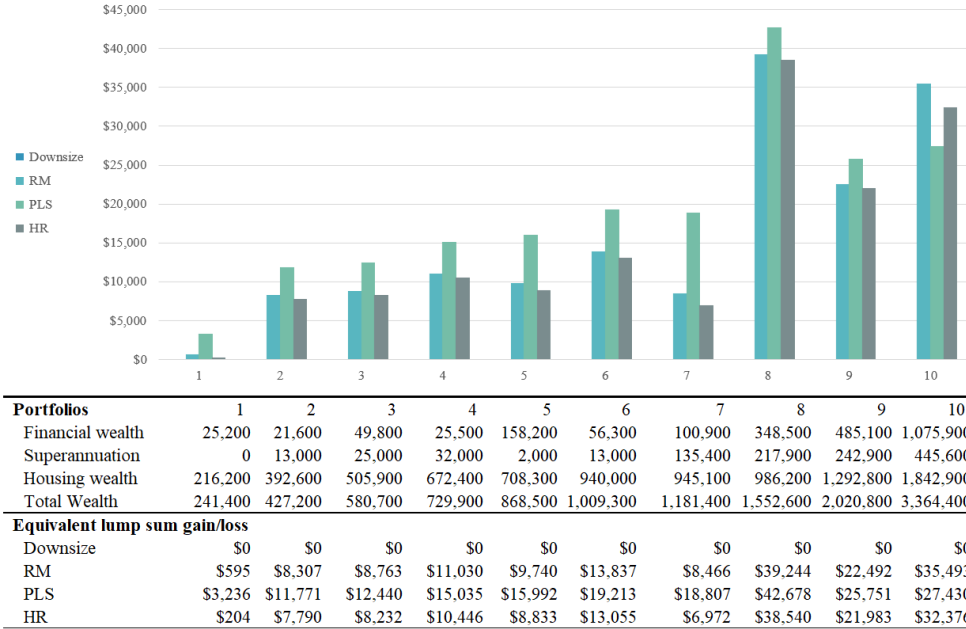
Note: RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach. Portfolios 1- 10 represent the single female households' wealth decile 1-10.

Figure 3.8: Equivalent lump-sum gain/loss for single female households by household wealth decile using different approaches (γ_c=3, γ_h=3, γ_h=3, θ=0.96, β=0.96, $\alpha^{lump\ sum}$=0.03).

Portfolios	1	2	3	4	5	6	7	8	9	10
Financial wealth	25,200	21,600	49,800	25,500	158,200	56,300	100,900	348,500	485,100	1,075,900
Superannuation	0	13,000	25,000	32,000	2,000	13,000	135,400	217,900	242,900	445,600
Housing wealth	216,200	392,600	505,900	672,400	708,300	940,000	945,100	986,200	1,292,800	1,842,900
Total Wealth	241,400	427,200	580,700	729,900	868,500	1,009,300	1,181,400	1,552,600	2,020,800	3,364,400
Equivalent lump sum gain/loss										
Downsize	-$9,544	$0	$0	$0	$0	$0	$0	$0	$0	$0
RM	$8,257	$12,637	$20,958	$24,510	$24,038	$28,376	$29,611	$101,599	$76,475	$33,326
PLS	$15,811	$22,557	$21,466	$21,351	$21,162	$22,959	$23,060	$24,822	$25,625	$27,430
HR	$7,110	$11,123	$19,318	$22,720	$21,264	$25,966	$28,068	$90,639	$73,113	$31,895
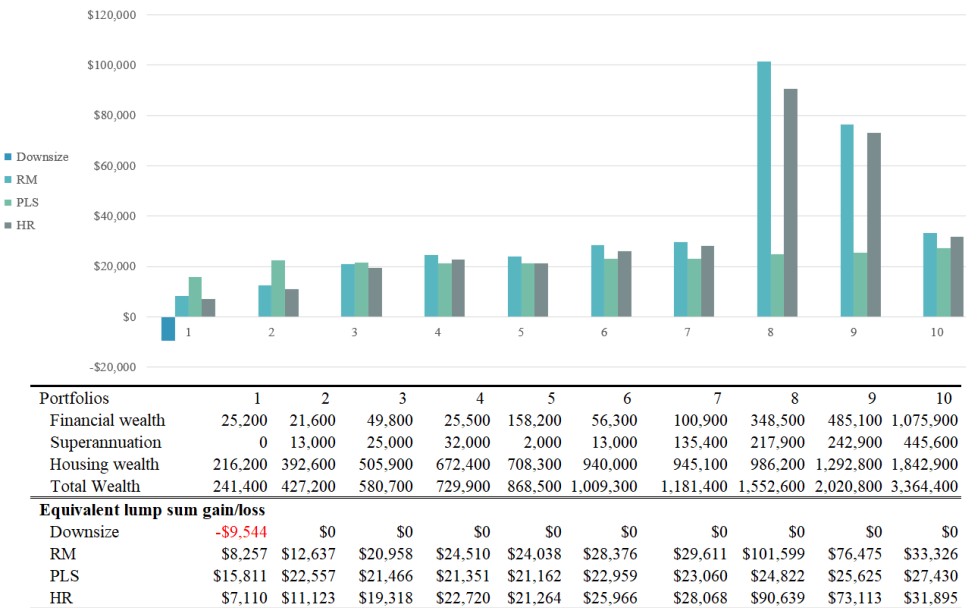
Note: RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach. Portfolios 1- 10 represent the single female households' wealth decile 1-10.

3.4.3 Couple households extract housing wealth for an income stream

One might expect couples to behave differently than a single female household. Using the baseline parameters, we performed the analysis with couple households to investigate changes in ranking and equivalent lump-sum gain/loss using the portfolios presented in Section 3.3.2. The retired couple is assumed to be aged 67 and fully retired. As there are two individuals in this household, the living standard differs from that of a single female household; as a result, the consumption floor in the consumption utility differs from that of the single female household.

Figure 3.9 shows that the equivalent lump-sum gain from the PLS, private reverse mortgage product, and home reversion is far greater than that of single female households. The downsizing approach shows two tendencies regarding the equivalent lump-sum gain, depending on the household portfolio. The ranking of the approaches remains the same as for single female households. The substantial gain is due to the consumption utility. Households with two members derive consumption utility for a longer period since the joint life expectancy is longer than for the single female life expectancy. As a result, the significance of the consumption utility increases, thereby driving the overall utility of the PLS, reverse mortgage, and home reversion approaches much higher than the base approach. Additionally, the high equivalent lump-sum is a result of the higher consumption floor in a two-person household.

For both cash- and asset-rich portfolios (e.g., households in wealth decile 10), the utility gain is far lower (in terms of the percentage gain compared to the total wealth) than for the other portfolios, which demonstrates that these households have relatively limited incentives for using housing wealth release approaches. We also observed that the massive equivalent lump-sum gain jump for Portfolio 7 is similar to that of the single female scenario. That is, the final utility is a cubic

function of liquid wealth, while the additional wealth in households in wealth decile 7 can easily reach the threshold for full Age Pension under the asset test. Thus, additional wealth would decrease the final utility since less Age Pension would be received. The final utility function increases again with liquid wealth when the liquid wealth is higher than the threshold to receive any Age Pension. As a result, to overcome the Age Pension threshold, the lump-sum gain is high. Households in wealth decile 8, 9, and 10 are much wealthier in terms of liquid wealth. Hence, these portfolios do not need to add as much liquid wealth as households in wealth decile 7 to overcome the asset test threshold.

Figure 3.9: Equivalent lump-sum gain/loss for couple households by household wealth decile using different approaches (γ_c=3, γ_b=3, γ_h=3, θ=0.96, β=0.96, α^{income}=0.01).

Portfolios	1	2	3	4	5	6	7	8	9	10
Financial wealth	31,800	76,900	78,700	87,000	205,100	200,800	199,800	495,700	645,500	2,043,800
Superannuation	0	32,000	34,000	61,000	47,800	128,700	163,000	181,000	250,700	967,000
Housing wealth	310,800	409,800	559,200	702,000	760,000	911,000	1,135,500	1,193,900	1,612,300	1,887,100
Total Wealth	342,600	518,700	671,900	850,000	1,012,900	1,240,500	1,498,300	1,870,600	2,508,500	4,897,900
Equivalent lump sum gain/loss										
Downsize	$1,408	-$1,176	$600	-$7,341	-$17,613	-$76,346	-$755,378	-$538,919	-$277,763	-$99,831
RM	$43,679	$45,287	$61,273	$72,862	$76,376	$94,982	$800,551	$680,210	$487,626	$166,170
PLS	$46,874	$51,448	$69,752	$84,247	$90,267	$127,216	$834,041	$704,311	$515,661	$202,954
HR	$40,289	$38,901	$52,533	$61,154	$62,378	$71,943	$733,362	$654,812	$457,711	$129,231

RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach. Portfolios 1- 10 represent the single female households' wealth decile 1-10.

For the downsizing approach, households in wealth deciles 1 to 6 derived equivalent lump-sum losses (see Figure 3.9). The reduction of housing and bequest utility is due to the reduced housing market exposure. Additionally, the downsizing approach includes the transfer duty cost, which is relatively high

compared to the PLS, reverse mortgage, and home reversion approaches. Hence, it is not an attractive approach for retired couple households. We only observe an equivalent lump-sum gain in the downsizing approach when the households are wealthy in both cash and assets (households in wealth deciles 9 and 10) because the downsized amount does not impact future entitlement to the Age Pension (these households do not receive any Age Pension in the base approach either).

Overall, our analysis demonstrates that couples experience a substantial amount of equivalent lump-sum gains if they use the PLS, reverse mortgages, and home reversion approaches to plan for their retirement.

3.5 Sensitivity analysis

Next, we examined how varying the parameters change the impact on the equivalent lump-sum gain for the single female households. We varied the preference parameters as well as the subjective discount rate and house price forecast. Through this analysis, we determined how preferences affect the impact on the equivalent lump-sum gain/loss. In addition to the household wealth portfolios reported in Section 3.3.2 (namely household wealth in different deciles), we constructed a series of hypothetical asset-rich but cash-poor portfolios to examine the impact on final utility by changing each wealth component (see Table 3.12). The majority of retired households' wealth is stored in the form of housing wealth. If these retired households do not utilize their housing wealth, they must rely on their entitled Age Pension payments for retirement expenditures after they have spent all financial and superannuation wealth. As a result, we would expect these households to have a higher demand for equity release approaches, which is also supported by theoretical and empirical studies (Shao *et al*., 2019; Hanewald *et al*., 2020).

3.5.1 Baseline parameters

We conducted a simulation analysis using baseline parameters (listed in Table 3.11) as the baseline result for the hypothetical portfolios. The same analysis for the actual portfolios was outlined in Section 3.4.1.

Table 3.12: Summary household wealth portfolios for hypothetical asset-rich but cash-poor retired single female households.

Asset-rich but cash-poor group	Single female			
	Financial wealth	Superannuation	Housing wealth	Total wealth
1	25,200	0	392,600	417,800
2	49,800	0	392,600	442,400
3	25,200	25,000	392,600	442,800
4	49,800	25,000	392,600	467,400
5	25,200	0	1,292,800	1,318,000
6	49,800	0	1,292,800	1,342,600
7	25,200	25,000	1,292,800	1,343,000
8	49,800	25,000	1,292,800	1,367,600

The results presented in Figure 3.10 demonstrate that all approaches utilizing housing wealth result in an equivalent lump-sum gain when using input parameter set 1 and the hypothetical household wealth alternatives in Table 3.12. For all portfolios, the PLS ranked first, followed by reverse mortgages and home reversion, while downsizing ranked last.

The PLS charges a lower interest rate and the annual payments remain under the maximum withdrawal; hence, this approach is superior to the reverse mortgage approach. For home reversion, the retired households relinquish a proportion of their housing wealth in exchange for lifetime cash flow. Given the simulated house price growth, giving up a proportion of housing wealth reduces the bequest amount more than the loan repayment under the reverse mortgage and PLS

approaches, leading to a lower equivalent lump-sum gain when compared to the other two approaches.

Downsizing ranks last since the transfer duty substantially reduces the downsized amount; however, this approach still shows some equivalent lump-sum gains compared to the base case for most portfolios. Although there is a reduction in the housing and bequest utility compared to other approaches due to vacating the current home for a new home with less value, an increase in consumption utility exceeds the losses of the other utilities.

On the other hand, we also observed patterns that would impact the equivalent lump-sum gain. First, more liquid wealth (i.e., total financial wealth and superannuation) reduces the equivalent lump-sum gain (a decreasing pattern was observed for hypothetical household wealth portfolios 1-4 and 5-8 in Figure 3.10). This finding aligns with theoretical literature stating that higher non-primary housing wealth results in less utility gain (Hanewald *et al*., 2016; Mayhew *et al*., 2017; Shao *et al*., 2019). It also aligns with empirical literature suggesting that households with high non-primary housing wealth have less interest in using home equity release products (e.g., reverse mortgages) since there are fewer economic incentives (Dillingh *et al*., 2017; Hanewald *et al*., 2020).

Given the same liquid wealth, greater housing wealth derives a higher equivalent lump-sum gain if the retired households extract the same percentage of housing wealth (compare hypothetical household wealth portfolios 1 to 5, 2 to 6, 3 to 7, and 4 to 8 in Figure 3.10). Since they have more housing wealth, the same percentage of housing wealth extraction results in more liquid wealth being extracted, which can further boost retirement income.

Overall, all approaches that allow retirees to utilize their housing wealth are beneficial when compared to the base case. The PLS is the preferred approach

for slightly boosting retirement income since it has a lower interest rate than private reverse mortgages; hence, it is superior to private reverse mortgages. The PLS allows retired households to retain exposure to the housing market, whereas downsizing and home reversion approaches reduce this exposure. Since house price growth remains strong in the simulated result, less exposure to the housing market would reduce the bequest amount and lead to lower equivalent lump-sum gains.

Figure 3.10: Equivalent lump-sum gain/loss for single female households with hypothetical household wealth portfolios using different approaches ($\gamma_c=3$, $\gamma_b=3$, $\gamma_h=3$, $\theta=0.96$, $\beta=0.96$, $\alpha^{income}=0.01$).

Portfolios	1	2	3	4	5	6	7	8
Financial wealth	25,200	49,800	25,200	49,800	25,200	49,800	25,200	49,800
Superannuation	0	0	25,000	25,000	0	0	25,000	25,000
Housing wealth	392,600	392,600	392,600	392,600	1,292,800	1,292,800	1,292,800	1,292,800
Total Wealth	417,800	442,400	442,800	467,400	1,318,000	1,342,600	1,343,000	1,367,600
Equivalent lump sum gain/loss								
Downsize	$17,838	$17,550	$16,459	$12,107	$51,955	$46,400	$40,222	$35,673
RM	$54,107	$51,288	$47,313	$45,350	$143,888	$141,386	$137,635	$135,310
PLS	$57,494	$55,205	$51,767	$50,131	$160,241	$158,172	$154,887	$152,961
HR	$39,012	$34,193	$28,815	$24,907	$76,062	$71,181	$64,812	$60,315
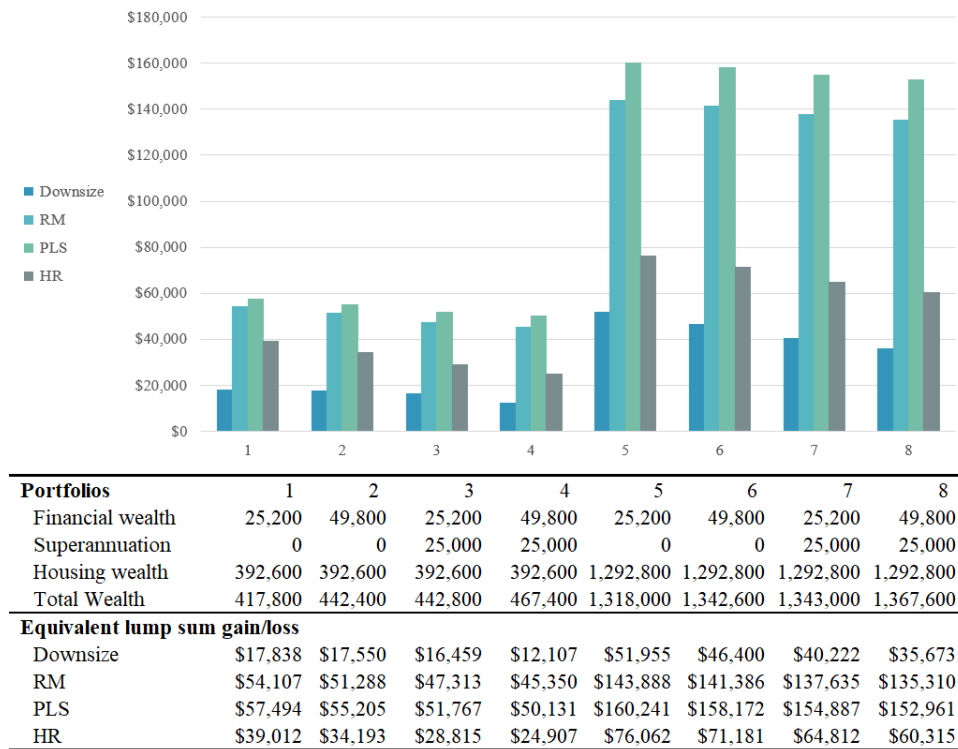
Note: RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach.

3.5.2 Households with a greater bequest preference

If the retired households are less risk-averse regarding bequests, γ_b should be reduced and we use the second set of input parameters to simulate the process (see Table 3.13).

The result is shown in Figure 3.11 for actual household wealth deciles and Figure 3.12 for hypothetical household wealth portfolios. Since the final utility function $U(C_t, W_t, S_t, H_t, G_t)$ is an additive function of $U_C(C_t, G_t)$, $U_B(W_t, H_t, S_t)$, and $U_H(H_t)$, a smaller value of γ_b derive more utility gain (or loss) from bequest over housing and consumption (as mentioned in Section 3.3.4). Hence, individuals are more bequest utility-driven when γ_b decreases. Among all of the approaches, the base approach provides the highest utility since the housing wealth has not been utilized. When there is greater liquid wealth, the lump-sum gains derived from private reverse mortgages, the PLS, and home reversion are offset by the loss of bequest utility. The main driver of the lower lump-sum loss for the PLS compared to private reverse mortgages is the lower interest rate, which leads to a greater remaining bequest amount. Similar to the results for the baseline parameters, we observed a trend in liquid wealth and housing wealth in this set of input parameters: when liquid wealth increases, there is more equivalent lump-sum loss. Moreover, when there is greater housing wealth, the effect of lump-sum gain/loss is magnified since the liquid wealth extraction is a percentage of the housing wealth.

Table 3.13: Parameters that indicate households with a greater bequest preference.

Input parameters	γ_c	γ_b	γ_h	θ	λ	β	α^{income}
Value	3	2	3	0.96	0.03	0.96	0.01

Figure 3.11: Equivalent lump-sum gain/loss for single female households by household wealth decile using different approaches (γ_c=3, γ_b=2, γ_h=3, θ=0.96, β=0.96, α^{income}=0.01).

Portfolios	1	2	3	4	5	6	7	8	9	10
Financial wealth	25,200	21,600	49,800	25,500	158,200	56,300	100,900	348,500	485,100	1,075,900
Superannuation	0	13,000	25,000	32,000	2,000	13,000	135,400	217,900	242,900	445,600
Housing wealth	216,200	392,600	505,900	672,400	708,300	940,000	945,100	986,200	1,292,800	1,842,900
Total Wealth	241,400	427,200	580,700	729,900	868,500	1,009,300	1,181,400	1,552,600	2,020,800	3,364,400
Equivalent lump sum gain/loss										
Downsize	-$23,083	-$47,325	-$82,475	-$109,513	-$196,879	-$176,793	-$423,066	-$325,007	-$308,324	-$394,657
RM	-$33,056	-$81,955	-$136,220	-$186,330	-$263,586	-$291,987	-$515,031	-$418,589	-$441,374	-$649,668
PLS	-$19,171	-$50,644	-$92,261	-$126,058	-$165,056	-$188,686	-$388,976	-$319,482	-$316,310	-$462,699
HR	-$54,102	-$120,072	-$206,788	-$304,409	-$357,076	-$434,019	-$691,522	-$436,459	-$517,351	-$769,242

Note: RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach. Portfolios 1- 10 represent the single female households' wealth decile 1-10.

Overall, retired households that demonstrate high bequest motives tend to prefer not to utilize their housing wealth.

Figure 3.12: Equivalent lump-sum gain/loss for single female households with *hypothetical* household wealth portfolios using different approaches (γ_c=3, γ_b=2, γ_h=3, θ=0.96, β=0.96, α^{income}=0.01).

Portfolios	1	2	3	4	5	6	7	8
Financial wealth	25,200	49,800	25,200	49,800	25,200	49,800	25,200	49,800
Superannuation	0	0	25,000	25,000	0	0	25,000	25,000
Housing wealth	392,600	392,600	392,600	392,600	1,292,800	1,292,800	1,292,800	1,292,800
Total Wealth	417,800	442,400	442,800	467,400	1,318,000	1,342,600	1,343,000	1,367,600
Equivalent lump sum gain/loss								
Downsize	-$44,729	-$50,019	-$53,755	-$61,376	-$251,132	-$299,347	-$313,632	-$390,103
RM	-$77,516	-$84,931	-$90,594	-$99,911	-$412,757	-$450,611	-$467,476	-$514,301
PLS	-$46,942	-$53,491	-$58,371	-$66,958	-$250,695	-$268,295	-$281,263	-$310,936
HR	-$116,719	-$122,534	-$127,199	-$137,907	-$571,367	-$580,328	-$586,316	-$596,337

Note: RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach.

3.5.3 Households with a greater consumption preference

The following scenario considers households with higher consumption preferences who withdraw more liquidity from housing wealth. Hence, γ_c is set at a lower value while α^{income} is set as a higher value. The third set of input parameters is presented in Table 3.14.

Figure 3.13 and Figure 3.14 show that all approaches greatly increase retirees' equivalent lump-sum gain since these approaches can help boost retirement income through utilizing housing wealth for actual wealth deciles and the hypothetical household wealth portfolios. For actual portfolios, reverse mortgages rank first for household wealth deciles 4, 5, 6, 7, and 10, while the PLS ranked first for the remaining wealth deciles (Figure 3.13).

For household wealth deciles 1, 2, and 3, the PLS ranked first because the annual extraction did not reach the cap of the PLS, hence, the difference between the PLS and reverse mortgages is the lower interest rate charged. As a result, the consumption utility gain for reverse mortgages and the PLS would be the same. Since the bequest utility of the PLS dominates that of reverse mortgages due to the lower interest rate charged, alongside the identical housing utility, the final utility of using the PLS would be higher than that of reverse mortgages.

For household wealth deciles 4, 5, 6, and 7, the households remain eligible to receive Age Pension. Since the annual extraction of reverse mortgages is higher than the cap of the PLS (the combined Age Pension and PLS payments are capped at 150% of full Age Pension, as detailed in Section 3.3.7), the consumption utility derived from reverse mortgages would be higher than that of the PLS. This benefit is slightly offset by the loss in bequest utility. However, reverse mortgages give the highest overall utility since the gain in consumption is higher than the loss in bequest utility.

For household wealth deciles 8 and 9, the households are not eligible for Age Pension since their liquid wealth is more than the asset test thresholds. Hence, the annual payments extracted from the PLS are the same as for reverse mortgages (since the cap does not need to be shared with the Age Pension payments due to the ineligibility of these portfolios).

Therefore, the results of these portfolios are similar to those of household wealth deciles 1, 2, and 3, with the PLS being ranked first. For household wealth decile 10, the annual extraction under reverse mortgages exceeds 150% of Age Pension. Thus, under the PLS, the annual extraction is less than that of reverse mortgages. As a result, reverse mortgages ranked first.

For the hypothetical household wealth portfolios, the key difference between Figure 3.14 and Figure 3.10 is the preference between private reverse mortgages,

the PLS, and home reversion for high housing wealth (hypothetical household wealth portfolios 5 to 8). Since there is an annual withdrawal cap under the PLS (the sum of Age Pension payments and the PLS payments cannot exceed 150% of the maximum annual Age Pension amount, detailed in Section 3.3.3) but not under private reverse mortgages, more income withdrawal is possible under private reverse mortgages for high housing wealth. Although a higher interest rate is charged for private reverse mortgages, the increase in consumption utility is greater than the reduction in bequest utility.

Additionally, the equivalent lump-sum gain greatly increased for hypothetical household wealth portfolios 5 to 8. This is because the utility is an increasing function of liquid wealth up to a certain level at which the Age Pension is not impacted. If the Age Pension payments are impacted, the utility function is no longer an increasing function of the liquid wealth (as explained in Section 3.3.4). The utility function becomes an increasing function again when the liquid wealth is too high to receive any Age Pension payments. Hence, there will be a significant discrepancy between equivalent lump-sum gains in different portfolios.

The home reversion approach becomes competitive with the PLS due to high liquidity extraction that the PLS cannot achieve. However, downsizing remains the least favored of all four home equity release approaches due to the high transfer duty (contribution to the superannuation is reduced by the transfer duty), less exposure to the housing market leading to a lower amount of inheritance for children, and the reduced housing utility from moving to a new home with a lower value.

Table 3.14: Parameters that indicate households with a greater consumption preference.

Input parameters	γ_c	γ_b	γ_h	θ	λ	β	α^{income}
Value	2	3	3	0.96	0.03	0.96	0.03

Figure 3.13: Equivalent lump-sum gain/loss for single female households by household wealth deciles using different approaches (γ_c=2, γ_b=3, γ_h=3, θ=0.96, β=0.96, α^{income}=0.03).
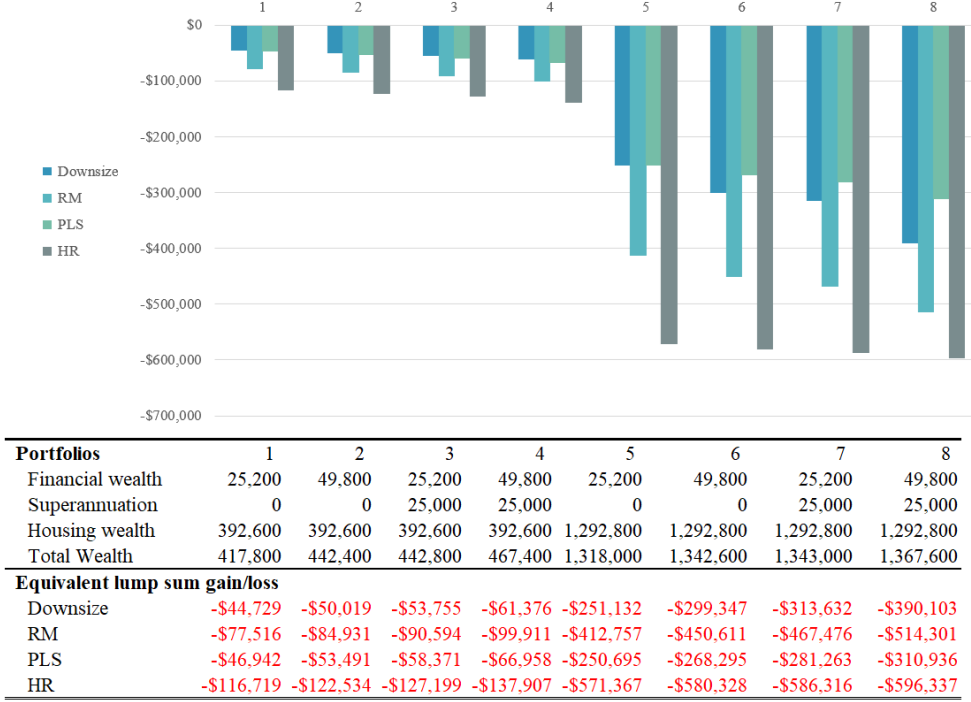

Portfolios	1	2	3	4	5	6	7	8	9	10
Financial wealth	25,200	21,600	49,800	25,500	158,200	56,300	100,900	348,500	485,100	1,075,900
Superannuation	0	13,000	25,000	32,000	2,000	13,000	135,400	217,900	242,900	445,600
Housing wealth	216,200	392,600	505,900	672,400	708,300	940,000	945,100	986,200	1,292,800	1,842,900
Total Wealth	241,400	427,200	580,700	729,900	868,500	1,009,300	1,181,400	1,552,600	2,020,800	3,364,400
Equivalent lump sum gain/loss										
Downsize	$74,773	$134,506	$167,985	$197,596	$103,810	$194,286	$25,835	-$47,469	$168,368	$174,265
RM	$104,576	$194,577	$733,822	$855,973	$971,426	$1,073,811	$1,127,070	$906,845	$912,028	$1,001,050
PLS	$114,610	$207,405	$739,997	$797,118	$892,187	$860,761	$931,446	$917,196	$924,920	$921,903
HR	$95,635	$167,090	$216,550	$754,681	$870,378	$946,622	$1,000,739	$787,772	$765,474	$806,988

Note: RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach. Portfolios 1- 10 represent the single female households' wealth decile 1-10.

Figure 3.14: Equivalent lump-sum gain/loss for single female households with *hypothetical* household wealth portfolios using different approaches (γ_c=2, γ_b=3, γ_h=3, θ=0.96, β=0.96, α^{income}=0.03).

Portfolios	1	2	3	4	5	6	7	8
Financial wealth	25,200	49,800	25,200	49,800	25,200	49,800	25,200	49,800
Superannuation	0	0	25,000	25,000	0	0	25,000	25,000
Housing wealth	392,600	392,600	392,600	392,600	1,292,800	1,292,800	1,292,800	1,292,800
Total Wealth	417,800	442,400	442,800	467,400	1,318,000	1,342,600	1,343,000	1,367,600
Equivalent lump sum gain/loss								
Downsize	$135,197	$134,511	$133,721	$133,118	$205,390	$200,916	$200,122	$189,606
RM	$196,146	$197,473	$194,480	$199,704	$1,280,767	$1,290,008	$1,283,462	$1,298,114
PLS	$208,781	$209,222	$207,226	$210,921	$843,968	$866,267	$858,571	$878,051
HR	$168,639	$168,229	$166,481	$166,134	$1,123,122	$1,133,790	$1,127,303	$1,137,416
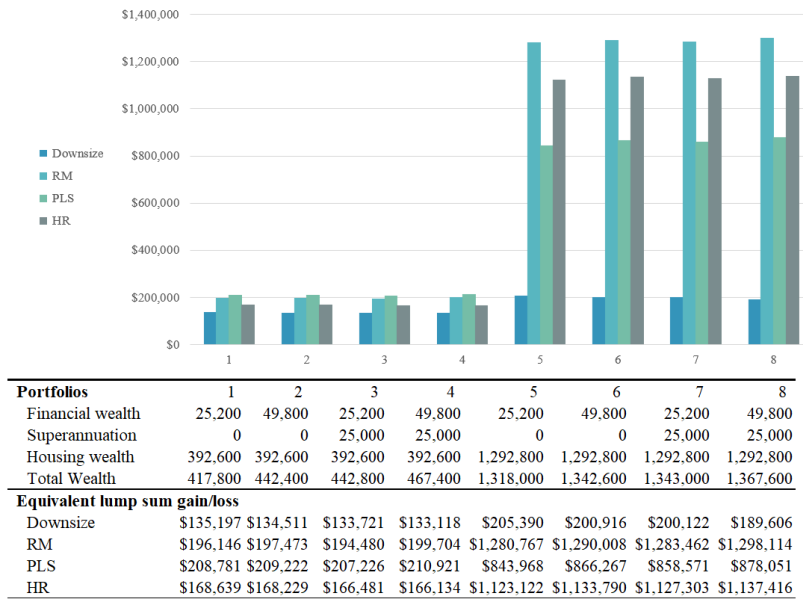
Note: RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach

3.5.4 Households with a greater housing preference

We also investigated how the housing risk aversion parameter impacts preferences and the equivalent lump-sum gain using parameters that indicate households with greater housing preference (presented in Table 3.15). Under this scenario, the ranking remains the same as for baseline parameters. As the housing risk aversion parameter decreases, the final utility depends more on the housing utility due to the increased curvatives (as mentioned in Section 3.3.4). For the approaches of using PLS, private reverse mortgages, and home reversion, the housing utility is the same as the base scenario under all housing risk aversion parameters since these approaches involve retirees remaining on the same property (based on comparing the approaches between Figure 3.6 and Figure 3.15, as well as Figure 3.10 and Figure 3.16). As a result, the equivalent lump-sum gain remains unchanged. An exceptional case is the downsizing approach because this approach requires vacating one's current home to move to a lower-value home, thereby leading to a decreased housing utility and equivalent lump-sum loss. Therefore, if the retired household with greater housing preference, retirees should avoid downsizing their housing wealth and choose another approach (e.g., the PLS, private reverse mortgages, or home reversion).

Table 3.15: Parameters that indicate households with a greater housing preference.

Input parameters	γ_c	γ_b	γ_h	θ	λ	β	α^{income}
Value	3	3	2	0.96	0.03	0.96	0.01

Figure 3.15: Equivalent lump-sum gain/loss for single female households with *actual* portfolios using different approaches (γ_c=3, γ_b=3, γ_h=2, θ=0.96, β=0.96, α^{income}=0.01).

Portfolios	1	2	3	4	5	6	7	8	9	10
Financial wealth	25,200	21,600	49,800	25,500	158,200	56,300	100,900	348,500	485,100	1,075,900
Superannuation	0	13,000	25,000	32,000	2,000	13,000	135,400	217,900	242,900	445,600
Housing wealth	216,200	392,600	505,900	672,400	708,300	940,000	945,100	986,200	1,292,800	1,842,900
Total Wealth	241,400	427,200	580,700	729,900	868,500	1,009,300	1,181,400	1,552,600	2,020,800	3,364,400
Equivalent lump sum gain/loss										
Downsize	-$16,620	-$13,298	-$30,515	-$31,359	-$517,278	-$40,982	-$657,746	-$402,063	-$305,316	-$265,508
RM	$32,204	$50,313	$56,839	$74,343	$73,904	$102,062	$519,054	$362,069	$265,627	$198,778
PLS	$34,175	$54,202	$63,238	$82,996	$83,704	$114,373	$545,878	$381,112	$288,648	$226,650
HR	$21,936	$34,411	$29,554	$37,429	$31,942	$50,134	$270,345	$255,867	$134,300	$67,844

Note: RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach. Portfolios 1- 10 represent the single female households' wealth decile 1-10.

Figure 3.16: Equivalent lump-sum gain/loss for single female households with *hypothetical* household wealth portfolios using different approaches (γ_c=3, γ_b=3, γ_h=2, θ=0.96, β=0.96, α^{income}=0.01).

Portfolios	1	2	3	4	5	6	7	8
Financial wealth	25,200	49,800	25,200	49,800	25,200	49,800	25,200	49,800
Superannuation	0	0	25,000	25,000	0	0	25,000	25,000
Housing wealth	392,600	392,600	392,600	392,600	1,292,800	1,292,800	1,292,800	1,292,800
Total Wealth	417,800	442,400	442,800	467,400	1,318,000	1,342,600	1,343,000	1,367,600
Equivalent lump sum gain/loss								
Downsize	-$14,879	-$15,514	-$16,222	-$24,845	-$30,826	-$40,104	-$49,126	-$72,125
RM	$54,107	$51,288	$47,313	$45,350	$143,888	$141,386	$137,635	$135,310
PLS	$57,494	$55,205	$51,767	$50,131	$160,241	$158,172	$154,887	$152,961
HR	$39,012	$34,193	$28,815	$24,907	$76,062	$71,181	$64,812	$60,315
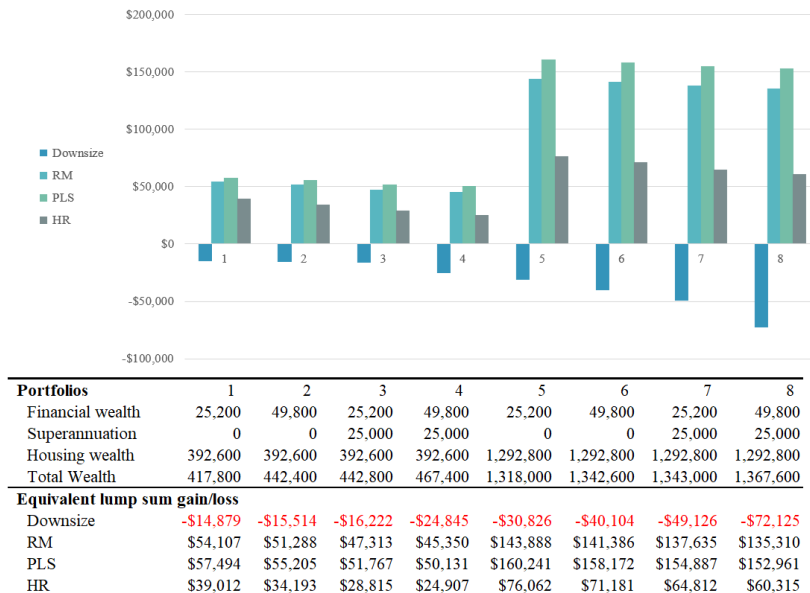
Note: RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach.
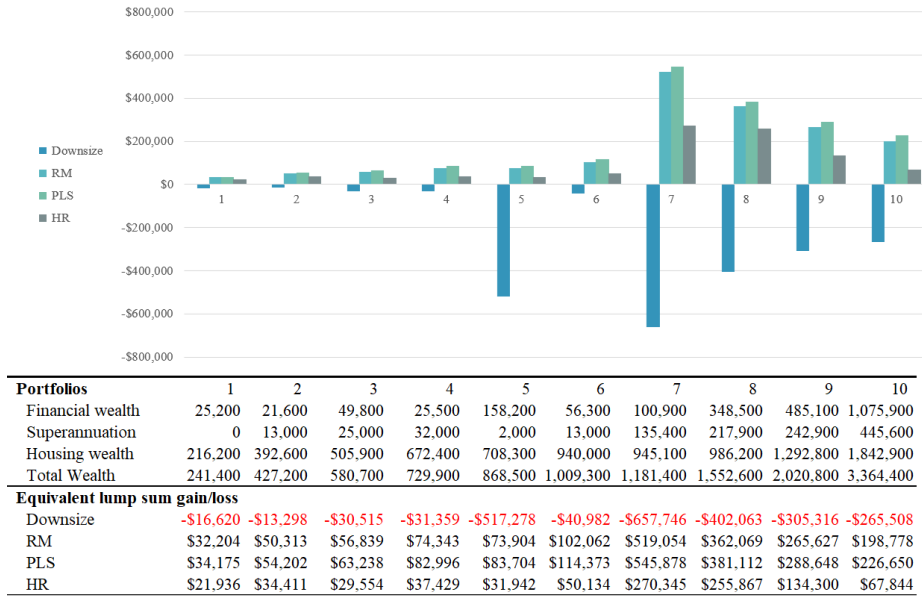
3.5.5 Households with a greater future preference

The subjective discount factor also plays an important role in the simulation analysis. When β increases, retired households show a greater preference for future consumption, housing, and bequest rather than current consumption. We used input parameter set 5 (see Table 3.16) to investigate how the preferences of retired households change. In Figure 3.17 and Figure 3.18, it is evident that the lump-sum gain generally decreases compared to the values in Figure 3.6 and Figure 3.10. This is because the base scenario provides the highest bequest since the housing wealth is not utilized for retirement consumption. With an increase in the subjective discount rate, the utility derived from bequest is given greater weight. Thus, the consumption utility gain under the other approaches utilizing housing wealth was offset by the bequest utility loss. However, the ranking remained unchanged from that of baseline parameters.

Figure 3.17: Equivalent lump-sum gain/loss for single female households by household wealth decile using different approaches (γ_c=3, γ_b=3, γ_h=3, θ=0.96, β=0.98, α^{income}=0.01).

Portfolios	1	2	3	4	5	6	7	8	9	10
Financial wealth	25,200	21,600	49,800	25,500	158,200	56,300	100,900	348,500	485,100	1,075,900
Superannuation	0	13,000	25,000	32,000	2,000	13,000	135,400	217,900	242,900	445,600
Housing wealth	216,200	392,600	505,900	672,400	708,300	940,000	945,100	986,200	1,292,800	1,842,900
Total Wealth	241,400	427,200	580,700	729,900	868,500	1,009,300	1,181,400	1,552,600	2,020,800	3,364,400
Equivalent lump sum gain/loss										
Downsize	-$221	$13,909	$9,307	$14,770	$5,085	$21,811	-$456,452	-$282,778	-$170,449	-$38,925
RM	$27,839	$42,620	$44,726	$58,341	$56,434	$80,088	$54,564	$327,563	$232,568	$156,002
PLS	$30,672	$47,480	$52,977	$69,443	$68,867	$95,719	$435,248	$356,893	$267,495	$192,798
HR	$15,250	$24,174	$15,708	$20,308	$10,894	$27,161	$38,857	$20,661	$7,893	$4,477

Note: RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach. Portfolios 1- 10 represent the single female households' wealth decile 1-10.

Figure 3.18: Equivalent lump-sum gain/loss for single female households with hypothetical household wealth portfolios using different approaches ($\gamma_c=3$, $\gamma_b=3$, $\gamma_h=3$, $\theta=0.96$, $\beta=0.98$, $\alpha^{income}=0.01$).
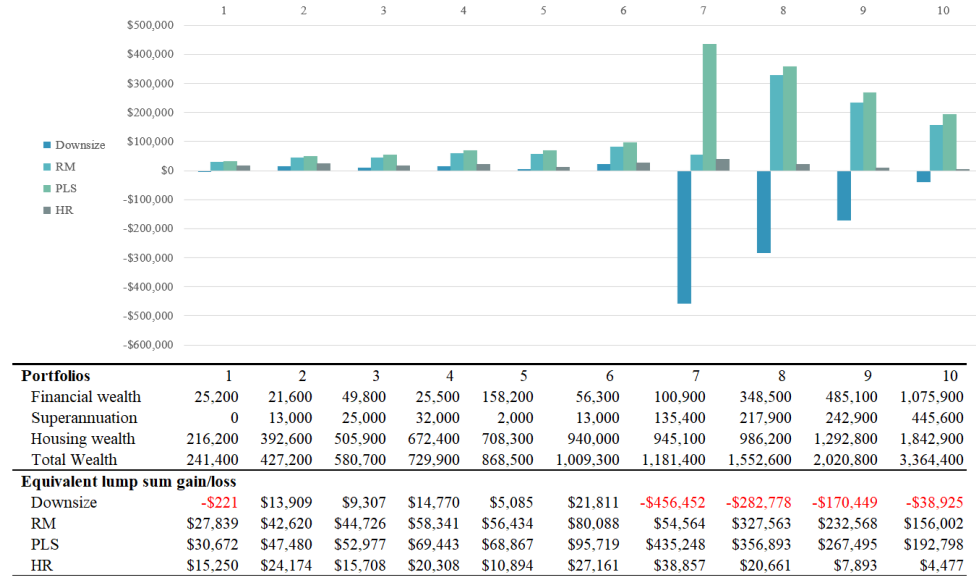

Portfolios	1	2	3	4	5	6	7	8
Financial wealth	25,200	49,800	25,200	49,800	25,200	49,800	25,200	49,800
Superannuation	0	0	25,000	25,000	0	0	25,000	25,000
Housing wealth	392,600	392,600	392,600	392,600	1,292,800	1,292,800	1,292,800	1,292,800
Total Wealth	417,800	442,400	442,800	467,400	1,318,000	1,342,600	1,343,000	1,367,600
Equivalent lump sum gain/loss								
Downsize	$12,702	$12,493	$11,455	$7,080	$41,905	$35,507	$29,047	$23,704
RM	$47,052	$43,406	$38,577	$36,082	$115,404	$112,246	$107,583	$104,659
PLS	$51,496	$48,514	$44,278	$42,255	$135,936	$133,379	$129,365	$126,991
HR	$28,220	$23,659	$18,726	$13,777	$49,026	$42,338	$33,991	$28,223

Note: RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach.

Table 3.16: Parameters that indicate households with a greater future preference.

Input parameters	γ_c	γ_b	γ_h	θ	λ	β	α^{income}
Value	3	3	3	0.96	0.03	0.98	0.01

3.5.6 Sensitivity analysis for house price growth

We also performed a sensitivity analysis of reduced house price growth. As stated in Section 3.3.6, the average annual growth rate is approximately 5% p.a., with a historical average growth of approximately 7% p.a. To assess how stressed house price growth impacts the equivalent lump-sum gain in different approaches, we reduced the simulated house price by 7% p.a. We used input parameter set 1 to illustrate the equivalent lump-sum gain. In Figure 3.19 and Figure 3.20, home reversion is shown to be the most beneficial approach for utilizing housing wealth in the stressed house price scenario, followed by the

downsizing approach. Both of these approaches reduce housing market exposure. On the other hand, the PLS and reverse mortgages do not reduce housing market exposure since these approaches do not reduce the equity component. Home reversion and downsizing retain a certain proportion of the housing wealth for leaving an inheritance. However, given that the exposure is smaller under home reversion and downsizing approaches, the reduced house price growth scenario has a lesser impact on the bequest amount compared to the base case (not utilizing housing wealth) and thus has less impact on bequest utility. Meanwhile, consumption utility increases as housing wealth are extracted for consumption. Consumption utility under the home reversion and downsizing approaches is offset by the reduction of bequest utility. For reverse mortgages and the PLS, the LVR at termination will be higher than the LVR at origination. Hence, a higher proportion of the property value is used to repay the loan and less housing wealth remains as part of the inheritance. As a result, there is a greater reduction in bequest utility than the base case. For a retired household that is pessimistic about the housing market and wishes to age in place, they should consider utilizing their housing wealth through home reversion.
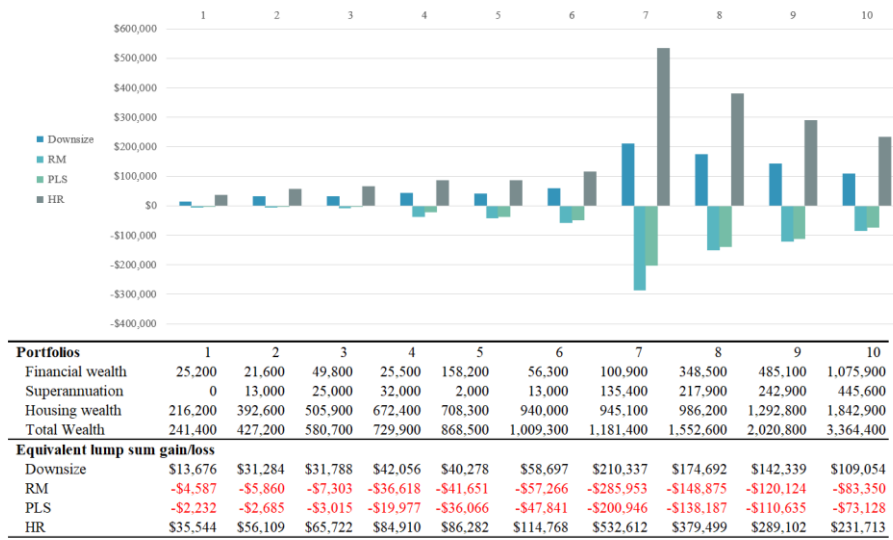
3.5.7 Sensitivity analysis for interest rates

On the other hand, from the results in the previous sections, the PLS and reverse mortgages would be less preferable when the interest rate charged by these products increases. This can be concluded by considering the similarity between the PLS and reverse mortgages. For example, as mentioned in Section 3.5.3, for household wealth deciles 1, 2, and 3, the difference between the PLS and reverse mortgages is only the lower interest charged. The result shows when a higher interest rate is charged (using reverse mortgages), the retirees would experience less utility gain. As a result, the approach would become less preferable. Some would argue that under the current low interest rate environment, the products

(the PLS and reverse mortgages) are charging a very high-interest rate. Given these two products are the most preferable under the baseline scenario (Section 3.5.1), the retirees would experience even higher utility and lump sum gain when the products are charging a lower interest rate.
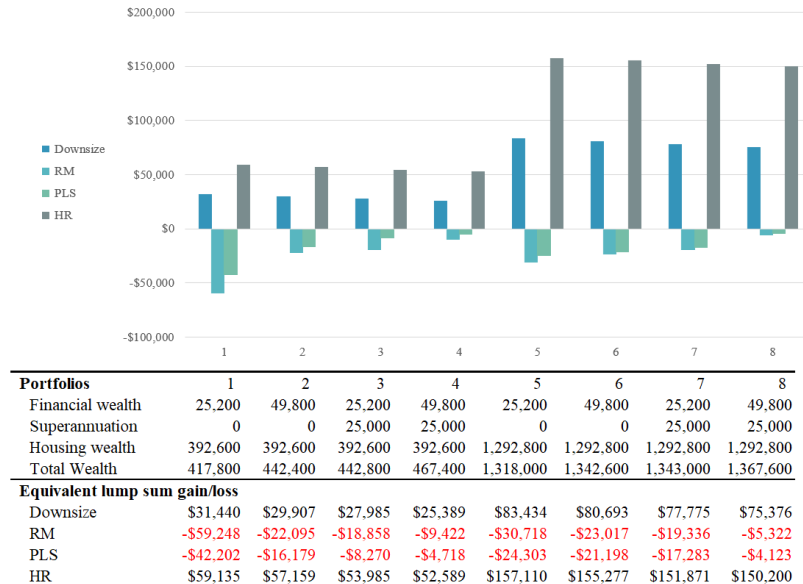
Figure 3.19: Equivalent lump-sum gain/loss for single female households by household wealth deciles using different approaches ($\gamma_c=3$, $\gamma_b=3$, $\gamma_h=3$, $\theta=0.96$, $\beta=0.96$, $\alpha^{income}=0.01$) with stressed house price growth.

Portfolios	1	2	3	4	5	6	7	8	9	10
Financial wealth	25,200	21,600	49,800	25,500	158,200	56,300	100,900	348,500	485,100	1,075,900
Superannuation	0	13,000	25,000	32,000	2,000	13,000	135,400	217,900	242,900	445,600
Housing wealth	216,200	392,600	505,900	672,400	708,300	940,000	945,100	986,200	1,292,800	1,842,900
Total Wealth	241,400	427,200	580,700	729,900	868,500	1,009,300	1,181,400	1,552,600	2,020,800	3,364,400
Equivalent lump sum gain/loss										
Downsize	$13,676	$31,284	$31,788	$42,056	$40,278	$58,697	$210,337	$174,692	$142,339	$109,054
RM	-$4,587	-$5,860	-$7,303	-$36,618	-$41,651	-$57,266	-$285,953	-$148,875	-$120,124	-$83,350
PLS	-$2,232	-$2,685	-$3,015	-$19,977	-$36,066	-$47,841	-$200,946	-$138,187	-$110,635	-$73,128
HR	$35,544	$56,109	$65,722	$84,910	$86,282	$114,768	$532,612	$379,499	$289,102	$231,713

Note: RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach. Portfolios 1- 10 represent the single female households' wealth decile 1-10.

Figure 3.20: Equivalent lump-sum gain/loss for single female households with *hypothetical* portfolios using different approaches ($\gamma_c=3$, $\gamma_b=3$, $\gamma_h=3$, $\theta=0.96$, $\beta=0.96$, $\alpha^{income}=0.01$) with stressed house price growth.

Portfolios	1	2	3	4	5	6	7	8
Financial wealth	25,200	49,800	25,200	49,800	25,200	49,800	25,200	49,800
Superannuation	0	0	25,000	25,000	0	0	25,000	25,000
Housing wealth	392,600	392,600	392,600	392,600	1,292,800	1,292,800	1,292,800	1,292,800
Total Wealth	417,800	442,400	442,800	467,400	1,318,000	1,342,600	1,343,000	1,367,600
Equivalent lump sum gain/loss								
Downsize	$31,440	$29,907	$27,985	$25,389	$83,434	$80,693	$77,775	$75,376
RM	-$59,248	-$22,095	-$18,858	-$9,422	-$30,718	-$23,017	-$19,336	-$5,322
PLS	-$42,202	-$16,179	-$8,270	-$4,718	-$24,303	-$21,198	-$17,283	-$4,123
HR	$59,135	$57,159	$53,985	$52,589	$157,110	$155,277	$151,871	$150,200

Note: RM: using the reverse mortgage approach; PLS: using the Pension Loans Scheme approach; HR: using the home reversion approach.

3.6   Summary of main results and sensitivity analysis

In the main results section, we have analyzed the following scenarios:

1. Single female households extracting an income stream under baseline parameters

   Key results: Using the PLS is the preferred approach to utilize housing wealth. Single female households in wealth deciles 1 to 6 experience an equivalent lump-sum gain of A$34,175 to A$102,062, which is equivalent to around 12% of their total wealth. Households in wealth deciles 7 to 10 have much greater lump-sum gain is because additional liquid wealth will reduce the entitled Age Pension amount until it reaches the asset test threshold. Using commercial reverse mortgages has slightly less equivalent lump-sum gain, as the interest rate charged is higher than the PLS. Using the home reversion approach also experiences equivalent lump-sum gain but the

amount is less than the commercial reverse mortgage and the PLS, due to less exposure to the housing market. Households downsizing in wealth deciles 7 to 10 experience a lump-sum loss as the housing utility and bequest utility were less than other approaches.

2. Single female households extracting a lump-sum under baseline parameters

   Key results: If the households only extract 1% of their housing wealth as a lump-sum, the PLS is still the preferred approach among all home equity release approaches for households in wealth deciles 1 to 9. However, for households in wealth decile 10, as the maximum lump-sum extraction is only 50% of the Age Pension in a 12-month period, which is less than 1% of housing wealth, the consumption utility gain for the commercial reverse mortgages is higher than that of the PLS. The consumption utility gain offsets and outweighs the loss of bequest utility (which is incurred by higher interest rate charged and more amount extracted). This effect is magnified when we simulate the same process with a higher lump-sum extraction percentage.

3. Couple households extracting an income stream under baseline parameters

   Key results: Using the PLS is the preferred approach and the ranking of the home equity release approach is the same as single female households across all deciles. The equivalent lump-sum gain for couples is much higher than single-female households. The gain is mainly derived from the consumption utility as households with two members derive consumption utility for a longer period since the joint life expectancy is longer than the single female life expectancy.

Following the baseline analysis, we performed sensitivity analyses to investigate households with different preferences and subjective views on house price impact on the benefits of using home equity release approaches. We do not only use the households' wealth in different deciles but also use some hypothetical

asset-rich but cash-poor portfolios to understand how the wealth level change impacts the equivalent lump-sum gain.

1. Household with a greater bequest preference

    Key results: None of the home equity release approaches would provide the equivalent lump-sum gain, as using these approaches would reduce the inheritance amount. This phenomenon is observed in both actual household wealth deciles and hypothetical portfolios.

2. Household with a greater consumption preference

    Key results: The lump-sum gain is much greater under this scenario for both actual household wealth deciles and hypothetical portfolios, which is driven by the increment of the consumption utility. When single female households continue to extract 1% of housing wealth, the ranking of home equity release approaches remains the same as the baseline parameters, in which the PLS comes first, followed by commercial reverse mortgages and home reversion, with downsizing ranking last. However, when the amount extracted increases, commercial reverse mortgages would rank first if the annual amount extracted is more than the cap of the PLS.

Through investigating the hypothetical portfolios, we observe that the lump-sum gain increases, across all approaches, when the households have more housing wealth, while the lump-sum gain decreases when the households have more financial wealth and superannuation balances.

3. Household with a greater housing preference

    Key results: While using the PLS, commercial reverse mortgages and home reversion remain unchanged, if the households prefer more to stick with the current home, they would have experienced further equivalent lump-sum loss when using downsizing.

4. Households with a greater future preference

   Key results: Across both actual household wealth deciles and hypothetical portfolios, the lump-sum gain is reduced but the ranking of the home equity release approaches remains unchanged.

5. Sensitivity analysis of house price growth

   Key results: Households who expect lower house price growth would see the home reversion as the preferred approach to utilize the housing wealth, for both actual household wealth deciles and hypothetical portfolios. Downsizing is another approach that results in the equivalent lump-sum gain, while reverse mortgages and the PLS would result in an equivalent lump-sum loss.

3.7 Conclusion

In this chapter, we developed a simulation analysis to explore the impact of four alternative home equity release approaches on illustrative Australian retire households by wealth decile. We included the Age Pension means tests, tax and superannuation rules, longevity risk, inflation risk, and house price risk and allowed for bequests and housing utility in the expected utility framework.

Our analysis showed that unless retiree households prefer to leave a higher bequest, they should extract housing wealth for retirement expenditure in the case of both single individuals and couples. The majority of scenarios demonstrate that using the PLS is the preferred approach to release home equity. The result suggested that using the PLS could help many Australian households to improve their retirement living standard. Private reverse mortgages only become the most attractive option when retirees have a higher consumption demand. This is because the interest rate charged is higher than that of the PLS. This indicates that when the retiree households' consumption needs cannot be

met by the PLS, using private reverse mortgages would be beneficial to the retirees to further enhance their retirement living standards. Moreover, home reversion is the most beneficial product if homeowners have lower expectations about house price growth. Downsizing is not an attractive approach for retirees since they usually face a loss in housing utility as well as the high cost of the transfer duty.

We also found that households with more housing wealth and/or less non-primary housing wealth would benefit from equity release in the Australian context. This aligns with existing theoretical and stated demand research (Nakajima and Telyukova, 2017; Davidoff *et al.*, 2017; Hanewald *et al.*, 2020). Hence, our study confirms that asset-rich and cash-poor individuals could benefit from utilizing their housing wealth through equity release contracts rather than downsizing from their current homes.

Similar results are observed for single and couple households. Couple households have significantly more lump-sum gains as they require additional liquid wealth to finance their retirement expenditures. Lump-sum extractions also help retirees satisfy lump-sum consumption needs which boost the consumption utility of the current period.

In addition to the theoretical literature (e.g., Hanewald *et* al., 2016; Shao *et al.*, 2019), this research identified the benefits of using various home equity release products to improve retirement living standards. However, the actual demand for home equity release products (e.g., reverse mortgages) remains low in the market. We name the gap between the theoretical demand and actual demand of home equity release approaches as the "home equity release puzzle." The next chapter of this thesis investigates the reasons for this low actual demand from behavioral perspectives such as mental accounting, choice bracketing, and information framing. Moreover, it resolves the puzzle by mitigating these behavioral barriers. Chapter 4 involves studying a possible method of reducing the effects of the

aforementioned puzzle by introducing hybrid financial products such as long-term care insurance financed through home equity release. These two chapters potentially serve as a supplement to this chapter since the current chapter cannot explain the low actual demand in the current market.

Since the retired households can increase their retirement income through various equity release approaches by taking additional risks (such as interest rate risks and house price risks), governments (both Australian and overseas) should enhance policies to increase the take-up rate of these schemes by improving government-funded reverse mortgages and providing incentives for development in the private equity release market in addition to educating the public about the risks of the home equity release approaches. Private providers should also design products that are attractive to retired households and complement existing government-funded schemes. As stated in Section 3.3.3.4, there are multiple constraints under the PLS, such as the maximum lump sum extraction and the borrowing amount each year. In this manner, the equity release market can mature, resulting in more beneficial options for different types of households to boost their retirement resources using the most beneficial approach for their situation.

Chapter 4

Demand for reverse mortgages: Behavioral explanations[*]

Abstract

Retired households typically hold a large component of their wealth in housing. A reverse mortgage allows older homeowners to access this wealth without moving out of their homes. Economic theory suggests that reverse mortgages should be popular, but reverse mortgage markets worldwide are small. Using an online survey administered to a sample of 948 Australian homeowners aged 60–80, we explore the role of behavioral factors – specifically mental accounting, narrow choice bracketing, and complexity – in this "reverse mortgage puzzle". 43% of our sample stated that they would take a reverse mortgage using an average of thirteen percent of their housing wealth. Participants who were presented with information designed to address mental accounting reported the highest demand for reverse mortgages. In addition, participants who reported that they would have trouble meeting expenses in retirement also expressed significantly higher demand when presented with information designed to offset narrow choice bracketing. We also found that the demand for reverse mortgages, both at the extensive and the intensive margin, was greater for non-retired participants with low non-housing wealth, who intended to use housing wealth for retirement, and who had experienced an impact of COVID-19 on health, wellbeing, and finances. This research contributes to our understanding of how to offset behavioral barriers to the use of housing wealth to finance retirement.

4.1 Introduction

In Australia, people typically fund their retirement using the Age Pension, superannuation, or both. However, for many Australian households at or near retirement, housing wealth is the largest component of total household wealth[12] (Daley and Coates, 2018). However, wealth stored in housing remains underutilized for retirement financial planning. While housing wealth is often included in the "voluntary saving" pillar for retirement income provision, it is rarely promoted as a source of retirement financing in a public policy context (Holzmann, 2005; Price, 2018). In Australia, this was addressed in the final report of the Retirement Income Review conducted in 2019–2020, which highlighted the role of housing wealth as a complementary resource to fund retirement with the Age Pension, superannuation, and financial assets (The Australian Government the Treasury, 2020).

People are generally very attached to their homes. Boland *et al.* (2017) documented that retirees from different countries prefer to age at home. Productivity Commission Report (2015) noted that 83% of older Australians strongly prefer to age at home. Moreover, James *et al.* (2019) found that 87% of individuals aged 65–74 want to stay within 10 km of their current home. There are several options for the elderly to utilize their housing wealth without moving out of their primary home, including reverse mortgages and home reversion–type schemes. Ratcliffe *et al.* (2020) found that 72% of Australians aged 18–91 want to remain at home to receive aged care in the future instead of moving to a nursing home.

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[12] In Chapter 3, we also find that housing wealth is the largest component of the retiree homeowners for household wealth across different deciles.

This chapter focuses on reverse mortgages, which are the most popular home equity release products in Australia and elsewhere, albeit in a small market. When using a reverse mortgage, retiree households effectively take out a loan on a certain percentage of their home value and can then receive payments as a lump-sum, a regular income stream, a line of credit, or a combination thereof. They do not have to (but can choose to) repay any principal and interest on this loan during their lifetime. Instead, when they move out or die, the sale proceeds from the home are used to repay the principal and interest on the loan. Hence, reverse mortgages could be suitable for retirees who have housing wealth but low regular income and prefer to age in place.

The Australian Government supports the development of a reverse mortgage market through both regulation and public provision. Purchasers of reverse mortgage products (borrowers) are protected under the *National Consumer Credit Protection Act 2009*, which ensures that the borrower remains the owner of the property, has the right to occupancy, and cannot owe more than the home is worth (the "NNEG"). Furthermore, the Australian Government provides a publicly funded reverse mortgage known as the Pension Loans Scheme (PLS), which was launched in 1985 for Age Pensioners and expanded in 2019 to allow higher borrowing against the home and provide access for self-funded retirees. This revised scheme allows retirees to receive up to 150% of the maximum Age Pension amount (including their current Age Pension amount if they receive one). Both the original and expanded PLS provide payments as regular income only. In the 2021–2022 Budget, the Australian Government proposed changes to the PLS to introduce two additional features: the NNEG and limited lump-sum withdrawal.

However, the actual take-up of reverse mortgage products in Australia is very low. There are few providers in the private market, and current providers are largely smaller banks and non-bank lenders (ASIC, 2018). Although interest in

the publicly provided PLS has been slow to develop, there has been some increase in take-up following the 2019 expansion, with approximately 1,500 new participants between July 2019 and March 2020 (The Australian Government the Treasury, 2020). As of March 2021, there are approximately 4,000 PLS participants (Hanewald *et al.,* 2021).

Several empirical studies have investigated the subdued demand for reverse mortgage products, including Ong *et al.* (2015) and Jefferson *et al.* (2017) for Australia, Davidoff *et al.* (2017) and Moulton *et al.* (2017) for the US, Dillingh *et al.* (2017) for the Netherlands, Fornero *et al.* (2017) for Italy, Fong *et al.* (2020) for Singapore, and Hanewald *et al.* (2020) for China. Most of these studies investigated the role of economic and demographic factors such as bequest motives, non-housing wealth, age, marital status, number of children, and retirement status, as well as financial literacy, product complexity, and personality traits to explain this low demand. However, the role of behavioral factors has been little examined.

There is a growing strand of literature exploring behavioral explanations for seemingly sub-optimal retirees' financial decisions. Most of these studies have focused on the low take-up rate of annuities. The behavioral barriers studied include *narrow framing* (Brown *et al.,* 2021), *investment/consumption framing* (Brown *et al.,* 2012), *gain versus loss framing* (Agnew *et al.,* 2008), and *product complexity* (Bateman *et al.,* 2018). Mental accounting has also been considered as a factor contributing to the low take-up rate for financial products in general (Abeler and Marklein, 2017; Zhang and Sussman, 2018).

In this study, we explored the role of behavioral factors as an explanation for the global disinterest in reverse mortgage products. By using an experimental survey to elicit the stated demand for reverse mortgages (which we called an equity release product), we explored whether demand is influenced by information framing to address potential *mental accounting*, *narrow choice bracketing,* and

product complexity. Our information frames include a case study (aimed to reduce *product complexity*), a description of the household financial portfolios available to fund retirement (to address potential *mental accounting*), and a detailed review of potential retirement expenditure (aimed to prompt a *broader* view of retirement expenditure and thereby address *narrow choice bracketing*). The equity release product that we studied has a flexible design (based on Hanewald *et al.,* 2020) to address some concerns regarding product design identified in previous studies (Davidoff *et al.,* 2017; Dillingh *et al.,* 2017; Jefferson *et al.*, 2017). By using a between-subjects design, participants entering the survey were randomly assigned to (i) a treatment that only included a basic explanation of the equity release product, (ii) to a control treatment that included a basic explanation and case study of the equity release product, or (iii) to one of three information treatments designed to address the various behavioral barriers. All participants were then asked to elicit their stated demand for the product. Following the choice task, participants were asked why they did not purchase any (or any more) of the product. Thereafter, they completed a quiz to elicit their understanding of the equity release product on offer. The final section of the survey collected data on planning and personality traits, financial skills and knowledge, and personal characteristics, including demographics, household finances, bequest motives, and the impact of COVID-19. The survey was administered in May 2020 to a sample of 948 Australian homeowners aged 60–80.

The analysis of data collected in the survey showed that 43% of participants would use the equity release product on offer to extract an average of 13% of their reported housing wealth. The information treatment designed to address mental accounting was the most successful. The amount of housing wealth participants reported they would use was significantly higher when retirees are prompted to think about housing wealth along with the Age Pension,

superannuation, and financial assets as a resource to fund retirement (17% of reported housing wealth compared to 12% in the absence of the mental account information treatment). Although we were unable to identify a link between the demand for equity release products and the amount borrowed by reducing the product complexity, we found that both the self-rated and objective understanding of reverse mortgages was much higher when survey participants were presented with a case study. We also found that, on average, participants with information designed to address narrow choice bracketing would have significantly lower demand for reverse mortgages. However, this was reversed to a significantly higher demand when we restricted the sample to participants who stated that they expected to have trouble meeting expenses in retirement.

We contribute to the literature on reverse mortgage demand by considering the impact of behavioral effects on the decision to use reverse mortgages. Our key finding is that the amount borrowed using equity release products can be significantly increased by addressing the potential for people to exclude housing wealth from their "retirement provision" mental account through information framing. In addition, we identify that addressing the narrow choice bracketing is associated with lower reverse mortgage demand, but the impact is reversed if the participants stated that they expect to have difficulties meeting their expenditure expectations. We also find that the stated demand for reverse mortgages is significantly associated with having low non-housing wealth and that the greater use of housing wealth to fund retirement through an equity release product is significantly associated with having low income and a high subjective understanding of the reverse mortgage products on offer. Our results provide important evidence for product providers and governments who want to encourage people to use housing wealth to finance retirement.

The remainder of the chapter is organized as follows. Section 4.2 explains the current Australian retirement system and summarizes the relevant literature.

Section 4.3 describes the online survey and the design of the reverse mortgage choice task. Section 4.4 presents the descriptive statistics, while Section 4.5 summarizes the regression analysis of the survey data, and Section 4.6 concludes this chapter.

4.2 Background

4.2.1 Australian retirement income system and household wealth

Our study was conducted in Australia, which has a multi-pillar retirement income system including a publicly provided safety net (the Age Pension), mandatory saving in individual accounts (the superannuation guarantee), and voluntary saving.

The Age Pension, funded from general tax revenue, is means-tested by income and assets[13]. It provides an indexed income stream for life (subject to eligibility) with the full rate set at 27.7% of average male earnings for a single retiree and 41.8% of average male earnings for a retiree couple.[14]

Introduced in 1992, the superannuation guarantee is a compulsory employer contribution to an approved superannuation fund, with the contributions and earnings thereon preserved to age 60. The current contribution rate is 10% of ordinary earnings, with legislated plans to increase this to 12%.[15] Employer superannuation contributions are taxed at a 15% flat rate on contributions and subsequent earnings, which is concessional for many income earners.

Voluntary saving comprises voluntary superannuation contributions, owner-occupied housing, and other financial assets such as shares, investment

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[13] For details of the means test, see
https://www.humanservices.gov.au/individuals/services/centrelink/age-pension
[14] According to The Australian Government the Treasury (2020), the Age Pension cost $47 billion (2.4% of GDP) in 2018-2019.
[15] The percentage will be increased by 0.5% per year from 1 July 2021 to 12% on 1 July 2025.

properties, and businesses. As of September 2020, the total assets in the superannuation system, which include both the superannuation guarantee and voluntary contributions, were A\$2.87 trillion (APRA, 2020). Superannuation is generally invested in a broad range of assets. Excluding self-managed superannuation funds[16], the average asset allocation in August 2020 was 49% in domestic and international equity and 34% in fixed income and cash, and 17% in other assets such as unlisted properties and hedge funds. For superannuation fund members at around retirement age, the mean (median) superannuation balance of a male aged 55–64 was around A\$332,700 (A\$183,000), and that of a female aged 55-64 was A\$245,100 (A\$119,000) in 2019 (ABS, 2019).

According to the Retirement Income Review (The Australian Government the Treasury, 2020), 76% of Australian retirees aged 65 or above are homeowners, and housing wealth is approximately 60–72% of the total wealth of the middle-wealth (40–70%) Australian retirees. Additionally, apart from the wealthiest 10% of retirees, housing wealth is the largest component of retirees' total wealth. CoreLogic (2020) reported that the net worth of Australian residential real estate is A\$7.1 trillion, which is more than double of total superannuation assets. In other words, housing wealth is an extremely large component of total household wealth but appears to be underutilized as a resource to fund retirement. Developing a reverse mortgage market could help retirees extract liquidity from their housing wealth to fund a range of ongoing and/or intermittent expenses in retirement.

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[16] The difference between self-managed superannuation funds (SMSF) and other types of superannuation funds is that the members of an SMSF are usually also the trustees. This means the members of the SMSF run it for their benefit and are responsible for complying with the super and tax laws.

4.2.2 Australian housing and reverse mortgage market

One of the key factors in developing a comprehensive home equity release market is the homeownership rate of retirees since the market mainly focuses on homeowners[17]. The United States has the largest reverse mortgage market in the world, while the homeownership rate of those aged 65 or above has been stable at 80% since 1994 (United States Census Bureau, 2021). At 81.7%, Australia has a similar homeownership rate for those aged 65 or above (AIHW, 2020), which demonstrates the potential of the reverse mortgage market in Australia. Additionally, house prices in Australia have increased significantly over the past decade. Data published by the Australian Bureau of Statistics (ABS) (2020) showed that residential property prices in the eight capital cities increased by 108% from September 2003 to March 2020 compared to a 45% increase in the inflation rate over the same period. Therefore, there is great potential for older households to utilize their housing wealth to finance expenditure in retirement.

Alongside the regulatory environment, the homeownership rate and strong house price growth demonstrate that the Australian reverse mortgage market has the potential to grow. Despite this, it currently remains underdeveloped. The first commercial reverse mortgage was offered by Advance Bank Australia[18] in the 1990s. The market proceeded to grow over the next decade, with more than 20 reverse mortgage providers by the mid-2000s. Since then, there have been developments to improve the regulatory environment for reverse mortgages. In 2012, the *Australian National Consumer Credit Protection Act* was implemented. Two key requirements[19] are limits on the prospective loan to value ratio (LVR)

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[17] Although the PLS allows pensioners to use other types of property as the collateral, such as farm, vacant land and commercial properties, the primary focus is to use the primary residential property. Most of the private home equity release providers only accept residential property as the collateral.

[18] Advance Bank Australia has merged with the St. George Bank.

[19] The other three requirements are: 1. responsible lending, whereby product issuers must inquire about consumers' future needs, including but not limited to aged care expenditure and leaving

and a "no negative equity guarantee". The maximum LVR for people aged 55 is set at 15%, and it increases by one percentage point with each year a person becomes older. In a reverse mortgage, the NNEG protects consumers so that they never owe more than the value of their property at termination. Simpkins (2021) reports that the current housing portfolio of the Australian retirees is worth more than A\$1 trillion, while only \$3.6 billion have been utilized through commercial reverse mortgages, excluding the PLS.

In Australia, a publicly provided reverse mortgage known as the PLS was introduced in 1985. The initial aim of this government-supported initiative was to top up the full pension rate of those retirees with property assets who receive a reduced pension rate due to the income or assets means test. The take-up rate of this version of the scheme was very low: there were only 13 applications in the first two months and only 710 outstanding loans by 2010. The PLS was further extended in 2019 and now tops up the Age Pension by up to 150% of the full pension rate. It was also extended to self-funded retirees. While the loan accumulates with a compound interest of 4.5% p.a.[20], the PLS is relatively inflexible compared to commercial products since retirees cannot take a lump-sum and the amount available is capped. Although there has been significant growth since the 2019 extension, the total number of PLS participants was only 4,000 in March 2021. The 2021–22 Australian Government Budget announced two changes to the PLS effective from July 2022. A NNEG will apply and restricted lump-sums will be allowed.

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the property as a bequest; 2. mandatory disclosure, whereby product issuers must provide consumers with cash flow projections of the home equity using the ASIC's website, an information sheet, tenancy protection warning, and annual account statement; and 3. product issuers must not commence enforcement proceedings unless they have spoken to consumers via phone or in person about the default notice and the consequences of failing to remedy the default.

[20] This interest rate is set by the Australian government and changes from time to time.

4.2.3 Economic benefits of using reverse mortgages

Several theoretical papers describe the economic gain and welfare benefits of using reverse mortgages. The general conclusion from the theoretical literature is that reverse mortgages can improve the well-being of retiree households.

Ong (2008) estimated the benefit of using reverse mortgages for Australian retiree households by determining lifetime monthly payments using a sinking fund formula and concluded that older single female households benefit most when using reverse mortgages to access their housing wealth. Davidoff (2010) developed a lifecycle model which identified that retirees derive the maximum utility when using home equity release products to release the asset commitment and purchase long-term care insurance, which would benefit retiree households.

Huang *et al.* (2013) used a three-period lifecycle model to confirm that Chinese retiree households would benefit from using reverse mortgages to smooth consumption when the bequest motive is mild. Hanewald *et al.* (2016) used a two-period model to estimate the utility gain when households have access to a range of products, including reverse mortgages, home reversion, long-term care insurance, and an annuity. The authors found that households could benefit from the use of home equity release products and that a higher utility gain is derived when using reverse mortgages rather than home reversion schemes. Shao *et al.* (2019) developed a multi-period model to include a more complex house price model (ARMA-GARCH) and confirmed the complementary nature of home equity release products and long-term care insurance. Furthermore, Nakajima and Telyukova (2017) used a Cobb-Douglas function that included the risk of moving to residential care, house price risks, and bequest motives, to examine the utility gain for households when using reverse mortgages.

Taken together, the studies mentioned above concluded that low income, low wealth, and households with poor health could benefit from a higher take-up rate

of reverse mortgages to improve their living standards. The previous chapter in this thesis used a simulation method to estimate the expected utility of different home equity release options by including stochastic mortality modeling, stochastic macroeconomic condition simulation, and current tax, superannuation, and pension rules in Australia. The simulation results showed that most retiree households could benefit from the use of reverse mortgages (either government-funded or offered in the private sector) since these products help retirees improve their retirement living standards in terms of higher expected utility.

The aforementioned studies recommended that retiree households utilize housing wealth by using reverse mortgages to enhance their financial well-being. However, as described in Section 3.2.2, the demand for reverse mortgages remains small. The mismatch between the theoretical prediction and the actual take-up rate of reverse mortgages is referred to as the reverse mortgage puzzle.

4.2.4 Factors explaining the reverse mortgage puzzle

Prior empirical studies have investigated the market for reverse mortgages products and have identified several factors that have contributed to the reverse mortgage puzzle. We group these factors into four categories: economic, demographic, financial competence (including product understanding), and personal characteristics.

From a demographic perspective, Fornero *et al.* (2016) for Italy and Fong *et al.* (2021) for Singapore suggested that older households are typically not confident using innovative or non-standard financial products. Ong *et al.* (2015) for Australia, Dillingh *et al.* (2017) for the Netherlands, and Moulton *et al.* (2017) for the US found that single retirees expressed higher stated demand for reverse mortgages. Moreover, less healthy retirees are inclined to worry about their medical expenses during retirement; thus, they seek extra support from housing wealth (Ong *et al.,* 2015; Moulton *et al.,* 2017). Like older retirees, less-educated

retirees also expressed less interest in using reverse mortgages since they are not confident in accessing innovative financial products. Retirees without children also require more financial support from their housing wealth since they cannot rely on children to support them (Hanewald *et al.,* 2020; Ong *et al.,* 2015).

In terms of economic factors, previous studies have found that people with higher non-housing wealth, non-conventional mortgages, and higher incomes are less interested in reverse mortgages. Hanewald *et al*. (2020) and Moulton *et al.* (2017) showed that households with more non-housing wealth do not require extra cash to sustain their retirement lifestyle since they have enough financial resources to maintain their living standards without extracting housing wealth.

Furthermore, retirees with smaller conventional mortgages face less financial pressure have expressed less interest in using reverse mortgages (Hanewald *et al.,* 2020; Fong *et al.,* 2020; Jefferson *et al.,* 2017; Davidoff *et al.,* 2017; Dillingh *et al.,* 2017; Fornero *et al.,* 2017; Moulton *et al.,* 2017). However, since retirees with less income would require more financial support for their retirement, their demand for reverse mortgages is higher (Fong *et al.,* 2021; Ong *et al.,* 2015; Moulton *et al.,* 2017).

On the other hand, the impact of housing wealth on the demand for reverse mortgages varies. Fong *et al.* (2020) and Fornero *et al.* (2017) found that retirees with more housing wealth are less interested in reverse mortgage products, whereas Ong *et al.,* (2015) and Moulton *et al.* (2017) found that retirees with more housing wealth have a higher demand for reverse mortgages. Furthermore, Jefferson *et al.* (2017) and Ong *et al.* (2015) found that retirees in Australia who want to use housing wealth as precautionary savings are less interested in reverse mortgages.

Regarding financial competence, Hanewald *et al.* (2020) and Fong *et al.* (2020) found that retirees with higher financial literacy have a higher demand for

reverse mortgages, whereas Davidoff *et al.* (2017) and Fornero *et al.* (2017) observed the opposite. Retirees with higher financial literacy are likely to possess the knowledge to understand complex financial concepts. Also, they are more likely to have better retirement plans; thus, it is unsurprising that the impacts differ in different studies. Both product understanding and product familiarity are positively correlated with the demand for reverse mortgages since retirees who are more familiar with and knowledgeable about relevant products would be more confident in using them (Hanewald *et al.,* 2020; Fong *et al.,* 2020; Jefferson *et al.,* 2017; Davidoff *et al.,* 2017). However, Jefferson *et al.* (2017) and Fornero *et al.* (2017) found that debt aversion contributes to the reverse mortgage puzzle.

Finally, other personal characteristics—such as health status, risk aversion, and bequest motives—have been found to influence reverse mortgage demand. Retirees with higher bequest motives have less demand for reverse mortgages since their preference is to preserve housing wealth to bequeath (Hanewald *et al.,* 2020; Davidoff *et al.,* 2017; Jefferson *et al.,* 2017; Moulton *et al.,* 2017). Moreover, Hanewald *et al.* (2020), Davidoff *et al.* (2017), Fornero *et al.* (2017), and Moulton *et al.* (2017) all demonstrated that retirees with higher risk aversion have a lower demand for reverse mortgages, which suggests that reverse mortgages are viewed as a risky financial product rather than a risk management product.

In summary, most previous studies have focused on how economic and personal characteristics influence the demand for reverse mortgages. There has been little investigation of the impact of behavioral factors, which are important for interest in and demand for other retirement financial products (Abeler and Marklein, 2017; Bateman *et al.,* 2018; Brown *et al.,* 2021).

4.2.5 Behavioral factors relevant to reverse mortgage demand

The standard lifecycle theory assumes that wealth is perfectly fungible and that all components of wealth are substitutes. Shefrin and Thaler (1988) proposed a modified version of the lifecycle model—the *behavioral* lifecycle model—that incorporates *mental accounting*. Thaler (1999) explained *mental accounting* as a set of cognitive operations that can drive the decision-making process for every financial activity. In other words, *mental accounting* is the process of how individuals group their assets and expenditures to determine their budget plans. Abeler and Marklein (2017) confirmed that people do not treat wealth equally in a simple, incentivized setup. Several other studies have argued that mental accounting is one explanation for why people's behaviors deviate from the predictions of the traditional life cycle model (Holzmann *et al.,* 2019; Bravo *et al.,* 2019).

Shefrin and Thaler (1988) were the first to incorporate *mental accounting* into behavioral lifecycle modeling. Since then, many studies have expanded this theory to explain the underutilization of housing wealth in retirement financial decision-making. Levin (1998) showed that the behavioral lifecycle model can explain how the consumption of individuals at or near retirement varies with changes in different types of financial assets. Using US data over the period 1969–1979, he found that spending was sensitive to changes in income and liquid assets; however, it was not very sensitive to changes in the value of other types of assets (e.g., housing and social security). Additionally, Toussaint (2011) studied the role of mental accounts through an exploration of household considerations about building and consuming housing equity in Germany, Hungary, and the United Kingdom. The results illustrated that housing wealth is the last resort among all financial assets and is thus underutilized in retirement financial planning. Furthermore, Yang *et al.* (2011) analyzed the role of housing in consumption by the elderly in urban China. They found that, on average,

changes in housing wealth have limited effects on elderly consumption and argued that this is due to mental accounting. Zhang and Sussman (2018) explained that while mental accounting can help individuals simplify financial decisions pertaining to both wealth accumulation and budgeting, it also creates barriers for individuals to consider their entire portfolio when making financial decisions. Additionally, Fox O'Mahony and Overton (2015) found that emotional aspects such as security, success, freedom, and control are compromised in the process of making financial decisions regarding housing wealth.

In this chapter, we explore whether the reverse mortgage demand would be enhanced if information framing addresses the tendency of people to allocate different components of household wealth to different mental accounts—not all of which are for spending in retirement.

In addition to mental accounting, *choice bracketing* can also be used to explain retirees' behaviors. Abeler and Marklein (2017) and Brown *et al.* (2021) provided empirical evidence of people's decisions being impacted by *choice bracketing*. Furthermore, Read *et al.* (1999) defined *broad bracketing* as circumstances in which people assess all possible consequences when making a financial decision, whereas individuals who use *narrow choice bracketing* only focus on some consequences and overlook others when making financial decisions.

In this chapter, we also examine the role of choice bracketing on the demand for reverse mortgages. Under "narrow choice bracketing", individuals will select the best outcome among the outcomes under consideration, which may not maximize their utility since the best option may not even be under consideration. Brown *et al*. (2021) showed that the demand for annuities was enhanced for survey participants subjected to broad bracketing. The broad bracketing treatment in that study included a message to prompt participants to consider the

consequences of using annuities. Similarly, Samek and Sydnor (2020) identified narrow choice bracketing as a barrier to insurance demand since individuals could not map the financial consequences. Following Brown *et al*. (2021), we examined whether addressing the narrow choice bracketing could enhance the demand for reverse mortgages to finance retirement. We motivated survey participants to think beyond the cost of reverse mortgages (such as the interest rate and the accumulating loan) to the broader issue of the full range of potential consumption needs in retirement. Based on the study of Brown *et al*. (2021), we prompted participants to consider the possible "consequences" of using a reverse mortgage to finance their retirement.

In addition to mental accounting and choice bracketing, *perceived product complexity* was also found to have an impact on demand. The provision of well-balanced information has been shown to increase the stated demand for annuities (Bateman *et al.,* 2018) and reverse mortgages (Hanewald *et al*., 2020). Since reverse mortgages are perceived as complex financial products (Jefferson *et al.,* 2017), one must take care to carefully explain the product and its implications to potential customers. In a portfolio choice study of investment options (including government bonds, company shares, subordinated notes, and capital notes), Basu and Dulleck (2020) showed that individuals with greater knowledge about more complex products are more cautious in approaching such products. On top of that, numerous studies have found that many people have low levels of financial literacy and find retirement planning and retirement products complex (Lusardi and Mitchell, 2014; Agnew *et al*., 2013). We also considered the role of product complexity. We address product complexity by presenting a short, clear description of the reverse mortgage product with a case study.

4.3   Survey design

Our experimental survey of reverse mortgage demand was designed and fielded to achieve two main objectives. First, we were interested in whether information treatments to address mental accounting, choice bracketing, and product complexity influence the demand for reverse mortgages at both the extensive and intensive margin. Second, we were interested in the demand heterogeneity based on economic factors, demographics, personal characteristics, preferences, financial competence, and other factors.

4.3.1 The experimental survey

The survey was fielded in May 2020 by the online survey firm PureProfile to a representative sample of 948 Australian homeowners aged 60–80. [21] We identified homeowners by asking participants whether they (or their spouses) own at least one property and set quotas on age, gender, and location. Participants who completed the survey were paid around A\$4 and had the opportunity to receive a bonus payment based on the results of a quiz testing their knowledge of the reverse mortgage product. The median completion time for the survey was 27 minutes.[22]

The survey had several components: questions to screen eligible participants and achieve the required quotas to ensure a representative sample; information treatments designed to address potential behavioral barriers to demand; a reverse mortgage choice task; survey questions to collect data for covariates (Figure 4.1).

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[21] The participants were recruited via email from PureProfile's contact list. Before commencing the survey, participants were required to complete a participant information and consent form.

[22] The live link to the survey can be found at https://survey.us.confirmit.com/wix/p944016183724.aspx and a complete set of screen shots appears in Appendix A.

Following the preliminary screening and quota questions, eligible participants were asked to report their housing wealth (which was used in the choice task) and were then randomly assigned to one of five information framing treatment groups (described in Section 4.3.2). They then completed the reverse mortgage choice task (described in Section 4.3.3) and completed a quiz to test their knowledge of the equity release product offered in the choice task. The final module consisted of questions to collect covariates in three groups: 1) planning and personality traits; 2) financial skills and knowledge; 3) personal characteristics. Between the sets of questions on planning and personality traits as well as financial skills and knowledge, we included an instrumental manipulation check (IMC), which allowed us to identify lack of attention (Oppenheimer *et al*., 2009).

The questions on planning and personality traits included the Big Five personality questions (Borghans *et al*., 2008; Agnew *et al*., 2018), as well as questions on risk attitudes (Dohmen *et al*., 2011), house price expectations (Davidoff *et al*., 2017), trust, and the impact of COVID-19 on their financial situation, health, and well-being. The questions on financial competence and skills included the Big Three financial literacy questions (Lusardi and Mitchell, 2011) and questions on subjective financial literacy, numeracy (Lipkus *et al*., 2001), and compound interest. We also collected information on the time taken to complete the survey and participants' ratings of the clarity of the survey questions, including which (if any) part of the survey was unclear.

To enhance the effectiveness of the survey, we implemented several features. For example, we did not use the term "reverse mortgage" but instead used "Equity Release Product A" to avoid any preconceptions that participants may have had with a commercial product name. Furthermore, we reminded participants to read the information presented carefully and included timers on each of the "information" screens to facilitate this. We incentivized participants

to pay attention and learn about the product by paying a bonus amount based on their scores in a reverse mortgage (equity release) product knowledge quiz. The type and order of the information presented in the survey were informed by the actual practices of the mortgage provider Household Capital Pty Ltd.

After completing the participant information statement and consent form, participants were asked to report their age (60–80 years old), whether they owned at least one residential property, and the location of the property. Participants were also required to answer questions about their gender and marital status. These questions helped us identify eligible participants and match quotas related to gender, residential location, and age. We targeted people aged 60–80 who owned at least one residential property with a gender mix of 49% male and 51% female to align with the 2016 Australian Census Data and a 60/40 capital city/regional mix. We set a quota of 60% for participants aged 60–69, while the remainder were aged 70–80.

Figure 4.1: Overview of the experimental survey design.
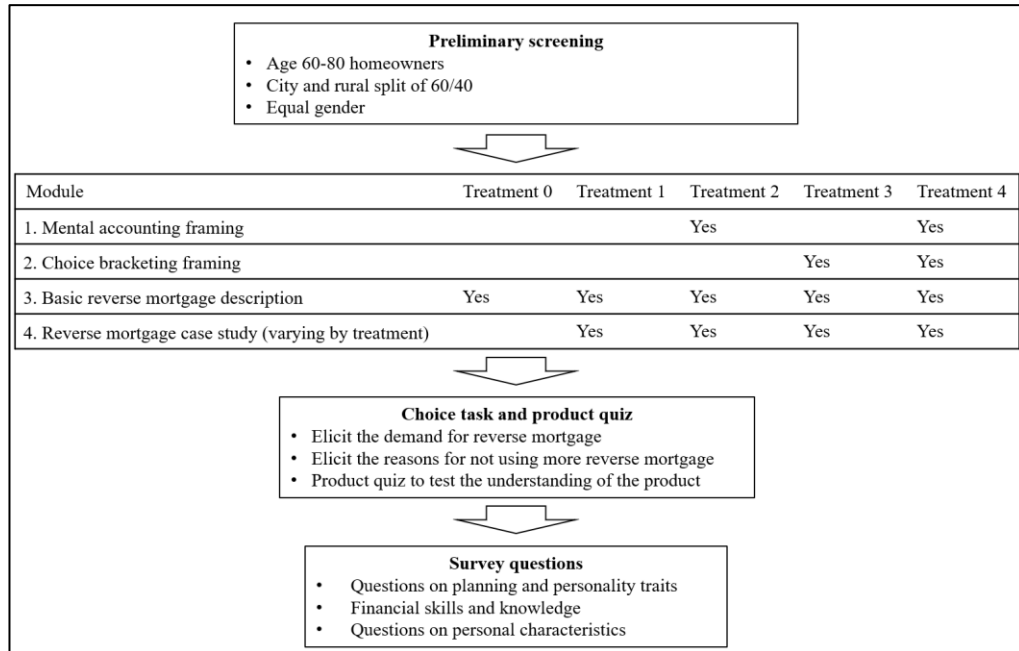
4.3.2 Design of information treatments

After answering the screening and quota questions, participants were randomly assigned to one of the five information treatment groups, as illustrated in Figure 4.1. Each treatment group completed the same choice task; however, before doing so, the groups were presented with different information designed to address the impact of behavioral factors (i.e., mental accounting, narrow choice bracketing, and product complexity) on their demand for the Equity Release Product A.

Participants in Treatment Group 0 were provided the least amount of information. Participants in this group were asked to read a short description of the equity release product before completing the choice task. Treatment Group 1 was the control group. Participants in this group were given the same product description and then an equity release case study before completing the choice task. The aim of the case study, which was provided to all other treatment groups except for

Treatment Group 0, was to address the complexity of the product. Treatment Group 2 was shown a screen designed to address mental accounting for available retirement resources, followed by a modified case study intended to offset mental accounting before completing the choice task. Similarly, Treatment Group 3 viewed a screen designed to address possible narrow consumption bracketing, followed by a case study that incorporated broad choice bracketing framing before completing the choice task. Finally, Treatment Group 4 was shown both the mental accounting and consumption framing screens, followed by a case study that incorporated both mental accounting and broad choice bracketing framing before completing the choice task. Following the choice task, all participants were asked about their reasons for not using a reverse mortgage (or for not taking the full amount available). They then completed the reverse mortgage product knowledge quiz and proceeded to answer questions included to collect covariates data.

4.3.2.1 Information presentation to address product complexity

We wanted to test whether the stated demand for reverse mortgages was influenced by information explaining how the product works. Davidoff *et al.* (2017) and Hanewald *et al.* (2020) found a higher demand for reverse mortgages when individuals are more knowledgeable about such products. To investigate the effectiveness of a case study illustrating how the product works, Treatment Group 0 was not provided with the case study. The control group (Treatment Group 1) was identical to Treatment Group 0, except for an additional case study to illustrate how the product works. Comparing the results of the control group to those of Treatment Group 0 confirmed the effectiveness of the case study. The case study specified that the product would not impact the entitled Age Pension, that the loan could be taken out as a combination of a lump-sum and a regular income stream, and that there is an NNEG (i.e., the estate would never need to repay more than the value of the property). This case study was designed to

reduce product complexity. The case study was also shown to Treatment Groups 2, 3, and 4, and was varied to include information framing to offset mental accounting (Treatment Groups 2 and 4) and narrow choice bracketing (Treatment Groups 3 and 4).

4.3.2.2   Information presentation to address mental accounting

The concept of mental accounting was first described by Thaler (1985), who argued that individuals' behaviors violate the simple economic principle of fungibility. Put simply, $1 in asset A for an individual is not treated in the same way as $1 in asset B. For example, an individual has $300,000 in total assets: $20,000 in cash, and $280,000 in a savings account. When they are faced with the decision of using $30,000 to renovate their current home, they may choose not to do so because they would be required to access their savings account. However, if their financial position remains the same but the asset allocation is $100,000 in cash and $200,000 in the savings account, they may choose to renovate their home. This is because each dollar in the savings account is worth more to the individual than each dollar in cash, and spending savings account money leads to a higher mental cost. In other words, the savings account is "future income," while the cash is a "current spendable item." Notably, "future income" has a higher mental value than the "current spendable item."

We extend Thaler's (1999) mental accounting theory to financial planning for retirement using housing wealth. Household wealth comprises superannuation, financial assets, and housing assets, which are often thought about separately; however, the housing assets are fungible. When individuals do not consider housing wealth at all in their planning for retirement, they violate the fungibility principle since housing wealth is also part of the household portfolio and should not be allocated to a separate mental account.

Figure 4.2: Screenshot of information framing to offset mental accounting.

The additional information provided to Treatment Groups 2 and 4 helped us to explore whether the framing of information on household wealth to overcome potential mental accounting can influence the demand for the equity release product we introduced in the survey (Figure 4.2). This was enacted by emphasizing that housing wealth is part of the financial resources available to fund retirement. A list of resources to finance retirement was provided to the participants (including the Age Pension). Notably, housing wealth was listed as one of the options. If the participants did not select housing wealth as part of their portfolio, a pop-up window alerted participants to the fact that they own a residential property since this was a pre-requisite for participation in the survey. After completing this screen, a pop-up window reminded participants that the selected assets (including their own home) could cover their expenditure in retirement. This treatment prompted participants to think about using their housing wealth when planning for expenditure in retirement.

4.3.2.3 Information presentation to address narrow choice bracketing

Brown *et al.* (2021) conducted an experimental survey to examine whether narrow choice bracketing impedes the valuation of annuities. In that study, participants were split into two groups, with the broad choice bracketing group provided with an additional "consequences message" to prompt the participants to consider the outcomes of different choices (i.e., enjoy the savings but run the risk of running out of money or spend the savings slowly but run the risk of not enjoying retirement).

Figure 4.3: Screenshot of information framing to encourage broad choice bracketing

We also used a similar approach by providing an additional "consequences message" about consumption after retirement. This was designed to address possible narrow choice bracketing when completing the equity release product choice task. In Treatment Groups 3 and 4, we provided a list of possible retirement expenditures and then encouraged participants to consider which were relevant to them; for each expenditure, participants were asked to select "Easy", "Difficult", or "Not relevant" (see Figure 4.3). The aim was to prompt broad choice bracketing for these participants when they completed the equity

release product choice task since they were motivated to think much more about the possible range of expenditures in retirement, both ongoing and periodic.

4.3.2.4 Reverse mortgage (equity release) product description and case study

Following the initial information framing, participants in Treatment Groups 2, 3, and 4 then proceeded to the product description for "Equity Release Product A" (the reverse mortgage product). The product description was identical across the five treatment groups and was based on the description of reverse mortgage products on the MoneySmart[23] website. The description explained the type of payments borrowers could receive (i.e., a lump-sum, regular income stream, and/or line of credit), that the interest is compounded throughout the loan, and that there is no repayment obligation while the borrower is alive. The description also clarified that the borrower retains full ownership of the home and that the loan would only be settled when the borrower sells or moves out of the property. The description also highlighted the requirement for "responsible lending." We considered this description as the minimum information required by participants to decide whether or not to use a reverse mortgage.

**Figure 4.4:** Screenshot of the description for Equity Release Product A.
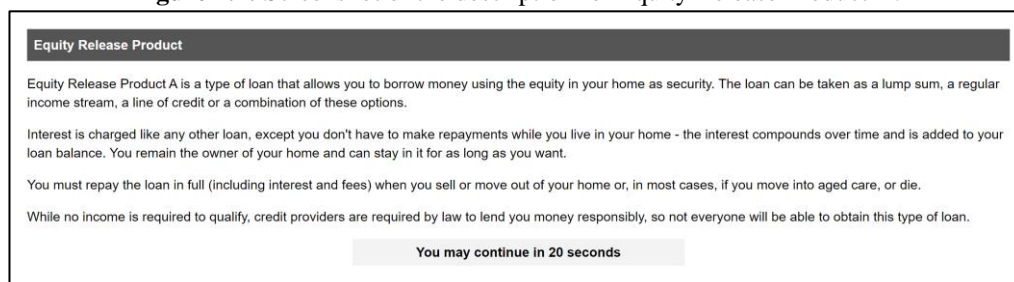
Participants in Treatment Groups 1 to 4 were shown the case study for Equity Release Product A. The case study varied slightly by treatment group. Treatment

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Group 1 saw a basic case study that illustrated how a retiree couple used a reverse mortgage to finance their retirement, how the contract was settled, and that there was a "non-negative equity guarantee" embedded in the reverse mortgage contract. The case study shown to Treatment Groups 2 and 4 included additional information about housing wealth that could also be used to plan for retirement (to emphasize the mental accounting framing), while Treatment Groups 3 and 4 were told how the couple could spend the equity release payments (to emphasize the choice bracketing framing) (see Figure 4.5).

Figure 4.5: Screenshot of the case study for Treatment Group 4.
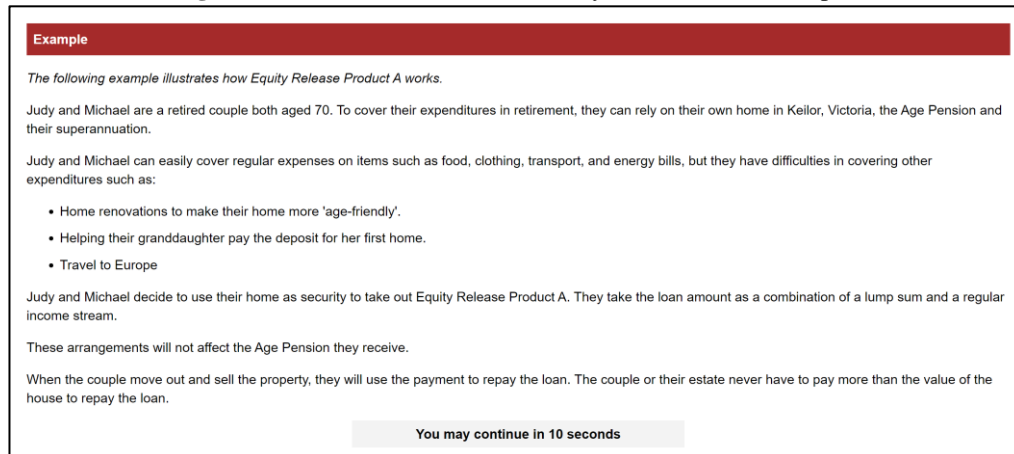
4.3.3 Equity release product choice task

Following the framing and information treatments, participants proceeded to the equity release product choice task. They were asked whether they were interested in using the equity release product, and if so, how much they would borrow using this product. In the introduction to the choice task, participants were shown the maximum amount they could borrow against their current home, as well as the cost of the product (i.e., the annual interest rate of 5.15% p.a. and

the establishment fee of 1.5% of the amount borrowed[24]). They were also told that any Age Pension payments would not be impacted by payments from the equity release product.

Figure 4.6: Screenshot of the choice task, with a self-reported home value of $1,000,000.

Participants were then asked to use a slider to indicate whether—and how much—they would borrow against their housing wealth using the equity release product (as illustrated in Figure 4.6). The maximum amount that could be borrowed against the housing wealth was set at 40% of the self-reported home value.[25] An outcome table below the slider showed the implications of the

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[24] At the time we designed the survey, our industry partner Household Capital adapted the one-off fee structure of 1.5% establishment fee, which is collected at the beginning of the contract, with the interest rate of 5.15% p.a. Hence, we use these information to construct our hypothetical product, Equity Release Product A.

[25] According to MoneySmart, a website established by the Australian Securities and Investments Commission (ASIC), reverse mortgage borrowers at age 60 can at most borrow 20% of the value of their home. Typical reverse mortgage products would allow a percentage point increase for each year over 60. As our target sample is homeowners at age 60-80, the maximum loan they can borrow is 40% of the value of their home.

participant's decision in terms of the potential lump-sum amount, the maximum line of credit amount, and the annual income that participants could obtain for ten years from the equity release product amount chosen. Participants were also shown the home equity value and percentage remaining ten years after commencing the equity release[26] product. Participants then used the slider in the middle of the screen to indicate the amount they would borrow. Participants were specifically told that if they did not want to borrow at all, they should move the slider and return it to $0. Once they had made their choice, a confirmation box appeared, and participants could select "yes" to continue to the next screen or "no" to revise their choice (Figure 4.6).

After completing the choice task, participants who chose a positive amount were asked how they would use the payments from the equity release product. They then completed the six-question equity release product knowledge quiz, which tested their understanding of 1) the payment structure of the product, 2) the purpose of using the payment, 3) the interest charged, 4) whether there was guaranteed occupancy of the property, 5) the loan settlement, and 6) the existence of a non-negative equity guarantee feature (Figure 4.7). Participants were then given a bonus payment of $0.50 per correct answer.

After completing the product knowledge quiz, participants were asked to report their reasons for not borrowing (or not borrowing more) against their home equity. All participants then proceeded to questions designed to collect covariates on planning and personality traits, financial skills and knowledge, and personal characteristics (including demographics).

The most informed group (Treatment Group 4) was presented with the choice bracketing information framing first, followed by the mental accounting framing, the reverse mortgage description, and the case study. For the other treatment

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[26] It is assumed that the house price has an annual growth rate of 3%.

groups, the order of the survey was the same as for Treatment Group 4, except that the irrelevant module was not shown.

Figure 4.7: Screenshot of the product knowledge quiz

4.4 Descriptive statistics

4.4.1 Sample characteristics

A total of 948 participants completed the survey. From this sample, we created an analysis sample by using decision rules to eliminate participants with unreasonably high or low self-reported amounts for superannuation, financial assets, and other assets. [27] The resultant analysis sample comprised 886 participants.

Our analysis sample is reasonably representative of the Australian population of homeowners aged 60–80. Table 4.1 reports the median values for key demographic variables and compares them to data from the nationally representative HILDA survey by applying the cross-sectional population

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[27] 1) Superannuation amount more than $10 million; 2) financial assets more than $15 million; 3) superannuation amount equal to $1 or $2; 4) financial assets equal to $1; and 5) other assets equal to $1. If any rules were breached, the observation was removed. The first two rules were included to prevent values that are too high to be realistic. Rules 3 to 5 were implemented to remove those putting $1 or $2 as a random response.

weights in the HILDA survey. The median age of the participants was 68 years, while 74.3% were married or in a long-term relationship with an average of two children. Approximately 58% of the participants who lived in a capital city owned their primary residence. Participants were generally highly educated: approximately 30% had a bachelor's degree, master's degree, or doctorate. Most participants were retired and/or stay-at-home caregivers.

Table 4.1: Participant characteristics: Comparison with HILDA data.

	Our survey	HILDA (Ages 60–80 homeowner)
Age (median)	68	67
Male	51.1%	48.6%
Married or in long-term relationship	74.3%	69.2%
Number of children (median)	2	2
HH non-housing savings (median)	A$350,000	A$123,000
HH house value (median)	A$600,000	A$656,200
HH income per year (median)	A$65,000–A$77,999	A$50,000–A$59,999
HH debt excluding mortgage (median)	A$0	A$0
HH mortgage (median)	A$0	A$0
Bachelor's degree and above	29.9%	25.8%
Current work status		
Employed	20.2%	29.9%
Retired/stay at home caregiver	73.0%	60.8%
Other	6.8%	8.3%
N	886	3,305

The HILDA survey collects data on the economic and personal well-being, family life, and labor market dynamics of Australian people on an annual basis. The data we used to compare against our sample is from Wave 19, which was conducted in 2019. Table 4.1 reports all HILDA participants aged 60–80 who owned at least one property. The statistics showed that the participants in our survey were quite similar to the Australian population of homeowners of the same age but were wealthier and more educated than those in the representative HILDA sample. These differences are likely due to the different sampling methods since we used an online platform that attracted more educated individuals, whereas most of the HILDA interviews are conducted face-to-face, with a small number being conducted via telephone. We acknowledge that our survey sample was more educated and wealthier than a comparison sample from

the nationally representative HILDA survey. However, I note that the aim is not to find an exact representative sample of 60-80 year olds but to find a sample that is reasonably representative to elicit their 'stated' demand for reverse mortgage products under a hypothetical scenario. As well, we do control for demographics in the regression analysis. The demand for long-term care insurance and the effect of home equity release on this demand may differ in the general population. Future research could aim to collect a broader sample and include individuals living in rural areas.

4.4.2 Product understanding and survey clarity

A reverse mortgage product is a relatively complex financial product that could be difficult for retirees to understand. For the collected data to be useful, it was important to ensure that the participants clearly understood the product and survey questions (see Section 4.3).

Most participants had heard of reverse mortgages before taking the survey, with 69% indicating that they were familiar with a similar product. Also, 20 of the 886 participants in the analysis reported that they are using a reverse mortgage product. Most participants had a very high self-rated understanding of the reverse mortgage product introduced in the survey: 35% reported that they completely understood it, 43% mostly understood it, and only 4% were either mostly confused or completely confused. We performed Welch's two-sample *t*-test[28] (Table 4.2) and found that the level of self-rated product understanding was higher for participants allocated to Treatment Groups 1, 2, 3, and 4 than for those allocated to Treatment Group 0, which was only shown a product description before completing the equity release (reverse mortgage) choice task.

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[28] The reason of using the Welch two-sample *t*-test instead of ANOVA test is because we are only interested the change between the control group and each of the other treatment groups, but not the difference between Treatment groups 1-4.

This suggests that the case study provided in Treatment Groups 1 to 4 helped the participants better understand how the product works.

We used six true-false questions in the incentivized product knowledge quiz to investigate the objective understanding of the equity release product introduced in the survey. Overall, the participants answered the product knowledge questions quite well: 21% answered all six correctly, and 82% answered at least four questions correctly. Again, using Welch's two-sample t-test, we found that the participants' objective understanding was much better in Treatment Groups 1, 2, 3, and 4 than in Treatment Group 0 (Table 4.3). These results suggest that the case study provided in Treatment Groups 1 to 4 helped the participants better understand how the reverse mortgage product worked.

Table 4.2: Welch's two-sample t-test results for self-rated product understanding.

Self-rated product understanding relative to Treatment Group 0	Test stat	df	p value	Mean	Mean
Treatment Group 1 (RM description + Case study)	3.45	347.1	0.000626***	4.62 (Treatment 0)	5.04 (Treatment 1)
Treatment Group 2 (Treatment Group 1 + mental accounting)	3.14	352.1	0.001846**	4.62 (Treatment 0)	5.01 (Treatment 2)
Treatment Group 3 (Treatment Group 1 + broad bracketing)	4.94	325.5	0.000001***	4.62 (Treatment 0)	5.18 (Treatment 3)
Treatment Group 4 (Treatment Group 2 + broad bracketing)	3.60	351.5	0.000365***	4.62 (Treatment 0)	5.07 (Treatment 4)

Notes: Self-reported product understanding is coded as: completely understand = 6, mostly understand = 5, sometimes clear = 4, sometimes confusing = 3, mostly confusing = 2, completely confusing = 1. +, *, **, and *** denote statistical significance at the 10%, 5%, 1%, and 0.1% levels,

respectively. Treatment Group 0 refers to the group that only received the basic information about Equity Release Product A.

Table 4.3: Results of Welch's two-sample *t*-test on objective product understanding.

Objective product understanding relative to Treatment Group 0	Test stat	df	p value	Mean	Mean
Treatment Group 1 (RM description + Case study)	2.52	322.5	0.01220*	4.31 (Treatment 0)	4.59 (Treatment 1)
Treatment Group 2 (Treatment Group 1 + mental accounting)	3.13	330.5	0.00189**	4.31 (Treatment 0)	4.65 (Treatment 2)
Treatment Group 3 (Treatment Group 1 + broad bracketing)	2.70	355.9	0.00703**	4.31 (Treatment 0)	4.58 (Treatment 3)
Treatment Group 4 (Treatment Group 2 + broad bracketing)	2.78	337.4	0.00566**	4.31 (Treatment 0)	4.60 (Treatment 4)

Notes: Objective product understanding is coded as the number of answers correct out of six questions asked. +, *, **, and *** denote statistical significance at the 10%, 5%, 1%, and 0.1% levels, respectively. Treatment Group 0 refers to the group that only received the basic information about Equity Release Product A.

Overall, the majority of participants reported that they found the survey to be clear, with over 92% stating that they found the survey completely or mostly clear.

4.4.3 Stated demand for the equity release product

Data collected from the Equity Release Product A choice task show that a large minority of the Australian homeowners aged 60–80 in our sample expressed a desire for the equity release product offered. Overall, 43% of participants stated that they would like to use Equity Release Product A to help fund their retirement. For those who use Equity Release Product A, they would extract13% of their housing wealth, on average. Table 4.4 reports the percentage take-up (the extensive margin) and loan amount (the intensive margin) for each of the five treatment groups.

Table 4.4 reports that 36 to 44% of participants expressed interest in using the product across all treatment groups. As previously mentioned, the treatment groups differed by the information provided before answering the choice task. To investigate whether there were significant differences in the demand and (conditional on purchase) the amount borrowed by the treatment groups, we performed Welch's two-sample t-test on both the extensive and intensive margins. We found no statistically significant difference between treatment groups for the extensive margin (i.e., whether participants would use Equity Release Product A). On the other hand, those who were interested in using Equity Release Product A stated that they would borrow 11–17% of their current home value (i.e., the intensive margin). The results of Welch's two-sample t-test showed that Treatment Groups 2 and 4 were statistically significantly different from Treatment Group 1, which provided a short product description with an example. Both Treatment Groups 2 and 4 were given information treatments designed to offset mental accounting. That is, they were reminded that available resources to finance retirement included their housing wealth. This suggests that framing product information to offset mental accounting could have a positive impact on the amount of housing wealth extracted using equity release products.

Table 4.4: Demand for Equity Release Product A.

Treatment group	No. of participants in the analysis sample	No. (%) of participants using Equity Release Product A	Housing wealth extracted using Equity Release Product A
0	183	79 (43%)	12%
1	173	76 (44%)	12%
2	174	73 (42%)	17%**
3	183	78 (43%)	11%
4	173	63 (36%)	16%*
Total	886	369 (42%)	13%

Notes: [+], [*], [**], and [***] denote statistical significance at the 10%, 5%, 1%, and 0.1% levels, respectively. The median house price across all treatment groups was A\$600,000. Treatment Group 0 refers to the group that only received the basic information about Equity Release Product A. Treatment Group 1 refers to the group that received basic information plus a case study. Treatment group 2 refers to the group that received the same information as Treatment Group 1, with additional information to address mental accounting. Treatment Group 3 refers to the group

that received the same information as Treatment Group 1, with additional information to address narrow choice bracketing. Treatment Group 4 refers to the group that received the same information as Treatment Group 2 with additional information to address narrow choice bracketing.

Overall, 20 participants stated that they have reverse mortgages in real life. Only 1 of them expressed that they would not use Equity Release Product A, which suggests most of them do not regret using a reverse mortgage or they find Equity Release Product A is a better product than the reverse mortgage they are using. However, since the sample size is small, further research could focus on including more participants with reverse mortgage arrangements in real life.

4.5 Regression results

We focused on two sets of regressions. First, we use the extensive margin (i.e., the stated demand for the equity release product) as the dependent variable, which we regressed against the treatment groups and a large array of covariates that have been identified as being associated with demand for reverse mortgages in previous studies, including economic and demographic factors as well as personal characteristics (e.g., subjective health condition, personality, and expectations). Since the dependent variable was an indicator variable, we used logistic regression to perform the analysis.

Second, we used the intensive margin (i.e., how much housing wealth is extracted using the equity release product) as the dependent variable. We defined the dependent variable as housing wealth extracted using the equity release product over the maximum housing wealth that the participant can extract.[29] Hence, the dependent variable is always between 0% and 100%. Following

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[29] The maximum housing wealth the participants could extract was 40% of their self-reported housing wealth.

Ferrari and Cribari-Neto (2004), we used a beta regression[30] with the logit link function. The independent variables were the same as in the first regression.

In all regressions, "time taken to complete the survey", and the IMC, which allowed us to identify inattention by asking whether they own their home twice in the survey were included as independent variables.

Section 4.7.1 Appendix to Chapter 4 presents the variable definitions. Most covariates were coded as binary variables. We converted numerical and ordinal variables to binary indicators to determine whether the participants' responses were higher than the sample median.

4.5.1 Treatments explaining the stated demand for Equity Release Product A

Table 4.5 Panel A reports the results of regressions of extensive and intensive reverse mortgage demand on the information treatments. For the intensive margin (column 2, the percentage of housing wealth to be extracted), we defined the dependent variable as the percentage of housing wealth borrowed compared to the maximum amount that could be borrowed, which is a numerical variable between 0 and 1. The maximum amount was set at 40% of the self-reported housing wealth. While this ratio is slightly different from the regulatory standard in Australia, we decided to use a 40% initial loan-to-value ratio across all ages because the initial LVRs set by the Australian regulator are relatively low, and higher LVRs could be more attractive to borrowers (Alai *et al.*, 2014). The model diagnostics (such as the pseudo-R square and BIC) are reported. Most of the models had a pseudo-R square of more than 0.3, indicating that the models perform reasonably well, given that the models are predicting human behavior.

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[30] More details about Beta regression can be found in 4.7.2 Appendix to Chapter 4.

As reported in Table 4.5 Panel A under the extensive margin (column 1, whether the participants are interested in using reverse mortgages), none of the treatment groups had a statistically significant impact on the demand for the reverse mortgage offered. In other words, the treatments provided to the participants did not have a significant impact on whether the participants would use reverse mortgages. However, for the intensive margin, participants in Treatment Group 2 (with the information format designed to offset mental accounting) would borrow significantly more (coefficient of 0.767 in Table 4.5) against their housing wealth, conditional on using the reverse mortgage. This suggests that information framing to offset mental accounting could address part of the reverse mortgage puzzle when people had already decided to use a reverse mortgage in retirement. Under this model, the extracted housing wealth is increased from 19% (in Treatment Group 1) to 26% (in Treatment Group 2) for a baseline person (a baseline person refers to a person with all covariate inputs x_i of the regression equation (4.5) equal to 0. For more details, please refer to Section 4.7.2 Appendix to Chapter 4).

Surprisingly, the opposite effect was observed for participants in Treatment Group 3 (the information format designed to offset narrow bracketing) since they indicated that they would borrow significantly less against their housing wealth (coefficient of -0.886 in Table 4.5). One explanation could be the design of the questions and framing of broad bracketing were not effective and perhaps led participants to be pessimistic about their available assets. As such, the design of the framing may have convinced the participants that they could afford the expenses listed without taking Equity Release Product A.

To further understand this, we performed a separate regression for Treatment Groups 3 (information format designed to offset narrow choice bracketing) and 4 (information format designed to offset mental accounting and narrow choice bracketing) by including an extra variable (compared to Table 4.5) with

"Difficult to finance retirement expense", which indicates that participants expressed their level of difficulty in financing retirement expenditure. This variable was only available for Treatment Groups 3 and 4 since these were the only groups provided with the broad bracketing treatment. We have constructed four regressions to examine the impact of this variable, which is shown in Table 4.7. Columns 1 and 2 of Table 4.7 show the extensive margin as the dependent variable of Treatment Groups 3 and 4, and columns 3 and 4 show the result of using intensive marge as the dependent variable. In Treatment Group 3, participants who expressed it being difficult for them to finance retirement expenditure would express higher interest in using reverse mortgages (coefficient of 2.284 in Table 4.7) and borrow significantly more (coefficient of 1.108 in Table 4.7) against their housing wealth using Equity Release Product A. This indicates that retirees tend to use—and use more—home equity release products when they experience difficulties in financing retirement expenditure. However, the result of the regression demonstrates that our treatment design to offset narrow bracketing possibly prompted the participants to believe that financing retirement expenditure is easier than they used to believe. Further research in this area could identify broader information framing that could allow participants to consider the complete picture of retirement expenditure.

Notably, the effect of Treatment Group 4 (which includes information formats designed to offset both mental accounting and narrow framing) is not statistically significant. In this case, the significant positive and negative coefficients in Treatment Groups 2 and 3 offset each other.

For Treatment Group 0 (who received a product description only), the regression results also indicate that there is no statistically significant impact on both extensive and intensive margins since the only difference between Treatment Groups 0 and 1 is the case study provided. Hence, we conclude that despite the case study helping participants better understand Equity Release Product A (both

subject and objective understanding, refer to Section 4.4.2), it does not impact the stated demand for it.

4.5.2 Factors explaining the stated demand for Equity Release Product A

Table 4.5 Panel B reports that covariates such as demographics, economic factors, and personal characteristics impact the stated demand for Equity Release Product A. In addition to the allocated treatment groups, the covariates were chosen in line with economic theory as well as the demographics and personal characteristics found to be important in previous studies (Fornero *et al.,* 2017; Dillingh *et al.*, 2017; Davidoff *et al.,* 2017; Moulton *et al.,* 2017; Hanewald *et al.*, 2020; Fong *et al.,* 2021). We measured the extensive margin (i.e., the stated demand for Equity Release Product A) using a binary variable, which is equal to 1 if the participants borrow more than \$0 against their housing wealth using the introduced reverse mortgage, and 0 otherwise. The result of the extensive margin is presented in columns 1 to 6, and each column represents the full sample and Treatment Groups 0 to 4. For analysis of the intensive margin (i.e., the amount borrowed as a percentage of housing wealth), we only included those who stated that they would use Equity Release Product A. Apart from running the regression analysis for the full sample (column 7 of Table 4.5 Panel B), we also performed the regression analysis for each treatment group (columns 8 to 12).

Table 4.5: Covariates explaining the stated demand for Equity Release Product A.

Independent variables	Dependent variable						Dependent variable					
	Reverse mortgage demand (extensive)						Reverse mortgage demand (intensive)					
	All	Treatment 0 (RM description only)	Treatment 1 (RM description + Case study)	Treatment 2 (Treatment 1 + Mental Accounting)	Treatment 3 (Treatment 1 + broad bracketing)	Treatment 4 (Treatment 2 + broad bracketing)	All	Treatment 0 (RM description only)	Treatment 1 (RM description + Case study)	Treatment 2 (Treatment 1 + Mental Accounting)	Treatment 3 (Treatment 1 + broad bracketing)	Treatment 4 (Treatment 2 + broad bracketing)
Panel A												
Treatment groups												
Treatment 0 (product description only)	-0.055	--	--	--	--	--	-0.067	--	--	--	--	--
Treatment 2 (Treatment 0 + case study + mental accounting treatment)	0.017	--	--	--	--	--	0.767***	--	--	--	--	--
Treatment 3 (Treatment 0 + case study + broad bracketing treatment)	-0.159	--	--	--	--	--	-0.886***	--	--	--	--	--
Treatment 4 (Treatment 0 + case study _ mental accounting treatment + broad bracketing treatment)	-0.294	--	--	--	--	--	0.050	--	--	--	--	--
Panel B												
Economic factors												
Home value	-0.072	-0.703	0.651	-0.157	-0.352	-0.389	-0.775***	-2.042***	0.608^{+}	-1.487***	-0.005	-0.778
Non-housing wealth Q2	-0.741**	-1.891**	-1.230*	-0.781	-0.218	-1.633*	-0.550**	0.253	-1.255**	-1.551***	-1.176**	0.893*
Non-housing wealth Q3	-0.704**	-1.406^{+}	-1.247^{+}	-1.362^{+}	1.068	-1.146	-0.591**	0.877*	-2.446***	-0.393	-0.729	-0.315
Non-housing wealth Q4	-0.994***	-1.735^{+}	-1.689*	-0.562	-0.257	-2.608**	0.094	1.249*	-1.446*	0.423	-1.339*	0.850
Household income Q2	-0.513^{+}	-1.864*	-1.886*	-0.188	-2.335*	0.519	-0.160	0.975	1.499*	-0.037	0.551	-1.244*
Household income Q3	-0.010	0.601	-0.470	0.950	-0.875	-0.489	-0.268	1.399**	-0.919	-0.748^{+}	0.547	-0.546
Household income Q4	-0.295	-0.399	-0.865	0.182	-2.440**	-0.926	-0.498*	0.468	-0.050	-2.540***	1.100*	-1.151*
Age Pension	0.081	0.119	-0.059	0.737	0.825	-0.880	-0.049	-0.422	-1.385**	0.453	0.394	-1.403**
Mortgage	0.239	1.446*	-0.800	-0.899	1.279*	1.102^{+}	0.187	-0.596	-1.377**	0.400	-0.239	1.403***

Continuation of Table 4.5

			Views on housing and COVID-19								
Would use housing for retirement	0.766***	1.255*	0.863	0.255	1.512*	0.742	0.456*	0.368	-0.311	0.112	1.163**	3.265***
Tenure in current home	-0.338*	-0.014	0.498	-0.942+	0.063	-1.164*	0.313	-0.252	-0.423	0.072	-0.252	2.235***
Expects house price growth	-0.174	-1.009*	-0.256	0.964*	1.051+	-1.019*	0.240+	1.448***	-0.632+	0.730*	0.114	0.558+
COVID impact on health, wellbeing, and finances	0.554***	0.234	0.356	0.993*	0.819+	0.941+	0.385**	0.769*	0.938**	0.984**	0.652*	-2.281***
				Demographics								
Age	-0.322+	-0.020	-0.581	-0.338	-0.756	-0.963+	-0.044	-0.950**	-1.254**	-0.250	-0.275	0.701+
Female	-0.141	0.350	-0.512	-1.480*	-0.058	-0.379	-0.271+	-1.040**	-1.029**	-0.754	-0.256	0.051
Married	0.000	0.859	-0.270	-1.011+	0.646	-0.536	-0.213	-0.973**	-0.670	0.167	-0.356	0.356
Retired	-0.645***	-1.322*	0.049	-1.641**	-0.286	-0.725	-0.595***	0.459	-0.151	-1.816***	-0.275	-0.658
Children	0.187	0.931	0.480	0.935	-0.998+	0.575	-0.305+	-0.523	0.626	-1.347**	0.796*	0.673
Grandchildren	-0.001	-0.072	0.167	-0.566	-0.077	0.297	-0.227	0.570	-0.501	0.691	-0.719+	-1.232**
Education	0.063	-0.256	-0.013	-0.053	1.546**	0.624	-0.084	0.535	-0.481	0.076	0.198	1.194**
				Preferences								
Prepared to take risk	0.076*	0.140	0.114	0.245*	0.045	0.004	0.054+	0.242**	0.005	-0.085	0.079	-0.165*
Future time perspective	-0.579***	-0.619	-0.488	-0.999*	0.148	-0.443	0.405**	1.202***	-0.137	0.242	-0.404	-0.545
Planned inter vivos transfer	-0.064	0.880	0.006	0.047	-0.657	0.613	0.143	0.207	-0.406	-1.180*	0.405	-0.234
Planned bequest	0.308+	0.004	-0.223	0.546	0.844	0.314	-0.362*	-0.442	-0.851**	0.521	0.872**	-0.617+
Optimism	-0.032	-0.048	0.013	-0.174	-0.143	0.052	-0.042	-0.030	0.138	-0.075	-0.204*	-0.035
Conscientiousness	-0.096	0.412	-0.345	-0.378	1.303*	-0.439	0.068	0.834*	1.111**	-0.736	-0.392	-0.486
			Financial competence and experience									
Prior awareness of RM	0.151	1.335*	-0.010	0.798	-0.481	0.619	-0.004	-0.100	0.335	-0.257	0.115	0.295
Self-rated understanding of RM	-0.027	-0.185	-0.037	-0.252	0.431	-0.218	0.172*	-0.091	0.184	0.248	0.039	-0.597**
Self-rated understanding of finance	0.084	0.325	-0.189	0.205	-0.488*	0.178	-0.094	-0.063	0.191	0.171	-0.120	0.084
Financial competence	-0.188	-0.541+	0.281	-0.391	-0.087	-0.335	0.136	-0.182	0.075	-0.228	0.213	0.283
RM knowledge quiz	-0.089	-0.482+	-0.106	-0.358+	-0.294	0.448*	0.080	0.223	0.172	0.217	0.265+	0.329+
		Reasons for not using (more of) the reverse mortgage										
Personal reasons	0.208	-0.021	0.457	-0.410	0.010	0.390	-0.794***	-0.524	-0.651+	-1.548***	-0.321	-0.753*

Continuation of Table 4.5

Perceptions of unattractive product design	-0.830***	-0.954+	-1.834***	-0.745	-1.876***	-1.038*	-0.613***	0.616*	-0.400	-1.357***	0.018	0.322
Health												
Health	0.176	-0.009	0.358	-0.451	1.711**	0.243	0.198	0.500	-0.083	0.998*	-0.617*	-0.100
Subjective life expectancy	0.308+	0.866+	-0.116	0.084	1.021*	0.094	0.200	0.241	0.608	0.669	-0.482	-0.543
Other information												
Survey clarity	0.073	-0.097	0.248	0.221	1.408**	-0.262	-0.131	-0.044	0.881*	-0.472	-0.051	-0.559+
Time spent on survey	0.415**	1.210*	-0.108	1.667**	0.682	-0.555	-0.108	0.192	0.198	0.349	0.082	-1.045**
Failed IMC	0.898***	1.100	0.678	1.987*	0.335	0.840	0.299	1.150**	-0.022	1.633**	0.029	-2.320**
Model information												
Intercept	0.702	1.064	1.700	4.024+	-1.171	1.150	-0.111	-2.807*	-1.214	1.842	-1.572	0.518
Pseudo R square	0.344	0.351	0.299	0.311	0.353	0.336	0.399	0.398	0.493	0.454	0.481	0.438
BIC	1321.7	366.8	390.9	364.3	363.4	351.6	-6.6	-6.6	-95.3	-345.1	58.2	-44.6
N	886	183	173	174	183	173	369	79	76	73	78	63

Notes: This table presents the results of logistic regressions of the extensive margin and beta regression of the intensive margin on independent variables. Variables are defined in Section 4.7.1. +, *, **, and *** denote statistical significance at the 10%, 5%, 1%, and 0.1% levels, respectively. Note that, as there are multiple hypotheses are tested, we implement the Bonferroni correction. To achieve the overall 5% significance level, the significance level of each covariate should be adjusted to 5% divided by the number of variables in the equation. In this regression table, there are 42 variables (28 for each treatment group), the adjusted significance level is about 0.1%. Therefore, a 0.1% significance level of each variable can achieve an overall 5% significance level of the regression model under the Bonferroni correction.

Table 4.6: Classification table of the stated demand for Equity Release Product A (extensive margin)

	All	Group 0	Group 1	Group 2	Group 3	Group 4
Classification Table of extensive margin						
True positive/All positive	52%	68%	68%	67%	69%	68%
True negative/All negative	81%	85%	67%	83%	84%	88%
False positive/All positive	48%	32%	32%	33%	31%	32%
False negative/All negative	19%	15%	33%	17%	16%	12%

Table 4.7: Covariates explaining the stated demand for Equity Release Product A with additional covariate variable "Difficult to finance retirement expenditure").

Independent variables	Dependent variable			
	Demand for the reverse mortgage (extensive)		Demand for the reverse mortgage (intensive)	
	Treatment 3 ((RM description + Case study + broad bracketing)	Treatment 4 ((RM description + Case study + Mental Accounting + broad bracketing)	Treatment 3 ((RM description + Case study + broad bracketing)	Treatment 4 ((RM description + Case study + Mental Accounting + broad bracketing)
Economic factors				
Home value	-0.149	-0.326	-0.001	-0.771
Non-housing wealth Q2	-0.051	-1.586*	-1.200**	0.902*
Non-housing wealth Q3	1.731$^+$	-1.070	-0.560	-0.321
Non-housing wealth Q4	0.205	-2.536**	-0.910$^+$	0.857
Household income Q2	-2.875**	0.582	0.414	-1.200*
Household income Q3	-0.918	-0.456	0.606	-0.498
Household income Q4	-2.481**	-0.865	0.938$^+$	-1.141$^+$
Age Pension	1.005	-0.852	0.570	-1.418**
Mortgage	1.145$^+$	1.044$^+$	-0.264	1.360***
Views on housing and COVID-19				
Would use housing for retirement	1.158$^+$	0.754	1.030*	3.296***
Tenure in current home	-0.353	-1.205*	-0.239	2.218***
Expects house price growth	1.299*	-1.014*	0.079	0.569$^+$
COVID impact on health, wellbeing, and finances	0.762	0.889$^+$	0.556$^+$	-2.303***
Demographics				
Age	-1.020$^+$	-0.952$^+$	-0.691	0.712$^+$

Continuation of Table 4.7

Female	-0.421	-0.386	-0.277	0.042
Married	0.748	-0.600	-0.275	0.319
Retired	-0.388	-0.723	-0.444	-0.682
Children	-1.141[+]	0.554	0.633[+]	0.688
Grandchildren	0.064	0.309	-0.465	-1.234[**]
Education	1.571[*]	0.641	-0.029	1.191[**]
Preferences				
Difficult to finance retirement expenditure	2.284[***]	0.275	1.108[**]	0.107
Prepared to take risk	-0.007	0.004	0.053	-0.165[*]
Future time perspective	0.700	-0.394	-0.206	-0.533
Planned inter vivos transfer	-1.001	0.630	0.531	-0.296
Planned bequest	1.054[+]	0.326	0.844[**]	-0.593[+]
Optimism	-0.104	0.051	-0.142	-0.039
Conscientiousness	1.194[*]	-0.439	-0.347	-0.497
Financial competence and experience				
Prior awareness of RM	-0.049	0.616	0.008	0.267
Self-rated understanding of RM	0.243	-0.210	-0.118	-0.607[**]
Self-rated understanding of finance	-0.351	0.179	-0.019	0.096
Financial competence	-0.430	-0.347	0.257	0.281
RM knowledge quiz	-0.260	0.432[+]	0.195	0.339[+]
Reasons for not using (more of) the reverse mortgage				
Personal reasons	-0.110	0.409	-0.380	-0.731[*]
Perceptions of unattractive product design	-2.125[***]	-1.075[*]	-0.162	0.325
Health				
Health	1.871[**]	0.223	-0.442	-0.098
Subjective life expectancy	1.320[*]	0.086	-0.473	-0.542
Other information				
Survey clarity	1.560[**]	-0.260	-0.008	-0.575[+]
Time spent on survey	0.617	-0.569	0.025	-1.059[**]
Failed IMC	0.879	0.813	0.340	-2.361[**]
Model information				
Intercept	-2.335	1.003	-2.180	0.452
Pseudo R square	0.417	0.337	0.530	0.438
BIC	352.8	356.54	54.6	-40.5
N	183	173	78	63

Notes: This table presents the results of logistic regressions of the extensive margin and beta regression of the intensive margin on independent variables. Variables are defined in Section 4.7.1. [+], [*], [**], and [***] denote statistical significance at the 10%, 5%, 1%, and 0.1% levels, respectively.

Economic factors: The results indicate that housing wealth is not a significant factor that impacts participants' decisions on the use of Equity Release Product A in the full sample, which aligns with the findings from Davidoff *et al.* (2017) and Hanewald *et al.* (2020). However, in the full sample (coefficient of -0.775 at 0.1% significance level in Table 4.5 Panel B) as well as in Treatment Groups 0 (no information framing and without case study) and 2 (with information framing to address mental accounting), the more housing wealth the participants have, the less likely they were to borrow against their housing wealth. This is because participants with higher housing wealth could extract a large amount of liquidity, even if they chose a lower percentage of housing wealth. The association between housing wealth and the stated demand for Equity Release Product A under Treatment Groups 3 (information to address narrow consumption framing) and 4 (information to address both narrow consumption framing and mental accounting) was insignificant.

Participants with high net non-housing wealth tended not to use (or use less of) the reverse mortgage offered in the survey—a trend that was also observed by Moulton *et al.* (2017) and Hanewald *et al.* (2020). Existing theoretical lifecycle studies (e.g., Nakajima and Telyukova, 2017; Hanewald *et al.*, 2016; Shao *et al.*, 2019) suggested that people with lower net wealth and income derive more utility gain when Equity Release Product A is available to them. Our findings confirm participants who had less non-housing wealth tended to use the reverse mortgage and borrow a higher percentage of their housing wealth. The same observations appeared in Treatment Groups 0, 1, 2, and 4 in the extensive margin and Treatment Groups 1, 2, and 3 in the intensive margin.

Higher-income participants in the full sample, Treatment Groups 0, 1, and 3 expressed higher interest in using reverse mortgages. This finding aligns with Davidoff *et al.* (2017) and Fong *et al.* (2021). Income level shows no significant impact in influencing the reverse mortgages in Treatment groups 2 and 4. For the intensive margin, the full sample, Treatment groups 1, 2, and 4 indicated that participants with higher income would extract less wealth from their housing through Equity Release Product A, but the high-income participants in Treatment groups 0 and 3 stated that they would extract more wealth using the reverse mortgage offered.

Most of the treatment groups, as well as the full sample, did not show an association between being an Age Pension recipient and the stated demand for Equity Release Product A—except for Treatment Groups 1 and 4, which showed a negative association.

Our results indicate that having a conventional mortgage was not associated with the stated demand for the equity release product in Treatment Groups 1, 2, and the full sample for the extensive margin. This aligns with the findings of Ong *et al.* (2015). For Treatment Groups 0, 3, and 4, the association is positive and significant, which aligns with the findings from Jefferson *et al.* (2017), Davidoff *et al.* (2017), and Fong *et al.* (2021).

Views on housing and COVID-19: We found that participants who were more willing to use their housing wealth to plan for retirement had a higher demand for the product, which was below the average across the full sample (coefficient of 0.766 at 0.1% significance level in Table 4.5 Panel B), Treatment Groups 0 (coefficient of 1.255 at 5% significance level in Table 4.5 Panel B) and 3 (coefficient of 1.512 at 5% significance level in Table 4.5 Panel B). This shows that if mental accounting barriers exist when participants make their financial decisions regarding retirement financial planning, they are likely to have a low demand for the reverse mortgage offered. Similar observations were identified

for the average across the full sample, Treatment Groups 3 and 4 under the intensive margin.

We also found that the longer participants had stayed in their current homes, the less willing they would be to use Equity Release Product A. We used tenure in the current home as a proxy for emotional attachment to the home since Colic-Peisker *et al.* (2015) suggested that tenure is the key factor affecting older Australians' ontological security. This result implies that participants who are more emotionally attached to their current home tend not to borrow against it. For the intensive margin, none of the groups had an association with the tenure in their current home—except for Treatment Group 4, which had a positive and significant coefficient.

Additionally, if participants believed that COVID-19 had severely impacted their health, well-being, and finances, they would use the reverse mortgage offered across the full sample (coefficient of 0.554 at 0.1% significance level in Table 4.5 Panel B), Treatment Groups 2, 3, and 4. They also borrowed more to help them further plan for retirement; however, Treatment Group 4 exhibited an opposite and significant coefficient. This indicates that most participants would use the reverse mortgage offered to address their current and immediate financial needs.

Demographics: Younger participants were more likely to use Equity Release Product A (consistent with Forneno *et al.*, 2017) and would also borrow more against their housing wealth in Treatment Groups 0 and 1. However, Treatment Group 4 showed a different result in which older participants would borrow more against their housing.

In general, gender was not linked to the stated demand for the reverse mortgage offered, except for Treatment Group 2, in which males tended to use the product, similar to the findings from Dillingh *et al.* (2017). For the intensive margin, the

full sample and Treatment Groups 0 and 1 demonstrated that males are more likely to borrow more against their housing wealth.

Marital status was not generally associated with the stated demand for Equity Release Product A, except Treatment Group 1 showed that single participants would borrow more against their housing wealth.

Moreover, non-retired participants were more interested in using the reverse mortgage offered for the full sample (coefficient of -0.654 at 0.1% significance level), Treatment Groups 0 (coefficient of -1.322 at 5% significance level), and 2 (coefficient of -1.641 at 1% significance level). Hanewald *et al.* (2020) also reported a similar finding for their retiree survey group. Notably, in the present study, the full sample and the participants in Treatment Group 2 indicated that they would borrow a higher percentage against their housing wealth.

The number of children was not associated with interest in using the reverse mortgage offered, which is similar to the findings of Davidoff *et al.* (2017). However, participants with few children wanted to borrow more against their housing. This was particularly true for regression for the full sample and Treatment Group 2, despite Treatment Group 3 showing that those with more children want to drawdown more from their housing. The number of grandchildren and the highest level of education attained were not generally associated with the stated demand for Equity Release Product A, which is similar to the findings of Ong *et al.* (2015), Davidoff *et al.* (2017), and Fong *et al.* (2021).

Preferences: Participants who are more prepared to take risks indicated more interest in using the reverse mortgage offered for the full sample and Treatment Group 2. This result indicates that Equity Release Product A is perceived as a risky financial product for retirement financial planning since only participants who were prepared to take a risk tended to use the product. Similar findings were identified for the intensive margin for the average of all participants and

Treatment Group 0; however, participants in Treatment Group 4 had an opposite and significant coefficient.

While participants who only considered the short term had a greater interest in using Equity Release Product A, they would borrow less against their housing wealth. These results demonstrate that participants would use the reverse mortgage if they had a current need; however, they would borrow more if they considered a long period of retirement. On the other hand, participants with higher planned bequest intention expressed a higher interest in using the reverse mortgage, but they would borrow a lower percentage of their housing wealth. This finding regarding the level of interest for higher planned bequest intention contradicts the existing literature (Hanewald *et al.*, 2020; Moulton *et al.*, 2017).

We did not detect any significant connection between *inter vivos* transfers, except for Treatment Group 2 for the intensive margin. However, we find some degree of connection between bequest motives and the stated demand. Participants who planned to leave an inheritance to their heirs would borrow less against their housing, particularly in Treatment Groups 1 and 4, as well as the full sample. Treatment Group 3 exhibited a different view, in which participants with bequest motives would borrow more against their housing.

Treatment Group 3 also demonstrated that more pessimistic participants would borrow less against their housing wealth, while other treatment groups did not show any significant association between optimism for either the intensive or extensive margins.

For conscientiousness, we also did not detect any significant association with the stated demand for particular treatment groups (i.e., Treatment Group 3 under the extensive margin; Treatment Groups 0 and 1 under the intensive margin), which showed a positive relationship between the level of conscientiousness and the stated demand.

Financial competence and experience: Interestingly, we did not find significant connections between the stated demand for the reverse mortgage offered and the prior awareness of reverse mortgages, except for Treatment Group 0, in which participants tended to demand Equity Release Product A (coefficients of 1.335 at 5% significance level in Table 4.5 Panel B).

Unlike Davidoff *et al.* (2017) and Hanewald *et al.* (2020), we did not find subjective understanding associated with the extensive. However, we found that, for the full sample, subjective understanding had a positive relationship with the intensive margin for all participants who would use the reverse mortgage offered. Treatment Group 4 showed a negative relationship between the level of subjective understanding and the intensive margin.

In general, we did not find any significant association between subjective understanding of finance and the stated demand for Equity Release Product A.

In contrast to Davidoff *et al.* (2017)—but consistent with Moulton *et al.* (2017)—we found no significant link between financial competence and the extensive margin of reverse mortgage demand.

We also did not identify a significant link between the reverse mortgage quiz score and the stated demand for the reverse mortgage offered in general. Certain treatment groups (i.e., Treatment Groups 0, 2, and 4 under the extensive margin; Treatment Groups 3 and 4 under the intensive margin) have some relationship; however, the statistical level was not high.

Reasons for not using (more) reverse mortgages: We identified that participants reported personal reasons as the reasons for not using more reverse mortgages [31] would borrow less against their housing wealth in the full sample.

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[31] This variable includes the following options: 1) I do not need more money from Equity Release Product A to cover my expenditures in retirement; 2) I want to have as little debt as possible; and 3) The property has an emotional value to our family.

However, we did not find significant relationships between the extensive margin and the reasons for not using reverse mortgages. This indicates that participants were either 1) debt-averse, 2) holding non-housing wealth, or 3) emotionally attached to their current home.

Participants who had negative perceptions about the unattractive product design[32] indicated a much lower stated demand for the reverse mortgage for both extensive and intensive margins—except Treatment Group 0, for which the association was positive and significant for the intensive margin. This suggests that product providers must resolve negative perceptions when introducing such products to prospective customers. If the participants indicated personal reasons[33] for not using more reverse mortgages, they would also borrow less against their housing wealth.

Health: Similar to Hanewald *et al.* (2020) and Fong *et al.* (2021), self-rated health was not associated with reverse mortgage demand, apart from Treatment Group 3, which showed a positive relationship. On average, the intensive margin did not have any association with self-rated health, despite Treatment Group 2 showing a positive relationship and Treatment Group 3 showing a negative relationship.

Participants with a higher subjective life expectancy relative to objective life expectancy were generally more likely to express an interest in using the reverse mortgage. This could be due to participants with higher subjective life

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[32] This variable includes the following options: 1) I think this product is too complex; 2) I do not think the product is a good deal; 3) I think this product will make my financial situation riskier; 4) I have heard bad news about similar products; and 5) I would worry about being evicted from my home.

[33] This variable includes the following options: 1) I do not need more money from Equity Release Product A to cover my expenditure in retirement; 2) The property has an emotional value to our family; and 3) I want to have as little debt as possible.

expectancies requiring extra liquidity during their retirement. We do not find any links between subjective life expectancy and the intensive margin.

4.5.3 Summary of the regression results

Through the regression analysis, we found that using information framing to address the mental accounting increase the stated borrowing percentage of the housing wealth. In addition, retirees who believe that they have difficulties in meeting their retirement expenses also expressed significantly higher demand when presented with information designed to offset narrow choice bracketing.

For other covariates of the extensive margin, we identify that non-retirees with less housing wealth, who would use housing to plan for their retirement and were being impacted by COVID expressed higher interest in using reverse mortgages. Participants who do not think the product is unattractive, and consider a more short-term perspective rather than long-term also demonstrated higher interest in using reverse mortgages.

For the intensive margin (percentage of housing wealth borrowed using reverse mortgages), the factors that are significantly associated with the demand for reverse mortgages are similar to the extensive margin, except for considering longer-term, which had a positive association with reverse mortgage demand. In addition, less planned bequest and higher subjective understanding about the product are positively linked to the demand for reverse mortgages. Furthermore, participants who do not use personal reasons as the reason for not borrowing more would borrow a higher housing wealth percentage.

4.6 Conclusion

As stated in the previous chapter and existing literature (e.g., Davidoff *et al.*, 2010; Hanewald *et al.*, 2016; Shao *et al.* 2019), home equity release products can help retirees enhance and improve retirement living standards. However, the

actual demand is low. Hence, this research investigates the potential demand, identifies potential behavioral impediments, and explores if the impediments can be addressed by introducing different information framings. To do so, we designed and fielded a stated choice survey to a representative sample of Australians of retirement age to better understand behavioral barriers to the demand for reverse mortgage products in Australia. Overall, 42% of survey participants indicated that they would use the reverse mortgage product offered and would borrow 13% of their housing wealth, on average. Our results can be summarized as follows:

- We found that participants who were presented with the information format designed to offset mental accounting would borrow more against their housing wealth. This suggests that the information framing to offset mental accounting could encourage people who had already decided to use a reverse mortgage in retirement to borrow more of their housing wealth.

- We found participants who were presented with the information framing designed to offset narrow bracketing would borrow less against their housing wealth. In contrast, for participants who expressed concerns in meeting their expenses in retirement, reverse mortgage demand and the amount borrowed against their housing are significantly higher. Further research is needed to confirm the impact of addressing narrow bracketing on the stated demand for home equity release products and test the effectiveness of the information framing.

- Younger, non-retired participants with less non-housing wealth and income expressed more interest in using reverse mortgages.

- Participants who stated that they would use housing wealth to plan for retirement had a higher stated demand for Equity Release Product A. This indicates that participants with mental accounting impediments would not consider their housing wealth when planning for their retirement, thereby

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leading to lower demand for reverse mortgage use. Addressing this behavioral impediment would effectively improve the demand. Participants who had lived longer in their current home also had lower stated demand for the product. Those who were being impacted by COVID in terms of their health, well-being, and financial conditions would have a higher stated demand for the product offered.

- We found that participants' subjective and objective understandings significantly improved when they were provided with a case study.

Through this research, we extend the existing literature by addressing the mental accounting impediments through information framing that can reduce the impact of the reverse mortgage puzzle. We found that the information framing we designed could partially address the reverse mortgage puzzle by increasing the amount borrowed against housing wealth. Addressing the narrow choice bracketing for those who are concerned about their retiree expenses can also enhance the reverse mortgage demand and the amount borrowed against the housing wealth. We also identified a case study illustrating how such products can help participants understand them properly. Further research in this area can enhance the design of information framing to offset mental accounting and narrow bracketing while addressing the reverse mortgage puzzle.

4.7 Appendix to Chapter 4

4.7.1 Variable definition

Table 4.8: Variable definition of the regression in Chapter 4.

Variable	Definition
Reverse mortgage demand	
Reverse mortgage demand (Extensive)	Indicator variable that equals one if the participant extracts any amount from housing wealth using the Equity Release Product A.
Reverse mortgage demand (Intensive)	A numerical variable that ranges between zero and one; the percentage of housing wealth extracted using the Equity Release Product A over the maximum housing wealth the participant can extract.
Treatment groups	
Treatment 0	Indicator variable that equals one if the participant is in Treatment group 0, which is only provided with minimal information regarding the reverse mortgage product, and zero otherwise.
Treatment 1	Indicator variable that equals one if the participant is in Treatment group 1, which is only provided with minimal information regarding the reverse mortgage product plus the base case study, and zero otherwise.
Treatment 2	Indicator variable that equals one if the participant is in Treatment group 2, which is provided with the mental accounting treatment in addition to the information provided to Treatment group 1, and zero otherwise.
Treatment 3	Indicator variable that equals one if the participant is in Treatment group 3, which is provided with the broad bracketing treatment in addition to the information provided to Treatment group 1, and zero otherwise.
Treatment 4	Indicator variable that equals one if the participant is in Treatment group 4, which is provided with the mental accounting and broad bracketing treatment in addition to the information provided to Treatment group 1, and zero otherwise.
Economic factors	
Home value	Indicator variable that equals one if the participant's home value is above the median, and zero otherwise.
Non-housing wealth Q2	Indicator variable that equals one if the participant's non-housing value is in the second quartile, and zero otherwise.
Non-housing wealth Q3	Indicator variable that equals one if the participant's non-housing value is in the third quartile, and zero otherwise.
Non-housing wealth Q4	Indicator variable that equals one if the participant's non-housing value is in the highest quartile, and zero otherwise.
Household income Q2	Indicator variable that equals one if the participant's household income is in the second quartile, and zero otherwise.

Continuation of Table 4.8

Household income Q3	Indicator variable that equals one if the participant's household income is in the third quartile, and zero otherwise.
Household income Q4	Indicator variable that equals one if the participant's household income is in the highest quartile, and zero otherwise.
Age Pension	Indicator variable that equals one if the participant receives at least some Age Pension, and zero otherwise.
Mortgage	Indicator variable that equals one if the participant's mortgage value is larger than the median, and zero otherwise.

Views on housing and COVID-19

Would use housing for retirement	Indicator variable that equals one if the participant thinks housing wealth can be used to cover expenditure and zero otherwise.
Tenure in the current home	Indicator variable that equals one if the participant's stay in the current home is longer than the median, and zero otherwise.
Expects house price growth	Indicator variable that equals one if the participant expects the value of the property to increase a lot (more than 20%) or moderately (5–20%), and zero otherwise.
COVID impact on health, wellbeing, and finances	Indicator variable that equals one if the participant thinks COVID's impact on health, wellbeing, and financial situation is larger than the median, and zero otherwise.

Demographics

Age	Indicator variable that equals one if the participant is aged 70–80, and zero otherwise.
Gender (Female)	Indicator variable that equals one if the participant is female, and zero otherwise.
Married	Indicator variable that equals one if the participant is married/in a long-term relationship, and zero otherwise
Retired	Indicator variable that equals one if the participant is retired, and zero otherwise.
Children	Indicator variable that equals one if the participant's number of children is greater or equal to the median, and zero otherwise.
Grandchildren	Indicator variable that equals one if the participant's number of grandchildren is greater or equal to the median, and zero otherwise.
Education	Indicator variable that equals one if the highest level of education attained is a Bachelor degree or above, and zero otherwise.

Preferences

Difficult to finance retirement expense	Indicator variable that equals one if the total number of eight retirement expenditure questions answered "difficult" is more than the median, and zero otherwise.
Prepared to take risk	A polychotomous variable that equals one if the participant is least ready to take risks and equal to 10 if they are most ready to take risks.
Future time perspective	Indicator variable that equals one if the total score of follow advice in a rainy day + think about life in future + distant future too uncertain + future is too vague + day-to-day living basis + enjoy the current is higher than the median, and zero otherwise.

Continuation of Table 4.8

Planned Inter Vivo transfer	Indicator variable that equals one if the participant plans to make inter Vivo bequest to family or other beneficiaries, and zero otherwise.
Planned bequest	Indicator variable that equals one if the participant plans to make a bequest to family or other beneficiaries, and zero otherwise.
Optimism	A polychotomous variable that equals one if the participant is self-rated pessimistic, equal to 10 if the participant is self-rated optimistic.
Conscientiousness	Indicator variable that equals one if the participant's conscientiousness score based on five questions is above the sample median, and zero otherwise.

Financial competence and experience

Prior awareness of RM	Indicator variable that equals one if the participant has heard of reverse mortgages, and zero otherwise
Self-rated understanding of reverse mortgages	A polychotomous variable that equals one if the participant's self-rated understanding of the reverse mortgage product is completely confused, equal to six if the participant's self-rated understanding of RM is completely clear.
Self-rated finance understanding	A polychotomous variable that is coded as: completely understand = 6, mostly understand = 5, sometimes clear = 4, sometimes confusing = 3, mostly confusing = 2, completely confusing = 1.
Financial competence	Indicator variable that equals one if the sum of the participant's financial literacy, numeracy, and compound interest score is above the sample median, and zero otherwise.
Reverse mortgage knowledge quiz	A polychotomous variable that equals the number of answers is correct out of six questions asked.

Reasons for not using (more of) the reverse mortgage

| Personal reasons | Indicator variable that equals one if the total score of: no need to cover regular expenditure + prefer less debt + emotional attachment is higher than the median, and zero otherwise |
| Perceptions of unattractive product design | Indicator variable that equals one if the total score of: thinking the product is too complex + believe the product is not a good deal + believe the product is making the financial position riskier + heard bad things about the product + is afraid of being evicted is higher than the median, and zero otherwise |

Health

| Health | Indicator variable that equals one if the participant's self-rated health is higher than the median, and zero otherwise |
| Subjective life expectancy | Indicator variable that equals one if the participant's self-rated life expectancy is longer than the objective life expectancy, and zero otherwise |

Other information

| Survey clarity | Indicator variable that equals one if the participant scores the survey clarity higher than the median, and zero otherwise |

Continuation of Table 4.8

Time spent on the survey	Indicator variable that equals one if the participant takes longer to complete the survey than the median, and zero otherwise
Failed IMC	Indicator variable that equals one if the participant has failed IMC, and zero otherwise

4.7.2 Beta regression

Beta regression is a regression that is tailored to scenarios in which the dependent variable y is measured between zero and one, that is, $0 < y < 1$. The advantage of the beta distribution is the flexibility of modeling proportions, as the density function can have different shapes depending on the values of the parameters. Some would argue for transforming the dependent variable so that it can present values on the real number line. The drawback of such a transformation is that it leads to difficulties in interpreting the model parameters. The density of the beta distribution is:

$$f(y; \mu, \phi) = \frac{\Gamma(\phi)}{\Gamma(\mu\phi) \times \Gamma((1-\mu) \times \phi)} y^{\mu\phi-1} \times (1-y)^{(1-\mu)\times\phi-1}, 0 < y < 1, \quad (4.1)$$

where $0 < \mu < 1$ and $\phi > 0$, $\Gamma(\cdot)$ is the Gamma function. The mean and variance of Y are:

$$\mathbb{E}[Y] = \mu; \; \mathbb{V}[Y] = \frac{\mu \times (1-\mu)}{1+\phi}. \quad (4.2)$$

After understanding the underlying distribution, consider the independent variables of the regression analysis. Let $x_1, \dots, x_n$ be the independent variables. The model can be written as:

$$g(y) = \sum_{i=1}^{n} \beta_i \times x_i = \eta, \quad (4.3)$$

where β_i is a set of unknown coefficients and fixed across different observations, x_i is a set of observations of the independent variables, which are assumed to be known. The function $g(\cdot)$ is assumed to be twice differentiable and a strictly monotonic link function that has a range between zero and one and the domain

of real numbers. In this work, we use the logit link function as $g(\cdot)$. See McCullagh and Nelder (1989) for more details on the selection of the link function. The logit function gives us the following relationship:

$$\ln \frac{y}{1-y} = \sum_{i=1}^{n} \beta_i \times x_i. \tag{4.4}$$

After rewriting the formula, we have:

$$y = \frac{\exp(\sum_{i=1}^{n} \beta_i \times x_i)}{1 + \exp(\sum_{i=1}^{n} \beta_i \times x_i)}. \tag{4.5}$$

These formulas can help us to understand and interpret the regression result. $40\% \cdot y$ is the percentage of housing wealth the participants extracted by using Equity Release Product A.

Chapter 5

Long-term care insurance financing using home equity release: Evidence from an experimental study*

Abstract

We explore new mechanisms to fund long-term care using housing wealth. We conduct and analyze an online experimental survey fielded to a representative sample of 1,200 Chinese homeowners aged 45-64 to assess the potential demand for new financial products that allow individuals to access their housing wealth to buy long-term care insurance. We find that access to housing wealth increases the stated demand for long-term care insurance. When they could only use savings, participants used on average 5% of their total (hypothetical) wealth to purchase long-term care insurance. When they could use savings and a reverse mortgage, participants used 15% of their total wealth to buy long-term care insurance. With savings and home reversion, they used 12%. Reverse mortgages do not require regular payments until the home is sold, while home reversion involves a partial sale and leaseback. Our results inform the design of new public

or private sector programs that allow individuals to access their housing wealth while still living in their homes.

5.1 Introduction

We explored new mechanisms to fund long-term care using housing wealth. Our research in this area was motivated by the following trends and policy challenges. There is a growing demand for long-term care services that exceed available funding. Health insurance programs often cover only basic long-term care costs (if at all) and few countries have public long-term care insurance programs, while private long-term care insurance markets are very small. As a result, individuals can face high out-of-pocket costs for long-term care. Simultaneously, many older individuals own their homes, with their housing wealth often forming the largest part of their household wealth and retirement savings. However, housing wealth is a very lumpy and illiquid asset. Furthermore, individuals often have a strong emotional attachment to their home, and many prefer to "age in place," and remain and receive care in their own home as they age. This trend has become even more important due to the COVID-19 outbreak and the effects the pandemic has had on older people in nursing homes.

These observations suggest that there is potential for new public or private sector programs that allow individuals to access their housing wealth while still living in their homes. In this paper, we use survey methods to investigate the stated demand for new financial arrangements that allow individuals to access their housing wealth to purchase long-term care insurance. We compared the stated demand for long-term care insurance when individuals can (i) only use their savings, (ii) use their savings and a reverse mortgage loan, or (iii) use their savings and home reversion to fund a single upfront premium for long-term care insurance. We focused on reverse mortgages and home reversion as the two most common types of home equity release arrangements internationally. With a

reverse mortgage loan, a homeowner borrows against their home and is not required to make any interest and capital repayments until the home is sold. With home reversion, the homeowner sells part of their housing wealth, receives a payment upfront, and also receives a proportional share of the sale proceeds when they die or permanently move out. The long-term care insurance product we tested is a joint life product that pays a regular monthly income (rather than reimburses expenses) when either or both of a couple qualifies for long-term care. The income can be used for various purposes, including (but not limited to) paying formal caregivers, compensating friends or family members for informal care, and paying for formal residential care.

Our study was based on an online experimental survey that was completed by 1,200 participants aged 45–64 who live in 49 of China's largest cities. We found that access to housing wealth increases the stated demand for long-term care insurance. When they could only use savings to finance their long-term care insurance premiums, participants used an average of 5% of their total (hypothetical) wealth to purchase long-term care insurance. When they could use savings and a reverse mortgage, the survey participants used 15% of their total wealth to purchase long-term care insurance. With savings and home reversion, they used 12%. We also analyzed the impact of economic and behavioral factors and found that married participants with higher household savings and debt and with lower income expressed higher potential demand for using these products. The results also show that participants who had considered long-term care before participating in the survey generally had more trust in insurers, less intended bequests, and higher subjective understanding, which also indicated a higher potential demand for the long-term care insurance products offered.

This chapter is the first to quantify the stated demand for bundled long-term care insurance and home equity release products. These results are consistent with

theoretical studies, which have used lifecycle models to show that the demand for long-term care insurance increases when home equity can be accessed to finance the insurance premium (e.g., Davidoff, 2010; Hanewald *et al*., 2016; Shao *et al.,* 2019; Achou, 2021). We find a larger effect of home equity release on long-term care insurance demand than a recent theoretical study by Achou (2021). Using a lifecycle model of single retirees in the US context, Achou finds that housing liquidity has a limited impact on long-term care insurance demand. His model suggests that, even if housing were made to be fully liquid, long-term care insurance rates would hardly rise above 10%, from a 5% baseline in his sample. The larger effect we find in our survey data from China may be due to a range of factors, including different long-term care risks and out-of-pocket costs individuals face in China. We also note differences in product design: We designed an income product that can be used to pay for informal care while Auchou (2021) used an expense reimbursement long-term care insurance to perform the analysis.

Our study also contributes to the growing body of empirical research exploring the demand for long-term care insurance. Lambregts and Schut (2020) provided a comprehensive review of 62 studies examining the low take-up of long-term care insurance in Western countries.[34] From an economic perspective, most studies showed that wealth was positively associated with the demand for long-term care insurance. However, when housing assets cannot be used as a financial resource to fund long-term care insurance premiums, housing wealth may crowd out the demand for long-term care insurance (Boyer *et al.,* 2017; Costa-Font and Rovira-Forns, 2008) as it may be retained for precautionary purposes. Our study

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[34] There are two types of studies in Lambregts and Schut (2020), namely stated preference experimental studies using experimental survey data and revealed preference studies using existing survey data. For the stated preference experiment, Lambregts and Schut (2020) include experiment hold in Hong Kong (He and Chou, 2018) and Italy (Allaire *et al*., 2016). For the revealed preference studies, Lambregts and Schut (2020) include HRS in the United States (Chatterjee and Fan, 2017) and SHARE in Spain (Jiménez-Martín *et al*., 2016).

is one of the first empirical studies (either stated preference or revealed preference) to examine how access to housing assets via home equity release products impacts the demand for long-term care insurance.

Our results inform the design of new public or private sector programs that allow individuals to access their housing wealth while still living in their homes. Hanewald *et al*. (2020b) discussed how such combined products could be introduced into the US market. Mayhew *et al.* (2017) developed a pricing framework for selling a proportion of housing wealth to purchase long-term care insurance, while Mayhew *et al.* (2021) evaluated the benefit of different financing strategies to purchase long-term care insurance. These authors suggested that both a single premium and a regular monthly premium for purchasing long-term care insurance would severely impact the daily expenses of retirees, particularly for those who are asset rich but cash poor. This suggested that it could be beneficial to finance long-term care insurance through home equity release, either via a reverse mortgage or home reversion, or in Australia, by utilizing the government offered Pension Loans Scheme (PLS). By identifying an additional source of funding for long-term care, our findings can also facilitate the development of long-term services. The additional funding generated through access to housing wealth could attract more service providers to the market and may also increase the availability of informal carers who can be compensated through the design of the LTCI product which pays regular health-contingent income.

Our results also inform current policy reforms in China, which aim to increase long-term care insurance coverage through government-funded schemes and the development of a private market for commercial long-term care products. In recent years the Chinese government has emphasized the development and enhancement of the long-term care funding system. In 2016, long-term care insurance pilot programs were launched in 15 different cities and extended to 49

cities in 2020 (General Office of the State Council of PRC, 2020). Currently, the public long-term care insurance pilot program covers more than 130 million residents, with more than 1.3 million residents have received benefits from the scheme (Li *et al.*, 2021). The program focuses on providing basic services or funding for basic long-term care services and aims to reimburse 70% of long-term care costs. The government plans to enhance the public long-term care scheme and develop the commercial long-term care insurance market to supplement the public scheme (General Office of the State Council PRC, 2020). Thus, there is potential to develop the long-term care insurance market in China.

The Chinese government has also shown its interest in developing the home equity release market. Homeownership rates are high and property prices have increased substantially (People's Bank of China, 2020). In 2014, a reverse mortgage program (known as the "House-for-Pension" scheme) was introduced in several large cities. Although uptake of the pilot scheme was low, the findings of a recent experimental study suggest a potential demand for simpler and more flexible reverse mortgage products (Hanewald *et al.,* 2020a). Our results suggest that home equity release products could provide an additional source of funding for purchasing long-term care insurance.

The remainder of this chapter is organized as follows. Section 5.2 provides background information on public and private long-term care insurance, housing wealth, and reverse mortgage programs in China. Section 5.3 describes the survey design. Section 5.4 reports descriptive statistics, while Section 5.5 presents the regression analysis of the survey data. Section 5.6 concludes.

5.2   Background

5.2.1 Long-term care needs and insurance in China

China's population is aging especially rapidly, which has resulted in a growing need for long-term care. In 2019, 12% of the population was aged 65 or above, and this proportion is projected to increase to 17% by 2030 and to 26% by 2050 (United Nations, 2020). Based on an analysis of the Chinese Longitudinal Healthy Longevity Survey (CLHLS) and the China Health and Retirement Longitudinal Study (CHARLS) using a Markov process (Renshaw and Haberman, 1995; Fong *et al.*, 2015; Hanewald *et al.*, 2019), we estimated a 30% (40%) chance that males (females) will require long-term care assistance in retirement (see Section 5.7.3.2 in the Appendix to Chapter 5 for detailed calculations).

Traditionally, long-term care in China is provided by spouses and other family members. When Chinese retirees are disabled, they expect their partners and/or children—especially their daughters and daughters-in-law—to take care of them (Zimmer, 2005; Chappell and Kusch, 2007; Lin, 2014; Scheil-Adlung, 2015). However, the increasing demand for informal care is met by inadequate supply. There are fewer children available to be caregivers as a result of the change in China's population structure associated with the "one-child policy" (Rowland, 2009; Ku *et al.,* 2013; Zeng and Hesketh, 2016). The resulting "4-2-1" family structure—comprising four grandparents, two parents, and one child—places an increased level of responsibility for long-term care on that single child who has no siblings to share the responsibility. Moreover, the increased mobility of workers due to the changes in the labor market has weakened family connections, making it increasingly difficult for children to provide informal care for their elders (Arnsberger *et al.*, 2000; Ku *et al.*, 2013; Feng *et al.*, 2020). Less

availability of informal care has led to a higher demand for formal care and unmet care needs.

To address this issue China is now developing its formal care facilities and services. Before the long-term care plan reform in 2016 most long-term care related services were provided in hospitals (Mi *et al.*, 2020). In 2016, the central government commenced a public long-term care pilot program in 15 cities, which was further extended to 49 cities in 2020. Since the plans and systems vary from city to city, we used Qingdao as an illustrative example. Qingdao is one of two focus cities for the development of the public long-term care pilot program. Long-term care services have now been expanded to four types: 1) mobile clinic care (for remote rural areas), 2) home care, 3) nursing homes, and 4) hospital care. The current system provides two types of services: medical care and daily living care. For medical services, the public long-term care plan pays up to RMB 1600 per year for mobile clinic care, up to RMB 50 per day for home care services, up to RMB 65 per day for nursing home care, and up to RMB 170 per day for hospital care. For daily care, the payment from the public plan is up to RMB 50 per day for daytime nursing home services and up to RMB 65 per day for short- and long-term nursing home services. These amounts only support relatively basic services, while comprehensive services would be a supplement to the basic support. As a result, developing the private long-term care insurance market would be a way to supplement the basic support and help retirees to reduce their costs through risk pooling.

Furthermore, in the private insurance market, only critical illness insurance and retirement village investment products[35] are offered by insurers. The former is a

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[35] China Life Insurance Company, People's Insurance Company of China, Cathay Life Insurance and Kunlun Health Insurance Company had offered monthly income benefit long-term care insurance products to the public, but due to various reasons such as low profitability and low demand, these companies now longer offer monthly income benefit long-term care insurance products.

lump-sum benefit that does not provide an income stream to hedge long-term care risks, whereas the latter does not provide risk pooling. Since the government aims to further support the public long-term care scheme, it would be beneficial for it to develop the commercial long-term care insurance market to supplement the public scheme (General Office of the State Council PRC, 2020). The research reported in this chapter examines the potential demand for long-term care insurance products that can top up the current government-funded long-term care scheme by using both out-of-pocket financial wealth and housing wealth.

5.2.2 Housing wealth and reverse mortgages in China

For most Chinese households, the majority of their wealth is in housing wealth. In 2019, the homeownership rate of urban households was 96% and they stored 74% of their total household wealth in housing (People's Bank of China, 2020). Furthermore, in the past 20 years, house price growth has been substantial. According to the Bank for International Settlements (2021), the average annual growth rate for housing prices in China was 7.4% p.a. from 2011 to 2021.

In 2013, the Chinese government released a policy document to encourage the development of a reverse mortgage market [36]. The government strongly recommended that financial institutions develop new financial products (specifically reverse mortgages) to support retirement financing, especially the cost of long-term care services. While several insurers obtained a license to offer reverse mortgage products, only one—Happy Life Insurance—followed through with the introduction of the "House-for-Pension" scheme in July 2014. This product has been unpopular, and take-up has been extremely low. The product is relatively complex and inflexible since it provides fixed monthly payments for life that are partly structured as a deferred annuity (Hanewald *et al.*, 2020a). The

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[36] Several Opinions of the State Council on Accelerating the Development of the Elderly Service Industry, which was issued September 2013.

product design remained unchanged between the launch in 2014 and the conduct of this research in mid-2021. However, a recent investigation suggests that there could be a higher demand for an appropriately designed product that provides flexibility for older households to access liquidity from their housing assets to finance the purchase of long-term care insurance (Hanewald *et al*., 2020a).

One potential concern for developing the home equity release market in China is property rights. In China, homeowners only own the buildings but not the land. Residential property owners need a large grant contract to obtain 70-year land-use rights, which are transferrable when a property is sold. However, according to Article 22 of the Law of the People's Republic of China on the Management of Urban Real Estate, land users (e.g., homeowners) can apply for an extension 1 year before the end of the term and may receive a renewal contract for the granting of land use rights upon approval. Additionally, Article 149 states that the right to use the land for residential construction should be automatically renewed upon the grant contract expiring. Moreover, Article 359 of the new Civil Code (which came into effect on 1 January 2021) states that the land use rights for residential construction will be automatically renewed by the payment of fees or reductions under the provisions of the law and administrative regulations. Furthermore, Article 366 of the Civil Code establishes a new right: the right to live on a property. In summary, although the risk of the renewal remains, it should not hinder the development of the home equity release market in China as the government has implemented several policies to guarantee land-use rights. The market should reflect the remaining policy risk when pricing the relevant home equity release products.

5.3   Survey design

We designed an online experimental survey to investigate the potential demand for long-term care insurance financed from savings and/or housing assets by

middle-aged urban homeowners in China. We focus on urban areas which are usually the main focus of the pilot policy programs in China. The experimental task elicited the demand for three alternative hypothetical long-term care insurance products. All three products provide a monthly income to the policyholder and their partner if at least one of the couple is disabled and qualifies for long-term care. The three products differ in the way the one-off premium (paid at the beginning of the contract) is financed: by cash from savings; by a combination of savings and borrowing against home equity via a reverse mortgage; by a combination of savings and selling part of one's home equity via home reversion.

5.3.1 Focus group testing

We developed a first draft of the survey based on related studies on the demand for long-term care insurance (Wu *et al.,* 2021) and reverse mortgages (e.g., Dillingh *et al*., 2017; Fornero *et al.,* 2016; Davidoff *et al.,* 2019; Hanewald *et al.,* 2020a). We used focus groups to pre-test the survey design—particularly the wording and level of detail of long-term care insurance product descriptions and the format of the choice tasks. The focus group discussions were conducted by the market research company Horizon Dataway in Shanghai, China, on 20–21 December 2018. The recruitment of focus group participants was aligned with the screening criteria for the online survey: urban homeowners aged 45–64 with no difficulties in performing any activities of daily living (ADLs). We provided a script to the moderator from Horizon Dataway to lead the discussion in Mandarin Chinese. Two focus groups, each with six participants, undertook a facilitated discussion of the product information and draft choice tasks for 2 hours.

The video-recorded focus group discussions allowed us to considerably improve the presentation of the product information and the setup of the choice tasks. The

focus group participants asked many detailed questions about the definition of long-term care and how the hypothetical products work. These questions and suggestions helped to refine the product descriptions presented in the online survey. For example, the participants asked whether non-permanent injuries would be covered, which party is responsible for appointing the doctor to determine the insured's health state, how the benefits are paid out, and whether the products provide a death benefit. The participants reported that numerical examples were critical for them to understand the products and provided some suggestions for the Chinese translation of the draft survey. We used this feedback to develop our final survey.

5.3.2 Survey structure

Figure 5.1 summarizes the structure of the final version of the survey. The broad structure commenced with screening questions followed by information about health states and long-term care, the choice tasks, and finally questions to collect covariate data. We will describe the survey components in detail in the following sections. The online survey was programmed in English and Chinese by the survey company dataSpring and administered in Chinese. Screenshots of the English version of the survey are available in Appendix A.[37]
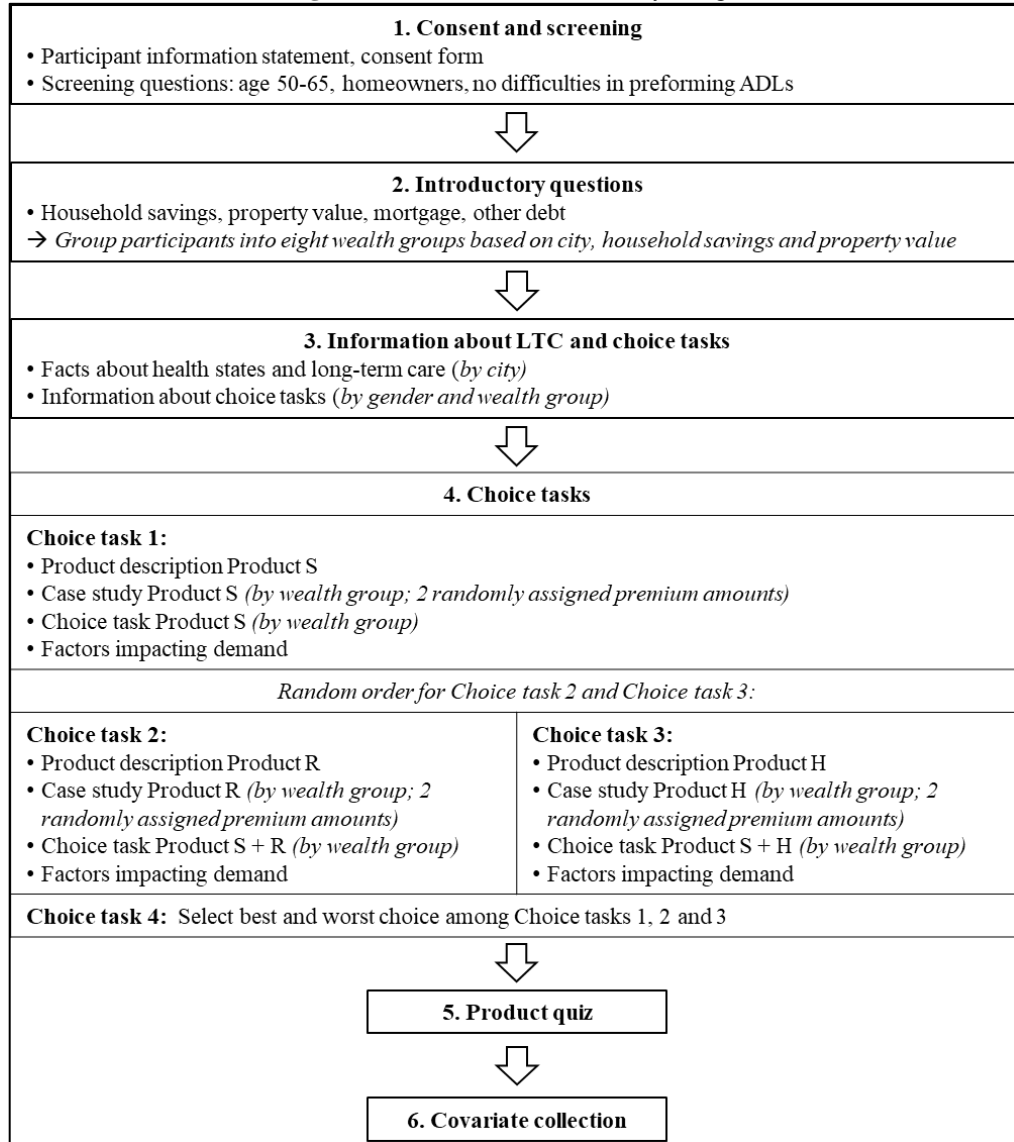
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[37] The live survey can be found at:
English: https://pro.wenjuan.com/s2/5d6e41097e634b90c7a7c319/?test_mode=1
Chinese: https://pro.wenjuan.com/s2/5da15ed57e634b50a6b3e6d1/?test_mode=1.

Figure 5.1: Overview of the survey design.

5.3.3 Sample

The Chinese version of the survey was fielded in November 2019 by the online survey firm dataSpring to a sample of 1,200 participants. dataSpring recruited the participants through email and an app from their database of over 1 million Chinese urban residents and from their network of panel suppliers to expand the reach of their database. Participants who completed the survey were paid a fixed

amount. Additionally, a bonus payment was based on the results of the product knowledge quiz. The median completion time for the survey was 19 minutes. The participation rate was approximately 5–10%.

The survey targeted urban homeowners aged 45–64 years, who could be potential customers for the long-term care insurance products we tested. We choose this age range as the retirement age in China for men is 60 and for women is 55. In addition, we wanted to examine the stated choices of people who had not yet made these decisions. We included quotas to target 50% males and 50% females, broad coverage of education levels, and representative geographical coverage across four Tier 1 cities (Shanghai, Beijing, Shenzhen, and Guangzhou) and 45 Tier 2 cities in China[38]. We required 50% of the participants to reside in Tier 1 cities and the other 50% to reside in Tier 2 cities. Tier 1 and 2 cities differ in population size, income level, business opportunity, and consumer behaviors. We also required the participants to have the urban "*hukou*" registration of the cities they reside in since this identifies participants who have a long-term relationship with the city. We identified homeowners by asking participants whether they (or their spouse) own at least one property (with an owner certificate). We excluded participants with difficulties in performing ADLs since such conditions would make them immediately eligible for long-term care insurance benefits and would therefore disqualify them from purchasing any of the long-term care insurance products.

5.3.4 Wealth groups

Eligible participants began the survey with nine introductory questions to provide information that would help us allocate the participants into different

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[38] Although the Chinese city tier system is not an official list. We used the definition by the Chinese Business Network (2021) to determine the tiers of the cities. In this survey, we grouped New Tier 1 cities and Tier 2 cities into one group and called them Tier 2 cities. Despite the ranking system is updated on an annual basis, Tier 1 cities remain unchanged throughout these years.

wealth groups. Based on the self-reported answers regarding their (net of loans) savings, the current (net of mortgages) values of their properties, and the tier of the city they live in, participants were allocated into one of eight wealth groups (see Table 5.1). The participants were then assigned hypothetical home values and saving amounts close to their self-reported financial situation.

Table 5.1: Wealth group allocation.

| Self-reported home value in RMB	Self-reported savings in RMB	City Tier	Wealth group	Hypothetical home value (H) in RMB	Hypothetical savings (W) in RMB
≥ 3,000,000	≥ 500,000	1	1	5,000,000	750,000
≥ 3,000,000	< 500,000	1	2	5,000,000	250,000
< 3,000,000	≥ 500,000	1	3	1,500,000	750,000
< 3,000,000	< 500,000	1	4	1,500,000	250,000
≥ 1,000,000	≥ 150,000	2	5	1,500,000	750,000
≥ 1,000,000	< 150,000	2	6	1,500,000	250,000
< 1,000,000	≥ 150,000	2	7	800,000	250,000
< 1,000,000	< 150,000	2	8	800,000	75,000

Notes: This table shows how we assigned participants into one of eight wealth groups based on their self-reported home values, savings, and the tier of the city they live in. The wealth groups have different hypothetical home values and saving amounts close to their self-reported values.

5.3.5 Information about long-term care and choice tasks

The participants then saw a screen titled "Facts about health states and long-term care", which explained long-term care, health status, and other key technical terms used in the survey in easy-to-understand language (see Figure 5.2). We developed this description based on insights from the focus group testing and previous research (Wu *et al.*, 2021). We provided estimates for the chance of requiring long-term care for men aged 60 and women aged 55. These ages correspond to the pension eligibility ages for men and blue-collar women under China's Basic Old-Age Insurance program, which covers urban employees and public servants (Deng et al., 2020). Section 5.7.3.2 in the Appendix to Chapter 5 describes how we calculated these rates using individual-level data from two household panel surveys in China: the CLHLS and the CHARLS.

Figure 5.2: Screenshot of "Facts about health states and long-term care" (translated).
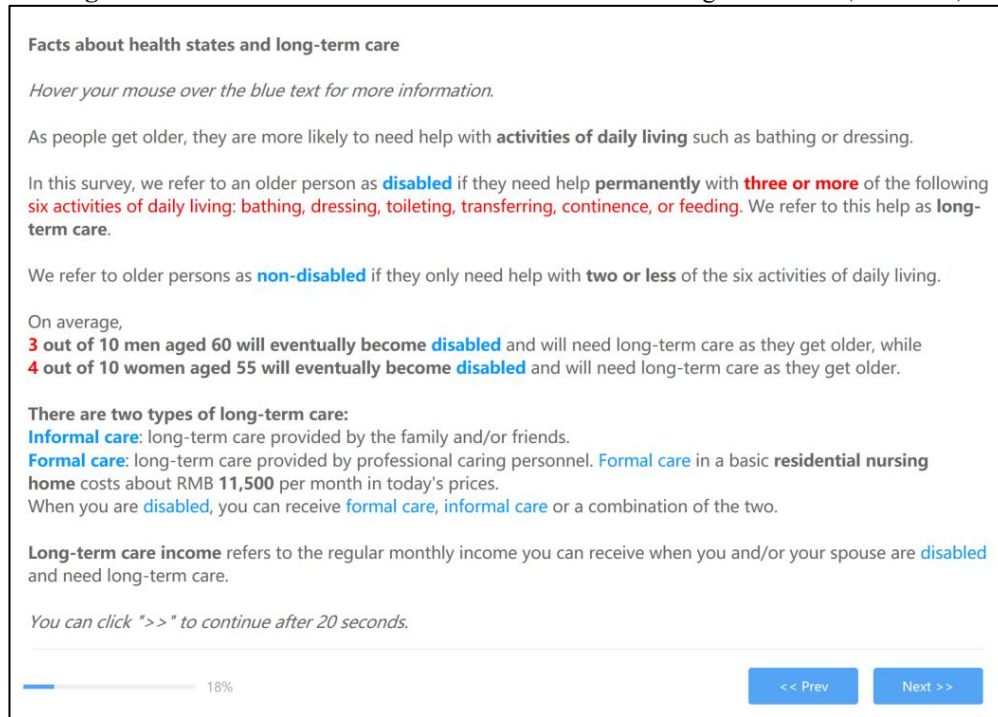
The "Facts about health states and long-term care" screen also included information about residential nursing home costs. The participants saw different prices according to the tier of the city they reside in. Participants in Tier 1 cities saw the cost of RMB 11,500 per month, whereas those in Tier 2 cities saw the cost of RMB 9,500. We estimated these costs based on the average cost of residential long-term care in Tier 1 and Tier 2 cities according to "58 Daojia," the national service provider that publishes residential long-term care costs in different cities every month (see Section 5.7.3.5 in the Appendix to Chapter 5). As shown in the screenshot, we used bold font and red font to emphasize important information. We used blue font color to highlight technical terms, which were explained via pop-up windows. We also required the survey participants to remain on important survey screens for at least 20 seconds.

On the next two screens, we prepared participants for the choice tasks. We explained that they would be asked to make choices regarding three new

financial products designed to fund long-term care. We informed the participants that each product would provide them with an income when they require long-term care. Participants were told that they would see product descriptions and a case study for each of the three long-term care income products before completing four choice tasks. We asked the participants to read the product descriptions carefully and that their understanding would affect the bonus amount they could earn from the survey (e.g., Hanewald *et al.,* 2020a).

We asked participants to ignore their financial circumstances in the choice tasks and imagine that they were aged 60 for males (55 for females), married to a spouse aged 55 (60 for females), about to retire, that they own their own home at a given value, that they have a given amount in a savings account, and that they have no other assets. We then showed the participants a hypothetical home value and savings amount close to their self-reported financial situation, as described in Section 5.3.4.

5.3.6 Choice tasks 1–3

As indicated in the overview of the survey design in Figure 5.1, participants then proceeded to Choice Tasks 1–3, each of which involved a different long-term care insurance product. Each choice task consisted of a product description, a case study of the product, and a choice task for the stated demand. All participants started with Choice Task 1, which was related to Long-Term Care Income Product S (long-term care insurance bought using savings). They then completed either Choice Task 2, in which participants could use savings and a reverse mortgage loan (via Long-Term Care Income Products S and R, respectively) to purchase long-term care insurance, or choice task 3, in which participants could use savings and home reversion (via Long-Term Care Income Products S and H, respectively) to purchase long-term care insurance. We randomized the order of Choice Tasks 2 and 3 to avoid potential ordering effects.

We used "S", "R", and "H" as the product names to avoid any (positive or negative) connection with existing financial products. . We did not refer to the products as insurance. Instead, we called them "products" or "contracts."

The remainder of this section describes other components of the choice tasks.

Product descriptions

Choice Tasks 1, 2, and 3 each began with the description of a new hypothetical product. The product descriptions consisted of a summary of the product and a detailed product description in a question-and-answer style presented in table format. Screenshots of all product descriptions can be found in Appendix B of the thesis. We explain the underlying pricing in Section 5.7.3 in the Appendix to Chapter 5.

The product description for Long-Term Care Income Product S explained that the participants could buy this product with a single payment from their savings and would receive a regular monthly income if they and/or their spouse required long-term care. The detailed description (in table format) explained that Product S was offered by a state-owned bank, would require a single payment at the start of the contract, would provide a monthly income for life in the case of being disabled and requiring long-term care services, and outlined other features.

The product description for Long-Term Care Income Product R explained that the participants could buy this product by borrowing against their home. It also stated that the product would pay a regular monthly income if the participant and/or their spouse required long-term care. The description of the long-term care insurance component was similar to that of Product S. The description of the reverse mortgage component was informed by the mortgage product description developed by Hanewald *et al.* (2020a), which reported high rates of product understanding. We explained that Product R would not require payment at the start of the contract but would incur a loan that accumulates a fixed interest

of 5.8%[39]. We also explained that no repayments would be required while the participant and/or their spouse live in their home. Instead, the product provider would sell the property at the highest possible market price after both partners had passed away or moved to a residential nursing home and would use the sale proceeds to repay the loan. The participants were also informed that if the sale proceeds were insufficient to cover the debt, they, their spouse, or their heirs would not be required to make any extra payment. That is, Product R included an NNEG, which is a common regulatory requirement for reverse mortgages.[40]

The product description for Long-Term Care Income Product H explained that the participants could buy this product by selling part of their home. The description of the long-term care insurance component was similar to those for Products S and R. The description of the home reversion component explained that Product H would not require payment at the start of the contract. Instead, the participant would sell a part of the home to the product provider. We also explained that the product provider would sell the property at the highest possible market price after both partners had passed away or moved to a residential nursing home and that the sale proceeds would be split between the product provider and the participant, their spouse (if in a nursing home), or their heirs.

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[39] Happy Life Insurance Company launched the pilot reverse mortgage in China in 2014. The interest rate charged is 5.5% p.a. However, there are a lot of fees charged in each year (such as lawyers' fee, policy fee and surveyor fee etc.) and at the beginning of the contract. We estimated the equivalent interest charged for these fees is around 0.3% p.a. Therefore, we use 5.5% + 0.3% = 5.8% p.a. as the interest rate charged in Product R.

[40] Compared to Hanewald *et al.* (2020a), this product is less flexible as it is only used for financing the premium of long-term care income product. However, in terms of the "no-negative equity guarantee", the right of renting out the property, and the arrangement of terminating the contract, Long-Term Care income Product R is similar to the product described by Hanewald *et al.* (2020a). We reduced the complexity of the current existing reverse mortgage product launched by Happy Life Insurance by removing the deferred annuity (both premium and benefit component) and different types of fees.

We included several product features in Products R and H that the focus group participants identified as important. Both product descriptions clarified that the participant would have a guaranteed right to live in their home while they or their spouse are non-disabled. Furthermore, the participants would retain full legal rights to their homes and would be allowed to rent them out. We also included an option for them to terminate the contract early and—importantly—an option for their heirs to repay the debt (with Product R) or buy back the share of housing wealth (with Product H) to keep the property when the contract terminates. Focus groups discussions suggested that these options are important for the acceptance of home equity release products.

Case study

After each product description, the participants were shown a case study. The case study illustrated how each product works using as an example of a hypothetical situation faced by a couple in the same wealth group as the participants. The case study described how the purchase of the product impacted the couple's initial housing wealth and savings, the monthly long-term care income they received when they became disabled, and also described the transactions at the end of the contract. For Products R and H which involve the use of housing wealth, we illustrated the outcomes for three possible scenarios at the time of the contract termination to illustrate the impact of house price growth and the option for their heirs to keep the property when the contract terminates. Figure 5.3 shows a screenshot of the case study for Long-Term Care Income Product R. The case studies for Products S and H have a similar structure and are shown in Appendix B of this thesis.

Figure 5.3: Partial screenshot of the case study for Long-term Care Income Product R (translated).

Case study for **Long-term Care Income Product R**

Hover your mouse over the blue text for more information.

Please read the following case study which illustrates how Long-term Care Income Product R works.

Mr. Wang is aged 60 and Mrs. Wang is aged 55 in 2019. They have an adult daughter. They live in their own apartment in Guangzhou which is worth RMB 5,000,000 and have RMB 750,000 in their savings account. They decide to buy Long-term Care Income Product R to cover their future long-term care needs.

- They choose to **borrow RMB 600,000 against their apartment** to buy long-term care income with Long-term Care Income Product R. The amount becomes a debt which accumulates interest at the fixed interest rate of 5.8% p.a
- If one or both are disabled, they will receive a **monthly income** according to the following table:

Both non-disabled/deceased	1 non-disabled/deceased, 1 disabled	Both disabled
RMB 0/month	RMB 10,542/month	RMB 21,085 /month

- They do **not have to repay anything** while **at least one of them** still **lives at home**.
- The couple **fully own their apartment**, including all growth in its value, if any.

This contract will **terminate** when **both** Mr. and Mrs. Wang **pass away**.

Assume that Mr. Wang remains **non-disabled** and **passes away in 2044**. In the **same** year, Mrs. Wang becomes **disabled** and **permanently moves** into a **residential nursing home**. The **outstanding debt** amount in **2044** accumulated from the **initial loan** is RMB 2,456,000. Below are **three** possible **scenarios** in 2044:

- Scenario A: The product provider **sells the home at the highest possible market price** of RMB 10,000,000. The sale proceeds are used to **repay** the debt. Mrs. Wang **receives the remaining** RMB 7,544,000. She will receive a long-term care income of RMB 10,542/month **until she passes away**.
- Scenario B: The product provider **sells the home at the highest possible market price** of only RMB 1,000,000. All sale proceeds **are used to repay** the debt. Mrs. Wang will **receive nothing from the sale**, but she is **not required to make an extra payment**. The difference is a loss to the product provider. Mrs. Wang will receive a long-term care income of RMB 10,542/month **until she passes away**.
- Scenario C: Their daughter decides to **repay the debt herself** and **keep** their property. Mrs. Wang will receive a long-term care income of RMB 10,542/month **until she passes away**.

To avoid the demand for long-term care insurance in the later choice tasks being influenced by the amount of long-term care insurance purchased in the numerical example, we showed half of the participants in each treatment group a numerical example with a higher (lower) amount of long-term care insurance purchased. We adjusted the financial consequences in the case study accordingly.

Below the case study, on the same screen, we asked participants to rate their understanding of the product described on the screen. The five possible answers ranged from *Completely clear* to *Completely confusing*. Participants could only proceed to the next screen after 20 seconds.

Choice task

After reading the case study, participants proceeded to the choice task. In each choice task, the participants were asked to assume that they have a given amount in their savings and own a home worth a given amount, as described in Section 5.3.4. The amounts were the same in Choice Tasks 1, 2, and 3. Participants were asked to assume the hypothetical home values and saving amounts listed in Table 5.1 to perform the choice tasks, which were close to their reported wealth amounts.

In Choice task 1, the participants were informed that they could use the money in their savings account to purchase long-term care income with Long-term Care Income Product S. They were then asked to make the following decisions: (1) *Would you like to buy long-term care income with Long-term Care Income Product S? And if you do;* (2) *How much of your savings do you want to use to buy long-term care income?* The participants used a configurator to indicate their choice. The configurator ranged from 0 to the hypothetical amount of savings.

Figure 5.4 shows a screenshot of the choice task for Choice Task 2. The participants were informed that they could use both Long-term Care Income Product S and R to purchase long-term care income and were asked to make the following decisions: (1) *Would you like to buy long-term care income? And if you do,* (2) *How much of your savings do you want to use to buy long-term care income with Long-term Care Income Product S?* (3) *How much do you want to borrow against your home to purchase long-term care income with Long-term Care Income Product R?* As shown in the middle of Figure 5.4, the participants were prompted to use two configurators to indicate their choice: one configurator for Long-term Care Income Product S (range: 0 to the hypothetical savings amount) and one for Long-term Care Income Product R (range: 0 to 40% of the hypothetical amount of housing wealth). With this setting, we assumed a maximum initial LVR of 40% for the reverse mortgage component in Product R.

Figure 5.4: Partial screenshot of Choice task 2 (translated).

Choice Task 3 involved Long-term Care Income Product S and Long-term Care Income Product H. The participants faced the following decisions: (1) *Would you like to buy long-term care income? And if you do,* (2) *How much of your*

savings do you want to use to buy long-term care income with Long-term Care Income Product S? (3) *How much of your home do you want to sell to buy long-term care income with Long-term Care Income Product H?* Again the participants were prompted to use two configurators to indicate their choice: one configurator for Long-term Care Income Product S (range: 0 to the hypothetical savings amount) and one for Long-term Care Income Product H (range: 0 to the maximum proportion of housing wealth that can be used to purchase long-term care insurance under home reversion.[41]).

The configurators in each choice task were initially set to 0. The participants read: *You can position the slider anywhere on the line, but you need to move it at least once before you can continue. If you DON'T want to buy Long-Term Care Product, place the configurator at RMB 0.* For each choice task, we showed an output table below the configurator(s) illustrating the financial consequences of the participant's choices, including the regular income in different disability states, the required payments, and the remaining wealth (see Figure 5.4, bottom). The table also reported the percentage of the cost of formal care or informal care that participants would be able to cover with the selected amount of long-term care income. The participants could review their choice and observe how their choice would impact their income and wealth in different scenarios. The numbers in dark blue changed when the participants moved the cursor on the configurator. Below the output table (not shown in the screenshot in Figure 5.4), participants were asked to select the main reason (from a list of seven possible reasons) for why they did not purchase more of the respective product.

5.3.7 Choice task 4

Following the separate decisions in Choice Tasks 1, 2, and 3, the participants were then asked to choose their most and least preferred of the three product

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[41] See 5.7.3.4 in the Appendix to Chapter 5 for the calculation of the home reversion values.

choices using a table that summarized the choices they made in Choice Tasks 1, 2, and 3 (see Figure 5.5).

Figure 5.5: Screenshot of Choice Task 4 (translated).

Task 4 of 4: Which of the following choices do you prefer?

Hover your mouse over the blue text for more information.

The following table summarises the three choices you have just made to buy long-term care income. We now ask you to choose which of the three choices would be BEST for you and which of the three choices would be WORST for you.

Product Properties	A Task 1 choice Long-term Care Income Product S	B Task 2 choice Long-term Care Income Product R	C Task 3 choice Long-term Care Income Product H
Regular income when you and your spouse are **non-disabled**	0 per month		
Regular income when **one** spouse is **disabled** and the **other** spouse is **non-disabled** or deceased	RMB 1,757 per month	RMB 4,393 per month	RMB 2,508 per month
Regular income when **both** spouses are **disabled**	RMB 3,514 per month	RMB 8,786 per month	RMB 5,016 per month
Total payment for long-term care income	Single payment of RMB 100,000 at the beginning of the contract	RMB 250,000	RMB 142,734
Payment for long-term care income from your **savings account**	RMB 100,000	RMB 50,000	RMB 40,000
Payment for long-term care income from Long-term Care Income Product R	Not applicable	RMB 200,000 loan with annual interest rate 5.8% p.a.	Not applicable
Value of home sold through Long-term Care Income Product H	Not applicable	Not applicable	RMB 350,000 is sold
Remaining money in your **savings account**	RMB 650,000	RMB 700,000	RMB 710,000
Your **remaining housing** wealth	RMB 5,000,000	RMB 5,000,000	RMB 4,650,000
Your **remaining total** wealth	RMB 5,650,000	RMB 5,700,000	RMB 5,360,000
Additional comments:	You receive the monthly income for as long as you/your spouse are disabled		
Which one of A, B or C would be **BEST** for you?	○	○	○
Which one of A, B or C would be **WORST** for you?	○	○	○

47%   << Prev   Next >>

5.3.8 Product quiz

After completing the choice tasks, the participants completed an incentivized product knowledge quiz comprising eight statements (as shown in Figure 5.6) that tested their understanding of Long-term Care Income Products S, R, and H. The participants were asked to select whether the statements applied to each of the three products.

Figure 5.6: Screenshot of the product knowledge quiz (translated).

5.3.9 Covariate collection

The final part of the survey asked questions to collect data for covariates, including demographics and information about children and grandchildren, health and subjective life expectancy, household income and wealth, financial literacy and numeracy, retirement plans, financial risk attitudes and personality traits, bequest plans, and expectations of house price growth and long-term care arrangements. Where possible, we used standard questions to ensure comparability with other surveys, including the CHARLS and CLHLS. For the financial literacy questions, we drew on Lusardi and Mitchell (2011), while the numeracy questions were from Lipkus *et al*. (2001) and personality traits were elicited using the Big Five personality questions (Borghans *et al*., 2008; Agnew

et al., 2018). We also included an IMC, which allowed us to identify inattention by asking about the highest level of education they attained twice in the survey (Oppenheimer *et al*., 2009). Questions eliciting bequest preferences, subjective views on retirement plans, and house price expectations were adopted from related studies on life care annuities and reverse mortgages (Davidoff *et al., 2017*; Wu *et al., 2021*; Hanewald *et al., 2020a*). We also measured the time taken to complete the survey. To gauge the quality of the survey, we asked participants to rate the clarity of the survey questions.

5.4   Descriptive statistics

5.4.1   Sample characteristics

Table 5.2 reports the average values for key demographic and socioeconomic variables for our sample and compares them with data from the nationally representative CHARLS. For this comparison, we used similar sample criteria to select a sample from the 2018 CHARLS survey wave. That is, we report statistics for all CHARLS participants aged 45–69 with an urban *hukou* (the Chinese word for residence permit) who live in a household that owns at least one property. Notably, our study sample is younger and has more children than the CHARLS sample. Furthermore, the participants in our survey were more educated and wealthier than those who participated in the CHARLS. These differences are likely due to the following factors: (i) the interview method (since our survey was conducted through an online commercial web panel, whereas the CHARLS used face-to-face interviews); (ii) the sampling method (since the participants in our survey were recruited from 49 selected cities—four Tier 1 cities and 45 Tier 2 cities—whereas the CHARLS recruited participants from cities all over China). We acknowledge that our survey sample of urban Chinese homeowners was more educated and wealthier than a comparison sample from the nationally representative CHARLS survey, as discussed in Section 4.1. The

demand for long-term care insurance and the effect of home equity release on this demand may differ in the general population. Future research could aim to collect a broader sample and include individuals living in rural areas.

Table 5.2: Participant characteristics: Comparison with CHARLS 2018 data.

	Our survey	CHARLS sample
Age (mean)	52.1	56.9
Male	50.0%	47.2%
Married	97.8%	88.2%
Number of children (mean)	1.3	1.0
Highest education attained		
Junior middle school and below	17.7%	74.3%
Senior middle school/college degree/diploma	49.2%	23.2%
Bachelor and above	33.1%	2.5%
Current work status		
Employed	84.1%	67.1%
Retired	14.4%	32.7%
Other	1.5%	0.2%
Urban *hukou*	100%	100%
Number of properties	1.3	1.4
HH savings (median)	RMB 150,001-250,000	[RMB 8,000]
HH house value (median)	RMB 1,600,000	[RMB 150,000]
HH debt excluding mortgage (median)	RMB 2,000 – RMB 9,999	[RMB 0]
N	1,200	4,900

Notes: HH denotes household. CHARLS refers to the 2018 wave of the China Health and Retirement Longitudinal Study. [] indicates that variable definitions differ.

5.4.2 Product familiarity, understanding, and survey clarity

Most participants had heard about reverse mortgages and long-term care insurance before taking the survey. Overall, 58% indicated that they had heard about a "House for Pension" scheme (i.e., the reverse mortgage product offered in China, see Section 5.2.2), while 73% indicated that they had heard of long-term care insurance.

Long-term care insurance, reverse mortgages, and home reversion are complex financial products. In Section 5.3, we described several methods that we used in the survey design to help the participants better understand these products, including detailed product descriptions with case studies and pop-up windows with definitions for technical terms. Participants rated their product

understanding following the product descriptions and numerical examples as relatively high.

Figure 5.7 reports the subjective product and survey understanding for the full sample and by product type. 36%, 32%, and 33% of participants rated their product understanding as completely clear for Long-term Care Income Products S, R, and H, respectively. Moreover, 48%, 49%, and 47% of participants rated their product understanding as mostly clear for Long-term Care Income Product S, R, and H, respectively. Only 1%, 2%, and 2% of participants rated their understanding as mostly confusing or completely confusing. Overall, 86% of participants reported that they found the questions in the survey completely or mostly clear.

We used 24 true-false questions to test the participants' objective understanding of the three long-term care income products. The data confirm that participants generally understood the products well, with 17% recording more than 80% correct answers in the quiz and 51% recording more than 75% correct answers.

Overall, these results suggest that the comprehensive product descriptions and numerical examples we developed based on previous research and focus group testing allowed participants to understand the complex financial products well.

Figure 5.7: Subjective product and survey understanding.
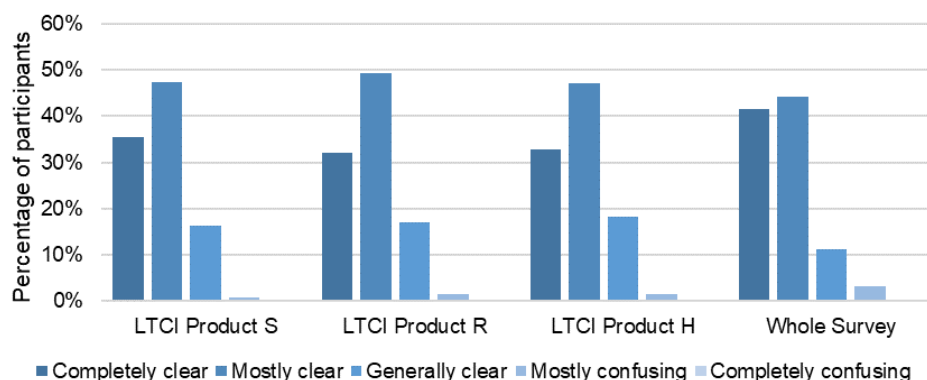
5.4.3 Demand for long-term care insurance

In Section 5.3.6, we explained that the survey contained three choice tasks in which participants indicated their demand for long-term care insurance with different financing methods: using savings (Product S) in Choice Task 1; using savings (Product S), and a reverse mortgage (Product R) in Choice Task 2; using savings (Product S) and home reversion (Product H) in Choice Task 3. Figure 5.8 shows that the demand for long-term care insurance varied among the different financing methods.

Figure 5.8: Average demand for long-term care insurance.
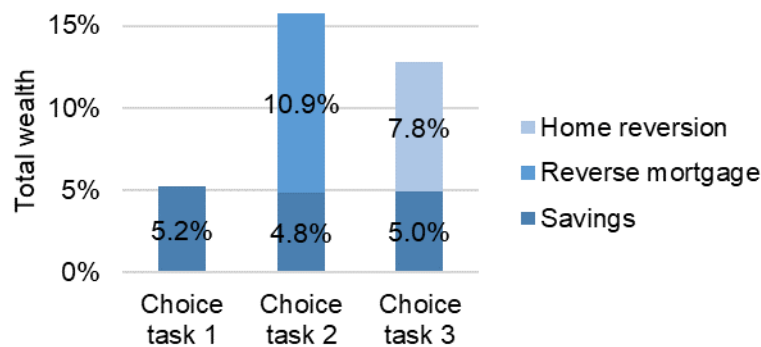
The demand for long-term care insurance was highest in Choice Task 2 (using Product S and Product R), where savings and a reverse mortgage were used to finance the product. On average, the participants stated that they would use 33% of their savings and 13% of their home value (i.e., 15% of their total wealth) to purchase long-term care insurance. The average purchase amount across all wealth groups was RMB 384,825, while the median was RMB 250,000. The demand for long-term care insurance was highest in Choice Task 2, where savings and a reverse mortgage were available. On average, the participants stated that they would use 33% of their savings and 13% of their home value (i.e., 15% of their total wealth) to purchase long-term care insurance in this scenario. The average purchase amount across all wealth groups was RMB 384,825, while the median was RMB 250,000.

The demand for long-term care insurance in Choice Task 3, in which participants could use their savings and home reversion (which involved the partial sale of their home) to purchase long-term care insurance, was also higher than in Choice Task 1. On average, participants stated that they would use 32% of their savings and 9% of their home value (i.e., 12% of their total wealth) to purchase long-term care insurance. The mean stated purchase price across all wealth groups was RMB 308,762, while the median was RMB 203,877.

Table 5.3 compares the change in wealth allocation when housing wealth was available to purchase long-term care insurance. The first comparison is the difference in demand for long-term care insurance between Tasks 1 and 2. The second comparison is the difference in demand for long-term care insurance between Tasks 1 and 3. We also compared the allocation of savings wealth to long-term care insurance between Tasks 1 and 2, and between Tasks 1 and 3. We used Welch's *t*-test for these four comparisons since we did not need to assume that the variance of the samples was equal.

Table 5.3: Welch's *t*-test results for differences between tasks.

Test	Mean	Mean	D Mean	Test stat	df	*p*-value
Demand for long-term care insurance						
Task 1 vs. 2	5.2% (Task 1)	15.7% (Task 2)	10.5%	31.7	1645.3	< 2.2e-16***
Task 1 vs. 3	5.2% (Task 1)	12.8% (Task 3)	7.5%	27.1	1857.1	< 2.2e-16***
Savings allocated to long-term care insurance						
Task 1 vs. 2	36.0% (Task 1)	32.8% (Task 2)	-3.2%	-3.6	2391.7	1.8e-4 ***
Task 1 vs. 3	36.0% (Task 1)	33.7% (Task 3)	-2.3%	-2.6	2395.3	5.0e-3**

Notes: Test stat denotes the test statistic of Welch's *t*-test. df denotes degrees of freedom. "D Mean" refers to the difference in mean between treatment groups. Task 1 refers to using savings to purchase the long-term care insurance offered. Task 2 refers to using savings and reverse mortgages to purchase the long-term care insurance offered. Task 3 refers to using savings and home reversion to purchase the long-term care insurance offered.

For all comparisons, we found that when housing wealth (accessed by either home reversion or a reverse mortgage) was available to purchase long-term care

insurance, the demand for long-term care insurance increased significantly. Furthermore, the amount of savings allocated to long-term care insurance was significantly reduced when housing wealth was available for purchasing long-term care insurance.

5.4.4 Preferred long-term care income products

In Choice Task 4, the participants were shown a table that summarized their choices in Choice Tasks 1–3. The participants indicated which of the three choices would be "best" for them and which would be "worst" for them. Overall, 42% of the participants selected their Task 1 choice as best, while 38% nominated their Task 2 choice, and 20% nominated their Task 3 choice.

The fact that Choice Task 1 was the most preferred on average is somewhat surprising. In Choice Task 1, only savings could be used to purchase long-term care income, while in Choice Tasks 2 and 3, savings **and** housing assets via a reverse mortgage **or** home reversion could be used. Thus, Choice Task 1 is a subset of Choice Tasks 2 and 3. The participants likely preferred Choice Task 1 because it was easier.

5.5   Regression results

We used regression analysis to better understand the factors driving individuals' preferences for long-term care insurance financing using home equity release. We regressed the demand for long-term care insurance in each task on different measures of product and survey understanding, the survey treatments, and covariates that have been identified as being associated with interest in long-term care insurance and reverse mortgages in previous research (e.g., Wu *et al.,* 2021; Brown *et al.,* 2012; Hanewald *et al.*, 2020a). The covariates included economic and demographic factors, health variables, and measures of personality and expectations. We included two variables measuring whether the

participants paid attention when completing the experimental survey: the IMC and the time taken to complete the experimental survey.

The variable definitions are listed in Section 5.7.2 in the Appendix to Chapter 5. Most covariates were coded as binary variables. We converted numerical and ordinal variables to binary indicators of whether the participants' responses were higher than the sample median.

Table 5.4 presents the regression results, where we analyzed the factors explaining long-term care insurance demand in different tasks. We measured individuals' long-term care insurance demand as the percentage of total wealth (i.e., hypothetical home value plus savings) they used to purchase long-term care insurance. Since the dependent variable ranged between 0 and 1, we used beta regressions (see Section 4.7.2 in the Appendix to Chapter 4 for more details) with a logit link function to estimate the relationships between the dependent variable and the independent variables (e.g., Ferrari and Cribari-Neto, 2004). This regression assumes that the underlying data has a beta distribution, which can be any shape depending on the combination of parameters under the beta law. Thus, using an inverse logit function would help us identify the impact of the coefficient on the dependent variable. We estimated separate regression models for Choice Tasks 1, 2, and 3: for the demand for long-term care insurance using savings only in Choice Task 1, using savings and housing assets accessed via a reverse mortgage in Choice Task 2, and using savings and housing assets accessed via home reversion in Choice Task 3. These results are reported in columns 1, 2, and 3 respectively.

In the following discussion, we discuss the association between demand for each of the three long-term care financing products and the covariates we collect. We compare our results to those of related studies on the demand for long-term care insurance conducted in Australia (Wu *et al.*, 2021), Canada (Boyer *et al.*, 2017), France (Courbage and Roudaut, 2008), Hong Kong (He and Chou, 2018), Spain

(Costa-Font and Rovira-Forns, 2008; Jiménez-Martín *et al.,* 2016), and the US (Brown and Finkelstein, 2008; Brown *et al.*, 2012; Chatterjee and Fan, 2017; Gottlieb and Mitchell, 2020; McGarry *et al.*, 2014; Schaber and Stum, 2007; Sloan and Norton, 1997; Van Houtven *et al.,* 2015). We note that these studies did not assess the demand for products that combine long-term care and home equity release (as in the present study).

Economic factors: As reported in Table 5.4, participants with higher self-reported household savings had a higher demand for long-term care insurance in all three tasks. Chatterjee and Fan (2017) and He and Chou (2018) also found that individuals with higher net non-housing wealth have a higher demand for long-term care insurance. The coefficient for self-reported household savings was largest for Choice Task 1 (LTCI purchased with savings). Furthermore, demand was higher for participants with a lower household income. Several studies found positive associations between income level and long-term care insurance demand (Schaber and Stum, 2007; Costa-Font and Rovira-Forns, 2008; Brown *et al.*, 2012; Jiménez-Martín *et al.,* 2016; Chatterjee and Fan, 2017). In Choice Task 1, participants with a lower self-reported value for their primary property had a significantly higher demand for long-term care insurance. This suggests that people with less precautionary savings (housing wealth is the main form of precautionary savings) would require higher coverage from long-term care insurance to plan for retirement. This observation aligns with Davidoff's (2009) argument that housing wealth is a substitute for long-term care insurance when housing wealth is illiquid. Since Choice Task 3 showed weak significance with a smaller coefficient, the presence of home reversions weakened the substitution effect.

Table 5.4: Explaining the demand for long-term care insurance.

	Demand for LTCI using Product S	Demand for LTCI using Product S + R	Demand for LTCI using Product S + H
Economic factors			
Household savings	0.619***	0.206***	0.216***
Household debt	0.227***	0.239***	0.272***
Household income	-0.086+	-0.129*	-0.129**
Social insurance	-0.038	-0.064	-0.276
Property value	-0.288***	-0.023	-0.081+
Mortgage amount	-0.028	-0.119	-0.147*
Demographic factors			
Age	0.013	0.002	0.016
Retired	0.056	0.104	0.073
Female	-0.018	-0.075	-0.071
Married	0.282+	0.423*	0.611***
1+ child	-0.045	0.198	-0.153
Daughter	-0.010	-0.093*	-0.114**
Child same HH	0.075	0.014	0.054
College above	0.043	-0.010	0.055
Tier 1 city	-0.131**	-0.144**	-0.161**
Health			
Health	-0.070	-0.014	-0.024
Life expectancy	-0.046	-0.094*	-0.098*
Smoker	0.023	-0.100+	-0.074
Personality and expectations			
Financial literacy and numeracy	0.032	-0.019	0.054
Awareness of financial products	-0.113*	-0.102+	-0.083
Awareness LTCI	0.067	0.124*	0.155**
Awareness RM	-0.023	-0.078	-0.061
House price expectations	0.034	0.142**	0.118*
Trust in banks	0.017	-0.002	0.016
Trust in insurer	0.039*	0.090***	0.084***
Thought of LTC	0.213***	0.264***	0.253***
Intended bequest	-0.203***	-0.273***	-0.280***
Product and survey understanding			
Subjective Product Understanding	0.245***	0.281***	0.292***
Product quiz	-0.016	-0.082+	-0.066
Survey clarity	0.024	0.015	0.039
Passed IMC	0.101	0.118	0.005

Continued on next page

Continuation of Table 5.4

Survey time	-0.018	0.007	0.045
Treatments			
Version R	-0.089*	-0.099*	-0.120**
High premium in example	0.059	0.048	0.061
Intercept	-4.249***	-3.279***	-3.323***
N	1,200	1,200	1,200
R^2	0.183	0.151	0.183

Notes: This table presents the results of beta regressions of the percentage of total wealth allocated to long-term care insurance on independent variables. Variables are defined in Appendix B. [+], [*], [**], and [***] denote statistical significance at the 10%, 5%, 1%, and 0.1% level, respectively.

Demographic factors: Similar to the results of McGarry *et al.* (2014) and Jiménez-Martín *et al.* (2016), there was no statistically significant link between long-term care insurance demand and age, retirement status, and gender. Married participants (including those in long-term relationships) had higher demand across all proposed products, which is in line with findings from Gottlieb and Mitchell (2020), but divergent from several other studies that found no link between marital status and long-term care insurance demand (Sloan and Norton, 1997; McGarry *et al.*, 2014; Jiménez-Martín *et al.,* 2016; Wu *et al.,* 2021). This might be because we asked individuals to assume that they were married in the hypothetical scenario in the choice task and the products offered were joint-life products. Thus, married participants could probably relate better to the task than single individuals. We also noted that 97.8% of the sample was married. When a home equity release was available to purchase long-term care insurance in Choice Tasks 2 (available to use reverse mortgages to fund for the long-term care insurance) and 3 (available to use home reversions to fund for the long-term care insurance), participants with a daughter indicated a lower demand for long-term care insurance. One of the explanations is that these participants expected to rely on their daughters to provide long-term care. Notably, there was no link between long-term care insurance demand and the participants' number of children, which is congruent with the findings of McGarry *et al.* (2014), Van

Houtven *et al.* (2015), and Wu *et al.* (2021). We also found that residents of Tier 2 cities had a higher demand for long-term care insurance.

Health: Similar to the results of Chatterjee and Fan (2017) and Gottlieb and Mitchell (2020), we found no significant link between subjective health and long-term care insurance. When home equity release was available for purchasing long-term care insurance in Choice Tasks 2 and 3, participants with a shorter subjective life expectancy indicated a higher demand for long-term care insurance. This finding differs from existing studies that found no relationship between subjective life expectancy and the demand for long-term care insurance (Sloan and Norton, 1997; Wu *et al.,* 2021). It is likely that participants with a shorter subjective life expectancy worried more about the risks of long-term care and thus purchased more long-term care insurance.

Personality and expectations: Participants who were familiar with fewer financial products had a higher demand for long-term care insurance in Choice Task 1 (only using savings to purchase the long-term care insurance). This might be because they did not know about other financial products (e.g., critical illness insurance and life annuities, both of which exist in China) that could be able to (partially) cover their long-term care expenditure. Participants who were aware of long-term care insurance before taking the survey had a higher demand for long-term care insurance in Choice Tasks 2 and 3 (when housing wealth could be used through reverse mortgages or home reversions). Additionally, participants who had higher house price growth expectations had a higher demand for long-term care insurance when housing wealth could be used. Moreover, participants who had thought about how to pay for long-term care expenses before participating in the survey allocated a significantly higher proportion of their total wealth to long-term care insurance in all tasks. This result aligns with the results of Courbage and Roudaut (2008), Brown *et al*. (2012), and Jiménez-Martín *et al.* (2016). The impact of trust in insurers and

thoughts about long-term care expenses were higher when housing wealth was available to finance long-term care insurance. Participants who stated that they were less certain about leaving an inheritance allocated more wealth to long-term care insurance in all tasks, which would leave less wealth for their estate. This result differs from the findings in Western countries (Brown *et al.*, 2012; Boyer *et al.*, 2017).

Product and survey understanding: Participants with higher subjective product understanding of all three products used a significantly higher percentage of total wealth to purchase long-term care insurance. The finding of a positive relationship between subjective understanding and demand for the product aligns with previous studies such as Davidoff *et al.* (2017) and Hanewald et al. (2020a), and the findings of the intensive margin in Chapter 4.

Treatments: Our survey included two random treatments. We randomized the order of the choice tasks as follows: After completing Choice Task 1, one group proceeded to Choice Task 2, followed by Choice Task 3, while the other group completed Choice Tasks 1, 3, and then 2. We found that participants who completed Choice Task 2 first allocated less wealth to long-term care insurance in all tasks.

We also randomized the numbers shown in the numerical example, as explained in Section 5.3. One group was shown a higher value allocated to long-term care insurance than the other group. Notably, there was no significant impact on the demand under this treatment.

Summary: Overall, we found plausible results for the effect of the independent variables on long-term care insurance demand. Our findings largely align with those of existing studies. The demand for long-term care insurance is higher when housing wealth is available to finance long-term care insurance. Moreover, the demand for long-term care insurance was higher for individuals with higher

savings and debt, less housing wealth, and those without daughters. Furthermore, long-term care insurance demand was higher for those with a shorter subjective life expectancy who were not aware of long-term care risks before taking the survey and had fewer bequest motives, higher trust in insurers, higher house price expectations, and higher subjective product understanding.

5.6   Conclusion

We conducted and analyzed an experimental online survey fielded to assess the potential demand for new public or private sector programs that allow individuals to access their housing wealth to purchase long-term care insurance, which pays an income when one or both of the couples are disabled. In our sample of 1,200 Chinese homeowners aged 45–64, we found that the stated demand for long-term care insurance in different hypothetical scenarios increased when individuals could use housing wealth in addition to savings to purchase long-term care insurance. Individuals preferred to access housing wealth via reverse mortgage loans rather than via home reversion, which involved the partial sale of housing wealth.

We identified the stated demand for all three proposed long-term care insurance products. On average, retirees were willing to use 5% of their hypothetical wealth to purchase long-term care insurance. The demand for long-term care insurance increased when the participants could access their (hypothetical) housing wealth. Under this scenario, they allocated an average of 15% of their total wealth to long-term care insurance when a reverse mortgage was available and 12% of their total wealth to long-term care insurance when home reversion was available. As stated by Davidoff (2010), housing wealth and long-term care insurance have a crowding-out effect. Through analyzing the results of this study, we found that the combination of home equity release and long-term care

insurance would eliminate this effect, despite Achous (2021) suggesting that the size of such elimination is limited.

We developed product designs associated with the descriptions and case studies that were well understood. Thus, these designs can be used to develop new public or private sector programs in China and other markets. For example, we included options for the homeowners' heirs to repay the reverse mortgage debt or buy back the home reversion share to keep the property upon contract termination.

Furthermore, we used regression results to identify factors driving the demand for the different long-term care insurance products in our study. Our findings indicate that individuals with more housing wealth would demand more long-term care insurance when home equity release is available for financing long-term care insurance. This result confirms the complementary nature of long-term care insurance and housing wealth when home equity release products are available (Davidoff, 2010). Participants expressed their interest in using the bundled products also aligns with existing optimal lifecycle studies that included long-term care insurance and home equity release products (Hanewald *et al*., 2016; Shao *et al.,* 2019). Participants who previously understand the costs of long-term care services also played an important role in the demand as they would be more likely to hedge the risk. In line with previous studies (Davidoff *et al*., 2017; Hanewald *et al*., 2020a) and the second substantive chapter of this thesis, we found that a subjective understanding of the products offered is important in determining the stated demand for the products.

Overall, our study documented a positive stated demand for a new financial arrangement that allows older homeowners to use their housing wealth to fund long-term care insurance. Hence, government and industry practitioners can consider developing a well-regulated commercial long-term care insurance market based on a three-step approach. The first step is to educate the public about the importance of long-term care to improve their awareness. The second

step is to develop commercial long-term care insurance as a supplement to the public long-term care scheme. The final step is to introduce home equity release as a financing mechanism for long-term care insurance. This approach can help retirees become familiar with long-term care and its insurance, thereby familiarizing them with the benefits of using housing wealth to fund long-term care insurance.

5.7   Appendix to Chapter 5

5.7.1 The pilot reverse mortgage product in China

Happy Life Insurance issued an income stream type RM. This contract has an embedded 'no negative equity guarantee', similar to the US home equity conversion mortgage (HECM). The 'no negative equity guarantee' property ensures that households do not have to pay anything out-of-pocket (except the housing asset) to terminate the contract. If the loan account balance is lower than the house price, the remaining proceeds will be delivered to the heirs of the household. Therefore, a household can enjoy the upside risk of the house price and the provider will bear the downside risk of the house price. It is important to note that when a household enters the contract, a loan account is set up. The loan amount will be settled when the household sells the property or passes away. The general income stream type reverse mortgage will deliver an amount of $x per month, and this amount will be added to the loan account. In addition, an interest rate of r% p.a. is charged each month on the loan account balance. The product issued by Happy Life Insurance is further split into two streams: 'with death benefit' and 'without death benefit'. For simplicity, further detail regarding the 'without death benefit' stream is presented. This product splits the retirement period of the household into two periods; the first N years is termed the 'deferred annuity premium paying period' and the second period the 'no premium required period'. In the first N years, apart from being charged $x per

month for the benefit received, the household is charged another amount, $y, annually, and this amount is also added to the loan account at the start of each year. This amount is treated as the premium for the deferred annuity. After N years, i.e. upon entering the second period of the contract, the households are neither charged x per month nor y per year, but they are still eligible to the benefit of $x per month. This is because the amount $y per year in the first N years covers the rest of the benefit, which is $x per month for the rest of the individual's life. This part can be treated as a deferred annuity. The interest rate charged each year on the loan account is fixed at the start of the contract, which is 5:5% p.a (the current conventional mortgage rate in China is around 5%). compounded monthly. Only individuals aged 60 to 85 are eligible to enter the contract.

The other stream of the product includes a death benefit. For this stream of the product, the deferred annuity component of the contract carries a 'Cash Value' such that when the contract is complete, the heirs of the household are eligible to receive the 'Cash Value' as a bequest. Therefore, the deferred annuity annual premium will be higher than the product without death benefit. In addition to the annual administrative fee and the one-off notary fee, a transaction fee and lawyer fee will be charged to the loan account. Table 5.5 illustrates the benefit received and the deferred annuity premium (in terms of RMB) paid by a male with starting age of 60 to 85 per RMB 1,000,000 housing assets.

Figure 5.9: Illustrative example of the Happy Life Insurance reverse mortgage for a male aged 60

Age	60	86
Events	Start of contract	End of period N
Amount add to loan each year	$12x + y$	0
Income per month	x	x

Table 5.5: Illustrative example of the Happy Life Insurance reverse mortgage for a male aged 60-85 to enter the contract comparing 'with death benefit' and 'without death benefit'.

Age	Without death benefit		With death benefit		Deferred annuity premium paying period
	Deferred annuity annual premium	Benefit per month	Deferred annuity annual premium	Benefit per month	
60	2,544	2,514	7,107	2,124	26
61	2,850	2,624	7,830	2,199	25
62	2,587	2,646	7,616	2,217	25
63	2,911	2,766	8,409	2,296	24
64	3,285	2,894	9,302	2,380	23
65	3,719	3,031	10,312	2,468	22
66	4,226	3,177	11,457	2,560	21
67	4,822	3,334	12,761	2,656	20
68	4,384	3,372	12,412	2,686	20
69	5,034	3,546	13,891	2,790	19
70	5,810	3,734	15,595	2,898	18
71	6,740	3,938	17,572	3,013	17
72	6,128	3,990	17,088	3,054	17
73	7,173	4,219	19,348	3,180	16
74	8,453	4,470	22,006	3,312	15
75	10,036	4,744	25,159	3,453	14
76	9,145	4,821	24,472	3,512	14
77	10,992	5,135	28,174	3,668	13
78	13,343	5,484	32,660	3,834	12
79	12,168	5,584	31,754	3,911	12
80	15,009	5,989	37,155	4,098	11
81	13,651	6,105	36,064	4,191	11
82	16,204	6,216	40,298	4,158	10
83	14,707	6,344	39,042	4,266	10
84	18,672	6,795	46,245	4,441	9
85	24,667	7,463	56,710	4,727	8

5.7.2 Variable definitions

Table 5.6: Variable definition of the regression in Chapter 5

Variable	Definition
Long-term care insurance demand	
Wealth allocated to long-term care insurance	A numerical variable that ranges between 0 and 1, the percentage of total wealth allocated to the long-term care insurance premium
Preferred scenario Product S/ Products S and R/ Products S and H	Indicator variable that equals one if the participant prefers the scenario in which only Product S is available/Products S and R are available/Product S and H are available and zero otherwise.
Economic factors	
Household savings	Indicator variable that equals one if the participant reports household savings excluding all properties (including saving accounts, term deposits, government bonds, stocks, shares in investment fund) above the sample median, and zero otherwise.
Household debt	Indicator variable that equals one if the participant reports household debt excluding all mortgages (including for example money borrowed from relatives, friends, or using credit cards, and bank loans other than mortgages above the sample median, and zero otherwise.
Household income	Indicator variable that equals one if the participant reports a household income (including bonuses and pension income) in the last year after paying tax and social security contribution above the sample median, and zero otherwise.
Social insurance	Indicator variable that equals one if the participant has social insurance, and zero otherwise
Property value	Indicator variable that equals one if the participant reports a property value (in RMB 1,000,000) above the sample median, and zero otherwise.
Mortgage amount	Indicator variable that equals one if the participant has a mortgage amount greater than the sample median, and zero otherwise.

Continuation of Table 5.6

Demographic factors	
Age	A polychotomous variable that equals one if the participant is 45-49 years and rising by one in five-year steps.
Retired	Indicator variable that equals one if the participant is retired, and zero otherwise.
Female	Indicator variable that equals one if the participant is female, and zero for male.
Married	Indicator variable that equals one if the participant is married (including living in a long-term partnership), and zero otherwise.
1+ child	Indicator variable that equals one if the participant has at least one child, and zero otherwise.
Daughter	Indicator variable that equals one if the participant has at least one daughter, and zero otherwise.
Child same household	Indicator variable that equals one if the participant has a child living in the same household, and zero otherwise.
College above	Indicator variable that equals one if the highest level of education attained by the participant is a college degree or above, and zero otherwise.
Tier 1 city	Indicator variable that equals one if the participant lives in a Tier I city, and zero otherwise.
Health	
Health	Indicator variable that equals one if the participant's self-rated health status on a five-point scale (1 = excellent … 5 = poor, coded reversely) is above the sample median, and zero otherwise.
Subjective life expectancy	Indicator variable that equals one if the participant's subjective life expectancy is above the sample median, and zero otherwise.
Smoker	Indicator variable that equals one if the participant is a current smoker, and zero otherwise

Personality and expectations

Continuation of Table 5.6

Financial literacy and numeracy	Indicator variable that equals one if the participant's financial literacy and numeracy score based on six questions are each above the sample median, and zero otherwise.
Awareness of financial products	Indicator variable that equals one if the number of the thirteen listed financial products that the participant had heard of is above the sample median, and zero otherwise.
Awareness of long-term care insurance	Indicator variable that equals one if the participant had heard of long-term care insurance before participating in the survey, and zero otherwise.
Awareness of RM	Indicator variable that equals one if the participant had heard of reverse mortgages before participating in the survey, and zero otherwise.
House price expectation	Indicator variable that equals one if the participant expects the value of the property to increase a lot (more than 20%) or increase moderately (5%-20%), and zero otherwise.
Trust in banks	Indicator variable that equals one if the participant's rating of the statement "Banks can generally be trusted" on an eleven-point scale (0 = Totally disagree… 10 = Totally agree) is above the sample median, and zero otherwise.
Trust in insurer	Indicator variable that equals one if the participant's rating of the statement "Insurance companies can generally be trusted." on an eleven-point scale (0 = Totally disagree… 10 = Totally agree) is above the sample median, and zero otherwise.
Thought of long-term care	Indicator variable that equals one if the participant has thought about how to pay for long-term care expenses before participating in the survey, and zero otherwise
Intended bequest	Indicator variable that equals one if the participant's rating of the statement "I would like to leave an inheritance." on an eleven-point scale (1 = Certainly not … 10 = Certainly yes) is above the sample median, and zero otherwise.

Product and survey understanding

Subjective product understanding	Indicator variable that equals one if the participant's self-rated product understanding in Tasks 1, 2, and 3 are all above the sample median, and zero otherwise.

Continuation of Table 5.6

Product quiz	Indicator variable that equals one if the participant's number of correct answers to the product quiz questions is above the sample median, and zero otherwise
Survey clarity	Indicator variable that equals one if the participant's rating of the survey's clarity on a six-point scale (1 = completely clear ... 6 = completely confusing, coded reversely) is above the sample median, and zero otherwise.
Passed IMC	Indicator variable that equals one if the participant answered the instructional manipulation check correctly, and zero otherwise.
Survey time	Indicator variable that equals one if the time taken by the participant to complete the survey was above the sample median, and zero otherwise.
Treatments	
Product R first	Indicator variable that equals one if the participant saw Product R before Product H, and zero otherwise.
High premium in example	Indicator variable that equals one if the participant saw the example with higher premiums

5.7.3 Pricing of the long-term care insurance products

5.7.3.1   CLHLS and CHARLS data

We use data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS) and the China Health and Retirement Longitudinal Study (CHARLS) to estimate the health transition model. CLHLS and CHARLS contain detailed information on health status, socioeconomic characteristics, family structure, and other demographic covariates of the elderly in different areas of China.

CLHLS is conducted by the Center for Healthy Aging and Family Studies at the National School of Development at Peking University. The baseline survey of CLHLS was conducted in 1998 and covered 22 provinces in China. The data were collected from face-to-face home-based interviews and physical capacity tests. The CLHLS targets the elderly aged 80 or above in the sample cities and rural areas. Follow-up surveys were conducted in 2000, 2002, 2005, 2008, 2011, 2014, and 2018, and these surveys contain replacements for deceased elderly. From 2002, CLHLS has been expanded to target a broader group of the population, including elderly aged 65 or above, and collects a large set of health, disability, demographic, family, socioeconomic, and behavioral risk factors.

CHARLS is conducted by the China Center for Economic Research at Peking University. The baseline survey of CHARLS was conducted in 2011 and 2012 and covered 28 provinces in China. The target population of these surveys is elderly aged 45 or above in the sample cities and rural areas. Follow-up surveys were conducted in 2013, 2015, and 2018.

We designed the experimental survey for this chapter in 2018-2019 and used CLHLS and CHARLS data for 2000-2015. Our sample includes individuals who are aged above 45 living in the urban area. The total sample size of the CLHLS and CHARLS is 28,354, but a lot of observations are in older ages. As the data

was not collected regularly, we use the age of each individual at the beginning and the end of the period to determine the transition period. We estimate the model using one-year age groups for the age range 65-99. We group all the individuals aged 100 or above in the "100+" group and those aged below 65 will be grouped in a five-year interval, i.e., 45-49, 50-54, 55-59, and 60-64. We estimate separate models for males and females.

We use ADL limitations as the measure of health states. Six ADL items were evaluated in both CLHLS and CHARLS: bathing, dressing, eating, using the toilet, continence, and transferring in and out of bed. Individuals reported their ability to perform these activities using three categories: do not need help, need partial help, and need full assistance. We classify an individual as being able to perform an ADL only if they do not need help. We define an individual as disabled if he/she has difficulties performing at least 3 of the ADLs. This definition is one of the triggers of benefit payments for many existing private critical illness insurance policies in China, such as the policies issued by Ping An Insurance and China Pacific Insurance.

We calculate the central exposed to risk for both healthy and disabled health states using the exact interview date, birth date, and death date. If these dates are missing, we use the 15th of the reported month. We assume that the transitions of health states happened in the mid-point between two survey waves.

5.7.3.2 Generalized linear model (GLM)

Following previous actuarial research (Renshaw and Haberman, 1995; Fong *et al.,* 2015; Hanewald *et al.,* 2019), we consider a Markov process as the basis for modeling long-term care status transitions and apply generalized linear models to estimate the transition probabilities. We consider a three-state Markov process as shown in Figure 5.10. The three health states are "N" (nondisabled), "F" (functionally disabled), and "D" (dead, absorbing state).

Figure 5.10: Three-State Markov Process.
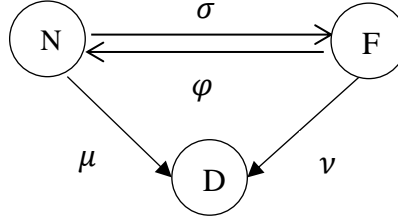
We consider four health transitions:

- $\sigma: N \to F$, the intensity for a healthy individual to become functionally disabled
- $\varphi: F \to N$, the intensity for a functionally disabled individual to recover
- $\mu: N \to D$, the mortality intensity for a healthy individual
- $\nu: F \to D$, the mortality intensity for a functionally disabled individual

The transition probabilities are assumed to follow a time-homogenous Markov process, which is time-independent, and where the transition probabilities only depend on the current state but not the history. So, we have the following equation:

$$P_{i,j}(x,t) = \Pr(S(x+t) = j | S(x) = i). \tag{5.1}$$

Under the GLM approach, there are three components to be specified: the probability distribution, the linear predictor, and the link function.

Probability distribution: The transition intensities of each one-year age group are assumed to be constant in a given time interval (between two survey waves), and the number of transitions is assumed to follow a Poisson distribution. In the following, we use the mortality intensities of a healthy individual at age x as an example to show the relationships of linear predictor and link function with the intensities. Let $n_x^{h,d}$ be the number of transitions from state H to D at age x:

$$n_x^{h,d} \sim \text{Poisson}(e_x^H \mu_x),$$

where e_x^H represents the central exposed to risk of the health state H at age x.

Linear predictor: Following Fong *et al.* (2015), we model the health transitions as polynomial functions of age. Therefore, the linear predictor is given by:

$$\eta_x = \beta_0 + \sum_{i=1}^{n} \beta_i x^i, \qquad (5.2)$$

where x represents the age, and β_i are the coefficients to be estimated.

Link function: We use the log link function $g(\cdot)$ as in Fong *et al.* (2015) and Hanewald *et al.* (2019). Following the example above, we have the following link function:

$$g(\mu_x) = \ln(\mu_x) = \eta_x. \qquad (5.3)$$

Model estimation

We use maximum likelihood estimation to estimate the parameters of the GLMs. Let Φ be the set of parameters. The log-likelihood function is given by (using the mortality intensities of a healthy individual as an example):

$$l(\Omega) = \sum_x \left[n_x \ln\left(e_x^H \mu_x(\Phi)\right) - e_x^H \mu_x(\Phi) \right] \qquad (5.4)$$

We use the Bayesian information criterion (BIC) to choose the functional form in Equation (2). We select the model with the smallest BIC value as the preferred model under the proposed GLM. Table 5.7 shows the BIC of the four nested models, while Table 5.8 shows the coefficients of the selected model.

Table 5.7: BIC for different nested models.

	Model	β_0	$\beta_0 + \beta_1 x$	$\beta_0 + \beta_2 x^2$	$\beta_0 + \beta_1 x + \beta_2 x^2$
σ	Male	1,036.37	441.51	**435.69**	438.06
	Female	1,500.77	**568.46**	577.09	569.48
μ	Male	3,835.29	546.23	644.36	**545.94**
	Female	4,577.01	531.58	727.17	**469.29**
γ	Male	314.21	296.92	301.7	**296.47**
	Female	460.75	**384.82**	388.77	389.2
ν	Male	618.98	**399.12**	409.57	401.4
	Female	613.21	**368.96**	374.31	373.34

Table 5.8: Coefficients of different nested models.

	Model	β_0	$\beta_0 + \beta_1 x$	$\beta_0 + \beta_2 x^2$	$\beta_0 + \beta_1 x + \beta_2 x^2$
σ	Male	-5.219***	--	9.414***	-5.219***
	Female	-6.231***	6.944***	--	-6.231***
μ	Male	-6.555***	1.182***	3.440*	-6.555***
	Female	-9.165***	22.599***	15.165***	-9.165***
γ	Male	-1.191***	-6.826**	7.124*	-1.191***
	Female	-1.135***	3.362***	--	-1.135***
ν	Male	-3.824***	5.557***	--	-3.824***
	Female	-3.843***	5.220***	--	-3.843***

After estimating the GLMs, we calculate the health state transition matrix. The following matrix is an example for a male aged x:

$$T_{male}(x, x+1) = \begin{bmatrix} p_{N,N}^{male}(x, x+1) & p_{N,F}^{male}(x, x+1) & p_{N,D}^{male}(x, x+1) \\ p_{F,N}^{male}(x, x+1) & p_{F,F}^{male}(x, x+1) & p_{F,D}^{male}(x, x+1) \\ 0 & 0 & 1 \end{bmatrix}, \quad (5.5)$$

where $p_{y,z}^{male}(x, x+1)$ is the transition probability that the individual transitions from health state y to health state z between age x and age $x + 1$.

Calculation of the long-term care insurance premium

In the experimental task, all individuals are assumed to be healthy and age 60 for males or 55 for females. To calculate the transition probabilities to age $60 + a$ of a healthy male aged 60, we use the following matrix multiplication:

$$\left[p_{h,h}^{male}(60,60+a) \quad p_{h,f}^{male}(60,60+a) \quad p_{h,d}^{male}(60,60+a)\right]$$

$$= \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \times \prod_{i=1}^{a} T_{male}(60+i-1,60+i). \tag{5.6}$$

Each entry of the resulting array is the probability of the transition from healthy to the corresponding health state at age $60+a$ of a healthy male aged 60. Assuming a limiting age of 100, we can use the above formula to obtain the transition probabilities to age 61 up to 100 by varying a from 1 to 40.

The long-term care insurance premium is given by the total expected present value of the benefit, which is the income when the individual becomes disabled. The formula for males is

$$\mathrm{E}\left[\mathrm{LTCI}^{male}\right] = \sum_{t=1}^{40} \mathrm{E}[benefit_t^{male}] \times DF_t, \tag{5.7}$$

where DF_t is the discount factor for the cash flow in t years' time. The long-term care insurance premium for females is calculated using the same methodology.

The long-term care insurance premium for a couple is given by:

$$\mathrm{E}[\mathrm{LTCI}^{total}] = \mathrm{E}\left[\mathrm{LTCI}^{male}\right] + \mathrm{E}\left[\mathrm{LTCI}^{female}\right]. \tag{5.8}$$

We assume a profit loading of 20% so that the final long-term care insurance premium is 1.2 times the expected present value.

5.7.3.3 Reverse mortgage

The initial loan of the reverse mortgage component is the price of long-term care insurance. We allow for a maximum loan-to-value ratio at the start of the contract of 40%. In the reverse mortgage pilot program in China, the interest rate charged is 5.5% p.a. plus annual management and policy fees. To simplify the fee structure, we assume no additional fees but instead assume a higher interest rate to capture the fees. We estimate that for an initial loan of RMB 1 million,

for a male aged 60 entered into the pilot reverse mortgage agreement, with a life expectancy of 30 years, the management fee is around 0.3% p.a. Therefore, we use an interest rate of 5.8% p.a. for the reverse mortgage loan.

5.7.3.4   Home reversion plan

Assuming a similar product design as in Alai *et al.* (2014), the home reversion contract involves selling a proportion κ of home equity to the contract provider to finance the long-term care insurance premium. A lease-for-life is embedded in the contract, which reflects the rent on the proportion of the home sold. Therefore, the sale proceeds consist of two components, the lease-for-life agreement and the amount that can be used to finance the long-term care insurance premium, so the following relationship holds:

$$\kappa H_0 = LL + amount\ can\ be\ used\ for\ LTC\ insurance, \qquad (5.9)$$

where H_0 is the current house price, and LL is the value of the lease-for-life agreement.

Let the rental yield be the constant RY. In each period, the value of the lease-for-life agreement would increase if they remain in the property. Assume the house price growth rate is g each year. Then, the EPV of the lease-for-life agreement is:

$$LL = \kappa H_0 \times \sum_{t=1}^{\omega-55} D_t \times RY \times (1+g)^t \times \Pr\left(\text{stay in the home}_t\right), \quad (5.10)$$

where ω is the limiting age, which is 100. $\Pr\left(\text{stay in the home}_t\right)$ is the probability that the couple will stay in the property for t years, which we calculate as:

$$\Pr(\text{stay in the home}_t) = 1 - \Pr(\text{moving out}_t)$$

$$= 1 - p_{h,f}^{male}(60,60+t) \times \left(p_{h,f}^{female}(55,55+t) + p_{h,d}^{female}(55,55+t)\right) \qquad (5.11)$$

$$- p_{h,d}^{male}(60,60+t) \times \left(p_{h,f}^{female}(55,55+t) + p_{h,d}^{female}(55,55+t)\right).$$

First, we compute the probability of the couple moving out of the property. The couple will need to move out of the property only when both are functionally disabled, one of them is dead and the other one is functionally disabled, or both are dead. As the sum of the probabilities of staying in the property and moving out of the property equals one, by rearranging the equation, the probability of staying in the property can be obtained. Therefore, to pay RMB 1 of long-term care insurance premium, the proportion of the property to sell is:

$$\kappa = \frac{1}{H_0 \times \left(1 - \sum_{t=1}^{\omega} D_t \times RY \times (1+g)^t \times \Pr(\text{stay in the home}_t)\right)} \ . \tag{5.12}$$

5.7.3.5   Data sources

Variable	Value	Note	Source
House price growth (p.a.)	5.00%	Annual house price growth in over 70 cities in China was 4.2% p.a. during 2005-2018. We round up to 5% p.a.	Residential Property Prices for China https://fred.stlouisfed.org/series/QCNN628BIS Retrieved on 20th January 2019.
Long-term care cost inflation (p.a.)	5.00%	The main cost of long-term care is the residential cost (Kalseth and Halvorsen, 2020). Therefore, we assume it has the same growth as the house price growth.	
Rental yield (p.a.)	1.80%	The rental yield of the major cities in China is around 1.8% in 2018.	Gross rental yields https://www.globalpropertyguide.com/Asia/china/Rental-Yields Retrieved on 20th January 2019.
Long-term care cost in 2018 (Tier 1 cities)/month	RMB 11,500 (USD 1,710)	Tier 1 cities are Beijing, Shanghai, Guangzhou, and Shenzhen, and other cities included in this study are Tier 2 cities. The cost is calculated from the average of each Tier.	Cost of residential nursing home per month https://www.daojia.com/jiage/bj/yanglaoyuan/ Retrieved on 12th January 2019.
Long-term care cost in 2018 (Tier 2 cities)/month	RMB 9,500 (USD 1,410)		
Discount rate (p.a.)	3.50%	Current inter-bank rates	https://tradingeconomics.com/china/interbank-rate

Chapter 6

Conclusion

This thesis discusses the benefits of using housing wealth for retirement planning and explores behavioral impediments to the low take-up rate of home equity release products and strategies. The output of this research addresses the gaps between the theoretical demand and actual utilization rate and recommends potential solutions to address the home equity release puzzle.

The research questions studied in this thesis include:

1. As measured by expected utility, what is the preferred approach (among downsizing, using reverse mortgages, PLS, and home reversions) for using home equity?
    a. What is the equivalent lump-sum gain compared to not utilizing housing wealth in retirement?
    b. For households with different economic situations and preferences, would the preferred approach for using home equity change?
2. What is the stated demand for reverse mortgages?
    a. Would information framing offset potential behavioral impediments on reverse mortgage demand?
    b. How does the stated demand for reverse mortgages differ for different types of retirees?
3. Will long-term care insurance demand be enhanced through access to housing wealth to finance the premium?
    a. How does the stated demand differ for different types of retirees?

> b. Which home equity release approach do retirees prefer to fund long-term care insurance premiums: reverse mortgages or home reversion?

We addressed the first main research question in Chapter 3. This chapter focused on quantifying the economic benefits of each home equity release approach to identify the preferred approach for different household types. Several studies using the lifecycle model have shown that using reverse mortgages and home reversion can maximize retirees' utility (Davidoff, 2009; Hanewald *et al.,* 2016; Shao *et al.*, 2019). We extended the literature by including the government-funded Pension Loans Scheme (PLS), downsizing, and other institutional settings (e.g., Australian Age Pension means tests, superannuation, and tax rules). We developed a simulation model under the expected utility framework to identify the preferred approach for different representative Australian retirees' portfolios and the corresponding lump-sum gain for each approach by comparing it against the benchmark case (where no housing wealth is used).In particular, we showed that there are economic benefits of utilizing home equity release, despite possible concerns about the risks associated with such products.

The results presented in Chapter 3 showed that most retired households should use the PLS to improve their retirement living standards. Using the PLS would be equivalent to giving the single female households an extra lump-sum payment of A\$30,000 to A\$500,000 (depending on their portfolios) under the baseline scenario, compared to those who do not utilize their housing wealth. The second most preferred approach is to employ private reverse mortgages, followed by home reversion schemes and downsizing. For households that need to extract more income or a large lump-sum at the beginning of their retirement, private reverse mortgages would be the preferred approach since these products are more flexible than the PLS. Home reversion schemes should be more economically favorable if households are pessimistic about house price growth in the future. Downsizing is not the preferred approach due to the high transfer

duty cost and the need to move out from one's current property, which leads to a loss of housing utility. As a result, Chapter 3 confirms that using home equity release products, such as the PLS and reverse mortgages, to plan for retirement in Australia is beneficial to retirees and can help retirees to improve retirement living standards through enhancing consumption while staying at the same home.

Since Chapter 3 demonstrated that using a home equity release approach to utilize housing wealth is an economically efficient approach to planning for retirement, Chapter 4 explored the stated demand for these products and investigated why relatively few retirees use home equity release products given that using these products results in economic gain. Stated demand studies in the literature (Davidoff *et al*., 2017; Dillingh *et al.* 2017; Hanewald *et al*., 2020) have focused on a list of reasons to explain the gap between the theoretical and actual demand (e.g., economic and demographic factors). This chapter used behavioral impediments and perceived product complexity to explain this disparity by conducting an experimental survey. Using a between-subjects design, participants entering the survey were randomly assigned to a treatment group with a basic explanation of the equity release product, or to one of four information treatments designed to address the various behavioral barriers.

The results presented in Chapter 4 demonstrated that the stated demand for reverse mortgages in Australia is high since 43% of participants expressed their interest in using Equity Release Product A (introduced in the survey). This study contributes to the literature by identifying that the amount borrowed when using equity release products can be significantly increased by addressing the potential for people to exclude housing wealth from their "retirement provision" mental account through information framing. We also found that high stated demand is linked to low non-housing wealth and that the greater use of housing wealth to fund retirement through an equity release product is significantly associated with having low income and a high subjective understanding of the reverse mortgage

product on offer. Furthermore, we demonstrated that providing a case study to participants greatly increased retirees' subjective understanding of the equity release product introduced in the survey. This result highlights a possible method for reducing the disparity between theoretical and actual equity release product demand. Furthermore, this chapter provided important evidence for global product providers and governments who want to encourage people to use housing wealth to finance retirement.

Besides improving retirement living standards, the literature suggests that using home equity release products improves long-term care risk management by complementing long-term care insurance demand (e.g., Davidoff *et al*., 2009; Hanewald *et al.,* 2016; Shao *et al.*, 2019). When housing wealth cannot be used as a financial resource to fund long-term care insurance premiums, housing wealth would crowd out the long-term care insurance demand since housing wealth is treated as precautionary savings (Boyer *et al.*, 2017; Costa-Font and Rovira-Forns, 2008). While combining home equity release products with long-term care insurance has been studied intensively from a theoretical perspective (e.g., Andrews and Oberoi, 2015; Mayhew *et al*., 2017; Hanewald *et al.,* 2021b; Mayhew *et al.,* 2021), this has not been intensively studied within the stated demand space. To fill this literature gap, we used survey methods to investigate the stated demand for new financial arrangements that allow individuals to access their housing wealth to purchase long-term care insurance. We designed, conducted, and analyzed an online experimental survey that was completed by 1,200 participants aged 45–64 who live in 49 of China's largest cities to determine the stated demand for long-term care insurance when individuals can (i) only use their savings, (ii) use their savings and a reverse mortgage loan, or (iii) use their savings and home reversion to fund the single upfront premium for long-term care insurance.

The results of Chapter 5 show that access to housing wealth increases the stated demand for long-term care insurance. When they could only use savings to finance the long-term care insurance premium, participants used an average of 5% of their total (hypothetical) wealth to purchase long-term care insurance. When they could use savings and a reverse mortgage, the survey participants used 15% of their total wealth to purchase long-term care insurance. With savings and home reversion, they used 12%. Notably, these results are consistent with existing theoretical studies. Hence, our results confirm that home equity release products are complementary to long-term care insurance from the stated demand perspective. These results can inform (i) countries such as China that aim to increase long-term care insurance coverage through government-funded schemes and develop a private market for commercial long-term care products; and (ii) the design of new public or private sector programs in other countries that allow individuals to access their housing wealth while continuing to live in their homes, in order to enhance the retirees' retirement outcome.

In summary, this thesis first identified the economic benefits of using home equity release approaches and the preferred approaches for different household types. Since using these approaches would benefit retirees economically (despite concerns about associated risks), we uncovered certain behavioral impediments to explain the low take-up rate of these products and proposed possible methods to improve the demand for—and understanding of—these products. Ultimately, we confirmed the complementary nature of long-term care insurance and home equity release products as an additional benefit of developing home equity release markets. The outcome of this thesis encourages industry practitioners and governments to consider developing home equity release markets to improve retiree living standards while reducing their reliance on government pension payments.

References

Abeler, J., & Marklein, F. (2017). Fungibility, labels, and consumption. *Journal of the European Economic Association*, 15(1), 99–127.

Achou, B. (2021). Housing liquidity and long-term care insurance demand: A quantitative evaluation. *Journal of Public Economics*, 194: 104353.

Agnew, J. R., Bateman, H., & Thorp, S. (2013). Financial literacy and retirement planning in Australia. *Numeracy,* 6(2), Article 7.

Agnew, J. R., Bateman, H., Eckert, C., Iskhakov, F., Louviere, J., & Thorp, S. (2018). First Impressions Matter: An Experimental Investigation of Online Financial Advice. *Management Science*, 64(1): 288–307.

Agnew, J. R., Anderson, L. R., Gerlach, J. R., & Szykman, L. R. "Who chooses annuities? An experimental investigation of the role of gender, framing, and defaults." *American Economic Review* 98.2 (2008): 418-22.

Allaire, B. T., Brown, D. S., & Wiener, J. M. (2016). Who wants long-term care insurance? A stated preference survey of attitudes, beliefs, and characteristics. *The Journal of Health Care Organization, Provision, and Financing*, 53: 1-8.

Ameriks, J., Briggs, J., Caplin, A., Shapiro, M. D., & Tonetti, C. (2016). The long-term-care insurance puzzle: Modeling and measurement. Working Paper w22726, National Bureau of Economic Research

Andrews, D., & Oberoi, J. (2015). Home equity release for long-term care financing: an improved market structure and pricing approach. *Annals of Actuarial Science*, 9(1): 85-107.

Arnsberger, P., Fox, P., Zhang, X., & Gui, S. (2000). Population aging and the need for long term care: A comparison of the United States and the Peoples Republic of China. *Journal of Cross-Cultural Gerontology*, 15(3): 207-227.

ASFA. (2021). ASFA retirement standard. Available at https://www.superannuation.asn.au/resources/retirement-standard, retrieved 15 August 2021.

Australian Bureau of Statistics (2019). *Gender Indicators, Australia*. Available at https://www.abs.gov.au/statistics/people/people-and-communities/gender-indicators-australia/nov-2019, retrieved 2 January 2021.

Australian Bureau of Statistics (2020a). *Household Income and Wealth, Australia: Age of Reference Person*. Available at

https://www.abs.gov.au/statistics/economy/finance/household-income-and-wealth-australia/latest-release, retrieved 15 August 2021.

Australian Bureau of Statistics (2020b). *Residential Property Price Indexes: Eight Capital Cities*. https://www.abs.gov.au/statistics/economy/price-indexes-and-inflation/residential-property-price-indexes-eight-capital-cities/latest-release, retrieved on 2 January 2021.

Australian Bureau of Statistics (2021a). *Consumer Price Index, Australia*. Available at https://www.abs.gov.au/statistics/economy/price-indexes-and-inflation/consumer-price-index-australia/latest-release, retrieved 2 July 2021.

Australian Bureau of Statistics (2021b). *Residential Property Price Indexes: Eight Capital Cities*. Available at https://www.abs.gov.au/statistics/economy/price-indexes-and-inflation/residential-property-price-indexes-eight-capital-cities/latest-release, retrieved 2 July 2021.

Australian Bureau of Statistics (2021c). *Average Weekly Earnings, Australia*. Available at https://www.abs.gov.au/statistics/labour/earnings-and-work-hours/average-weekly-earnings-australia/latest-release, retrieved 2 July 2021.

Australian Institute of Health and Welfare (2020). *Homeownership and housing tenure*. Available at https://www.aihw.gov.au/reports/australias-welfare/home-ownership-and-housing-tenure, retrieved on 2 January 2021.

Australian Prudential Regulation Authority (2020). *Quarterly Superannuation Statistics*. Available at https://www.apra.gov.au/quarterly-superannuation-statistics, retrieved 2 January 2021.

Australian Securities & Investments Commission (2018). *Review of reverse mortgage lending in Australia.* Available at https://download.asic.gov.au/media/4851420/rep-586-published-28-august-2018.pdf, retrieved on 2 January 2021.

Australian Treasury, 2020. *Retirement Income Review*. Canberra: Australian Government Treasury.

Bank for International Settlements. (2021). Residential property prices: detailed series. Available at https://www.bis.org/statistics/pp_detailed.htm?m=6%7C288%7C593, retrieved on 17 August 2021.

Basu, A. K., & Dulleck, U. (2020). Why do (some) consumers purchase complex financial products? An experimental study on investment in hybrid securities. *Economic Analysis and Policy*, 67: 203–220.

Bateman, H., Eckert, C., Geweke, J., Louviere, J., Satchell, S., & Thorp, S. (2014). Financial competence, risk presentation and retirement portfolio preferences. *Journal of Pension Economics & Finance*, 13(1): 27-61.

Bateman, H., Eckert, C., Iskhakov, F., Louviere, J., Satchell, S., & Thorp, S. (2018). Individual capability and effort in retirement benefit choice. *Journal of Risk and Insurance*, 85(2); 483–512.

Boland, L., Légaré, F., Perez, M. M. B., Menear, M., Garvelink, M. M., McIsaac, D. I., Guérard, G.P., Emond, J., Brière, N. & Stacey, D. (2017). Impact of home care versus alternative locations of care on elder health outcomes: an overview of systematic reviews. *BMC Geriatrics*, 17(1): 1-15.

Borghans, L., Duckworth, A. L., Heckman, J. J., & Ter Weel, B. (2008). The Economics and Psychology of Personality Traits. *Journal of Human Resources*, 43(4): 972-1059.

Boyer, M., De Donder, P., Fluet, C., Leroux, M. L., & Michaud, P. C. (2017). *Long-term care insurance: Knowledge barriers, risk perception and adverse selection* (No. w23918). National Bureau of Economic Research.

Bradbury, B. (2010). Asset rich, but income poor: Australian housing wealth and retirement in an international context. *FaHCSIA Social Policy Research Paper*, 41.

Bravo, J. M., Ayuso, M., & Holzmann, R. (2019). Making use of home equity: The potential of housing wealth to enhance retirement security. IZA Discussion Papers, No. 12656, Institute of Labor Economics (IZA), Bonn.

Brown, J. R., & Finkelstein, A. (2008). The interaction of public and private insurance: Medicaid and the long-term care insurance market. *American Economic Review*, 98(3): 1083-1102.

Brown, J. R., Goda, G. S., & McGarry, K. (2012). Long-term care insurance demand limited by beliefs about needs, concerns about insurers, and care available from family. *Health Affairs*, 31(6): 1294-1302.

Brown, J. R., Kapteyn, A., Luttmer, E. F., Mitchell, O. S., & Samek, A. (2021). Behavioral impediments to valuing annuities: Complexity and choice bracketing. *Review of Economics and Statistics*, 1–45.

Brown, J. R., Kling, J. R., Mullainathan, S., & Wrobel, M. V. (2008). Why don't people insure late-life consumption? A framing explanation of the under-annuitization puzzle. *American Economic Review*, 98(2), 304–309.

Cairns, A. J., Blake, D., & Dowd, K. (2006). A two-factor model for stochastic mortality with parameter uncertainty: theory and calibration. *Journal of Risk and Insurance*, 73(4), 687-718.

Chappell, N. & Kusch, K. (2007). The gendered nature of filial piety: a study among Chinese Canadians. *Journal of Cross-Cultural Gerontology*, 22(1): 29-45.

Chatterjee, S., & Fan, L. (2017). Household demand for private long term care insurance: An exploratory note. *Economics Bulletin*, 37: 1975-1981.

Chen, H., Cox, S. H., & Wang, S. S. (2010). Is the Home Equity Conversion Mortgage in the United States sustainable? Evidence from pricing mortgage insurance premiums and non-recourse provisions using the conditional Esscher transform. *Insurance: Mathematics and Economics*, 46(2), 371-384.

Chen, J., Hardin III, W., & Hu, M. (2020). Housing, wealth, income and consumption: China and homeownership heterogeneity. *Real Estate Economics*, 48(2): 373-405.

Chen, W., Koo, B., Wang, Y., O'Hare, C., Langrené, N., Toscas, P., and Zhu, Z. (2020). Using a stochastic economic scenario generator to analyse uncertain superannuation and retirement outcomes. *Annals of Actuarial Science*, 1-18.

China Insurance Regulatory Commission (2014). No. 53 of the Chinese Insurance Regulatory Commission, 2014: Guiding Opinions of the China Insurance Regulatory Commission on Carrying out the Pilot Program of the Elderly Housing Reverse Mortgage Pension Insurance. Available at http://www.pkulaw.cn/fulltext_form.aspx?Db=chl&Gid=228278, retrieved on 7 June 2018. In Chinese.

Cho, D., Hanewald, K., & Sherris, M. (2015). Risk analysis for reverse mortgages with different payout designs. *Asia-Pacific Journal of Risk and Insurance*, 9(1), 77-105.

Cho, S. W. S., & Sane, R. (2013). Means-tested age pensions and homeownership: Is there a link?. *Macroeconomic Dynamics*, *17*(6), 1281-1310.

Chomik, R., Graham, S., Yan, S., Bateman, H., and Piggott, J. (2018). *Part III - Private resources*. Retirement income in Australia. Australian Research Council (ARC) Centre of Excellence in Population Ageing Research (CEPAR).

Cocco, J. and Lopes, P., (2020). Aging in Place, Housing Maintenance, and Reverse Mortgages. *The Review of Economic Studies*, 87; 1799-1836.

Corelogic (2020). *Monthly Chart Pack: August 2020*. Retrieved from http://reports.corelogic.com.au/CL-HOUSING-MARKET-UPDATE/CL-HOUSING-MARKET-UPDATE-F3B53C88.pdf, retrieved on 8 September 2020.

Costa-Font, J. (2010). Family ties and the crowding out of long-term care insurance. *Oxford Review of Economic Policy*, 26(4): 691-712.

Costa-Font, J., & Rovira-Forns, J. (2008). Who is willing to pay for long-term care insurance in Catalonia? *Health Policy*, 86(1): 72-84.

Costa-Font, J., Elvira, D., & Mascarilla-Miró, O. (2009). Aging in place? Exploring elderly people's housing preferences in Spain. *Urban Studies*, 46(2): 295-316.

Courbage, C. & Roudaut, N. (2008). Empirical evidence on LTCI purchase in France. *The Geneva Papers on Risk and Insurance-Issues and Practice*, 33(4): 645-658.

Daley, J., & Coates, B. (2018). *Money in Retirement: More Than Enough*. Melbourne: Grattan Institute.

Davidoff, T. (2009). Housing, Health and Annuities. *Journal of Risk and Insurance*, 76(1): 31-52.

Davidoff, T. (2010). Home equity commitment and long-term care insurance demand. *Journal of Public Economics*, 94(1–2):44–49.

Davidoff, T., Gerhard, P., & Post, T. (2017). Reverse Mortgages: What homeowners (Don't) Know and How It Matters. *Journal of Economic Behavior and Organization*, 133(1): 151-171.

Deng, Y., Fang, H., Hanewald, K., & Wu, S. (2021). Delay the Pension Age or Adjust the Pension Benefit? *Implications for Labor Supply and Individual Welfare in China (No. w28897)*. National Bureau of Economic Research.

Dillingh, R., Prast, H., Rossi, M., & Brancati, C. U. (2017). Who wants to have their home and eat it too? Interest in reverse mortgages in the Netherlands. *Journal of Housing Economics*, 38: 25-37.

Ding, J. (2014). Essays on post-retirement financial planning and pension policy modelling in Australia (Ph.D. dissertation), Macquarie University, Sydney, Australia.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., & Wagner, G. G. (2011). Individual risk attitudes: Measurement, determinants, and behavioral consequences. *Journal of the European Economic Association*, 9(3): 522-550.

Dong, F., Liu, J., Xu, Z., & Zhao, B. (2021). Flight to housing in China. *Journal of Economic Dynamics and Control*, 130, 104189.

Eyres, J., (2018, August 28). CBA, Bankwest, Heartland warned by ASIC over reverse mortgages. *Australian Financial Review*, Available at: https://www.afr.com/companies/financial-services/cba-bankwest-

heartland-warned-by-asic-over-unfair-reverse-mortgages-20180828-h14lg1, retrieved on 2 August 2021.

Fang, H., & Feng, J. (2018). The Chinese pension system. NBER Working Paper No. 25088. National Bureau of Economic Research.

Fang, H., Gu, Q., Xiong, W., & Zhou, L. A. (2016). Demystifying the Chinese housing boom. *NBER Macroeconomics Annual*, 30(1): 105-166.

Feng, Z. (2018). In: Zang, X., Zhao, LX., eds. Filial piety and old-age support in China: tradition, continuity, and change. *Handbook on the family and marriage in China.* Cheltenham: Edward Elgar Publishing, 266 – 285.

Feng, Z., Glinskaya, E., Chen, H., Gong, S., Qiu, Y., Xu, J., & Yip, W. (2020). Long-term care system for older adults in China: policy landscape, challenges, and future prospects. *The Lancet*, 396(10259): 1362-1372.

Ferrari, S., & Cribari-Neto, F. (2004). Beta regression for modelling rates and proportions. *Journal of Applied Statistics*, 31(7): 799-815.

Fong, J., Mitchell, O., & Koh, B. (2021). Asset-rich and cash-poor: Which older adults value reverse mortgages? *Ageing and Society*, 1-18.

Fornero, E., Rossi, M., & Brancati, M. C. U. (2016). Explaining why, right or wrong, (Italian) households do not like reverse mortgages. *Journal of Pension Economics and Finance*, 15(2): 180–202.

Fox O'Mahony, L., & Overton, L. (2015). Asset-based welfare, equity release and the meaning of the owned home. *Housing Studies*, 30(3), 392–412.

General Office of the State Council of PRC (2013). No. 35 of the State Council, 2013: State Council Opinions on Accelerating Development of the Elderly Care Service Industry. Available at http://www.gov.cn/zwgk/2013-09/13/content_2487704.htm, retrieved on 7 September 2021. In Chinese.

General Office of the State Council of PRC (2020). 14th Five-Year Plan (2021-2025) for National Economic and Social Development and the Long-Range Objectives Through the Year 2035. Available at https://new.qq.com/omn/20210313/20210313A04AA900.html, retrieved on 17 August 2021. In Chinese.

General Office of the State Council of PRC (2020). No. 37 of the State Council, 2020: Guiding Opinions of the National Healthcare Security Administration and the Ministry of Finance on the Expansion of Pilot Programs for Long-term Care Insurance System. Available at http://www.gov.cn/gongbao/content/2020/content_5570107.htm, retrieved on 17 August 2021. In Chinese.

Gottlieb, D., & Mitchell, O. S. (2020). Narrow Framing and Long-Term Care Insurance. *Journal of Risk and Insurance*, 87(4): 861-893.

Haffner, M. E., Ong, R., & Wood, G. A. (2015). Mortgage equity withdrawal and institutional settings: An exploratory analysis of six countries. *International Journal of Housing Policy*, 15(3): 235-259.

Hanewald, K., Bateman, H., Fang, H., & Wu, S. (2020a). Is There a Demand for Reverse Mortgages in China? *Journal of Economic Behavior and Organization,* 169: 19-37.

Hanewald, K., Bateman, H., Sun, K. (2021, May 17). *Budget changes make Pension Loans Scheme more attractive to senior homeowners*, Available at: https://www.businessthink.unsw.edu.au/articles/pension-loans-scheme, retrieved on 2 August 2021.

Hanewald, K., Eaton, R., and Ho, T. L. (2020b). The Home Stretch: Accessing Home Value to Fund Long-Term Care, *Long-Term Care News*. November 2020, Society of Actuaries.

Hanewald, K., Li, H., & Shao, A. W. (2019). Modelling multi-state health transitions in China: a generalised linear model with time trends. *Annals of Actuarial Science*, 13(1): 145-165.

Hanewald, K., Post, T., & Sherris, M. (2016). Portfolio Choice in Retirement – What is The Optimal Home Equity Release Product? *Journal of Risk and Insurance*, 83(2): 421-446.

He, A. J., & Chou, K. L. (2020). What Affects the Demand for Long-Term Care Insurance? A Study of Middle-Aged and Older Adults in Hong Kong. *Journal of Applied Gerontology*, 39(4): 413-422.

Holzmann, R. (2005). *Old-age income support in the 21st century: An international perspective on pension systems and reform.* World Bank Publications.

Holzmann, R., Ayuso, M., Alaminos, E., & Bravo, J. M. (2019). Life cycle saving and dissaving revisited across three-tiered income groups: Starting hypotheses, refinement through literature review, and ideas for empirical testing. IZA Discussion Papers, No. 12655, Institute of Labor Economics (IZA), Bonn.

https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/6523.02017-18?OpenDocument, retrieved on 2 January 2021.

Hughes, D., (2018, October 22). CBA and Bankwest axe reverse mortgages amid rising costs and tougher scrutiny. *Australian Financial Review*, Available at: https://www.afr.com/wealth/cba-and-bankwest-axe-reverse-mortgages-amid-rising-costs-and-tougher-scrutiny-20181022-h16xqk, retrieved on 2 August 2021.

Iskhakov, F., Thorp, S., & Bateman, H. (2015). Optimal annuity purchases for Australian retirees. *Economic Record*, 91(293): 139-154.

James, A., Rowley, S., Stone, W., Parkinson, S., Spinney, A., & Reynolds, M. (2019). Older Australians and the housing aspirations gap, *Australian Housing and Urban Research Institute*. AHURI Report No. 317.

Jefferson, T., Austen, S., Ong, R., Haffner, M. E. A., & Wood, G.A. (2017). Housing equity withdrawal: Perceptions of obstacles among older Australian home owners and associated service providers. *Journal of Social Policy*, 46(3): 623–642.

Jiménez-Martín, S., Labeaga-Azcona, J. M., & Vilaplana-Prieto, C. (2016). Interactions between Private Health and Long-term Care Insurance and the Effects of the Crisis: Evidence for Spain. *Health Economics*, 25: 159-179.

Kahneman, D., & Tversky, A. (1984). Choices, values, and frames. *The American Psychologist*, 39(4), 341–350.

Knaack, P., Miller, M., & Stewart, F., (2020). *Reverse mortgages, financial inclusion, and economic development: Potential benefit and risks*. World Bank.

Ku, L., Liu, F., & Wen, M. (2013). Trends and determinants of informal and formal caregiving in the community for disabled elderly people in Taiwan. *Archives of Gerontology and Geriatrics*, 56(2): 370-376.

Lambregts, T. R., & Schut, F. T. (2020). Displaced, disliked and misunderstood: A systematic review of the reasons for low uptake of long-term care insurance and life annuities. *The Journal of the Economics of Ageing*, 17: 100236.

Levin, L. (1998). Are assets fungible? Testing the behavioral theory of life-cycle savings. *Journal of Economic Behavior & Organization*, 36(1): 59–83.

Li, F., & Otani, J. (2018). Financing elderly people's long-term care needs: Evidence from China. *The International Journal of Health Planning and Management*, 33(2): 479-488.

Li, H., Wang, M., & Shen, S. (2021, August 13). The long-term care insurance system has been piloted for 5 years, with 134 million people participating. *People's Daily,* Available at: http://money.rednet.cn/content/2021/08/13/9775941.html, retrieved on 17 August 2021. In Chinese.

Lin, W. (2014). Challenges of long-term care provisions for the elderly in urban China. *China: An International Journal*, 12(2): 144-160.

Lipkus, I. M., Samsa, G., & Rimer, B. K. (2001). General performance on a numeracy scale among highly educated samples. *Medical Decision Making*, 21(1): 37-44.

Lockwood, L., (2018). Incidental Bequests and the Choice to Self-Insure Late-Life Risks. *American Economic Review*, 108(9), pp.2513-2550.

Lu, B., Liu, X., and Yang, M. (2017). A budget proposal for China's public long-term care policy. *Journal of Aging & Social Policy*, 29(1): 84-103.

Lusardi, A., & Mitchell, O. S. (2011). Financial literacy and planning: Implications for retirement wellbeing. *NBER Working Paper No. w17078*. National Bureau of Economic Research.

Lusardi, A., & Mitchell, O. S. (2014). The economic importance of financial literacy: Theory and evidence. *Journal of Economic Literature*, 52(1): 5–44.

Ma, S. and Deng, Y. (2006). *Insurance premium structure of reverse mortgage loans in Korea*. Social Science Research Network Working Paper Series.

Mayhew, L., Rickayzen, B., & Smith, D. (2021). Flexible and affordable methods of paying for long-term care insurance. *North American Actuarial Journal*, 25(sup1): 196-214.

Mayhew, L., Smith, D., & O'Leary, D. (2017). Paying for care costs in later life using the value in people's homes. *The Geneva Papers on Risk and Insurance-Issues and Practice*, 42(1): 129-151.

Melbourne Institute of Applied Economic & Social Research (2021) Poverty Line, Australia, March Quarter 2021. Available online at: https://melbourneinstitute.unimelb.edu.au/__data/assets/pdf_file/0007/3889393/Poverty-Lines-Australia-March-2021.pdf, retrieved on 2 October 2021.

McCullagh, P., & Nelder, J. A. (1989). *Generalized Linear Models*, 2nd ed. London: Chapman and Hall.

McGarry, B.E., Temkin-Greener, H., Li, Y., (2014). Role of Race And Ethnicity In Private Long-Term Care Insurance Ownership. *Gerontologist,* 54: 1001-1012

Mi, H., Fan, X., Lu, B., Cai, L., & Piggott , J. (2020). Preparing for population ageing: Estimating the cost of formal aged care in China. *The Journal of the Economics of Ageing*, 17: 100183.

Mitchell, O. S., & Piggott, J. (2004). Unlocking housing equity in Japan. *Journal of the Japanese and International Economies*, 18(4): 466–505.

Moulton, S., Loibl, C., & Haurin, D. (2017). Reverse mortgage motivations and outcomes: Insights from survey data. *Cityscape*, 19(1): 73–98.

Nakajima, M. and Telyukova, I., (2017). Reverse Mortgage Loans: A Quantitative Analysis. *The Journal of Finance*, 72(2): 911-950.

NSW Revenue. (2021). Taxes, duties, levies and royalties. Available at https://www.revenue.nsw.gov.au/taxes-duties-levies-royalties/transfer-duty, retrieved on 15 August 2021.

OECD. (2020). Instructional manipulation checks: Detecting satisficing to increase statistical power. OECD Publishing, Paris, available at https://www.oecd.org/health/health-systems/Spending-on-long-term-care-Brief-November-2020.pdf, retrieved on 15 August 2021.

Olsberg, D., Winters, M. (2005). *Ageing in place: intergenerational and intrafamilial housing transfers and shifts in later life*. Tech. Rep. 88. Australian Housing and Urban Research Institute, Melbourne.

Ong, R., (2008). Unlocking Housing Equity Through Reverse Mortgages: The Case of Elderly Homeowners in Australia. *European Journal of Housing Policy*, 8(1): 61-79.

Ong, R. (2016). Financing aged care: The role of housing wealth and intergenerational relationships. *Population Ageing*, 281-297.

Ong, R., Wood, G. A., Austen, S., Jefferson, T., & Haffner, M. E. (2015). Housing equity withdrawal in Australia: Prevalence, patterns and motivations in mid-to-late life. *Housing Studies*, 30(7): 1158–1181.

Oppenheimer, D. M., Meyvis, T., & Davidenko, N. (2009). Instructional manipulation checks: Detecting satisficing to increase statistical power. *Journal of Experimental Social Psychology*, 45(4): 867–872.

Pauly, M. V. (1990). The Rational Nonpurchase of Long-Term Care Insurance. *Journal of Political Economy*, 98(1): 153-168.

People's Bank of China (2020). Survey of Households' Assets and Liabilities of Urban Residents in China 2019. Statistics and Analysis Department, People's Bank of China, available at http://www.pbc.gov.cn/diaochatongjisi/116219/116227/index.html, retrieved on 15 August 2021.

Price, W. (2018). *Designing Pension Systems with Coherent Funded Private Pillars Including Issues for Notional Defined Contribution Schemes*. Policy Research Working Paper, No. 8420, World Bank Group.

Productivity Commission (2015). *Housing Decisions of Older Australians*, Commission Research Paper. Canberra: Productivity Commission.

Ratcliffe, J., Chen, G., Cleland, J., Kaambwa, B., Khadka, J., Hutchinson, C., & Milte, R. (2020). *Australia's aged care system: Assessing the views and preferences of the general public for quality of care and future funding*. Caring Futures Institute, Flinders University, South Australia.

Read, D., Loewenstein, G. & Rabin, M. (1999). Choice bracketing. *Journal of Risk and Uncertainty,* 19(1-3): 171–197.

Reserve Bank of Australia (2021). *Cash Rate Target*. Available at https://www.rba.gov.au/statistics/cash-rate, retrieved 2 July 2021.

Rosanes, M. (2021). The 10 biggest mortgage lenders in Australia. *Mortgage Professional Australia,* Mortgage Professional Australia Magazine, 26 May 2021, https://www.mpamagazine.com.au/sections/features/the-10-biggest-mortgage-lenders-in-australia-277054.aspx, retrieved on 30 June 2021.

Rowland, D. (2009). *Global population aging: History and prospects.* In P. Uhlenberg (ed.). International Handbook of Population Ageing. Heidelberg, Germany: Springer Netherlands.

Samek, A., & Sydnor, J. R. (2020). *Impact of Consequence Information on Insurance Choice* (No. 28003). Cambridge, the USA: National Bureau of Economic Research, Inc.

Services Australia. (2021) Age component amount. Available at https://www.servicesaustralia.gov.au/individuals/services/centrelink/pension-loans-scheme/how-much-you-can-get/maximum-loan-amount/age-component-amount, retrieved on 15 August 2021.

Schaber, P. L., & Stum, M. S. (2007). Factors impacting group long-term care insurance enrollment decisions. *Journal of Family and Economic Issues*, 28(2): 189-205.

Scheil-Adlung, X. (2015). *Long-term care protection for older persons: a review of coverage deficits in 46 countries*. ILO. Available at https://www.ilo.org/secsoc/information-resources/publications-and-tools/Workingpapers/WCMS_407620/lang--en/index.htm, retrieved on 12 September 2021.

Seniors First (2019). *The history of reverse mortgage loans in Australia*. Available at: https://www.seniorsfirst.com.au, retrieved on 2 August 2021.

Shao, A. W., Chen, H., & Sherris, M. (2019). To borrow or insure? Long term care costs and the impact of housing. *Insurance: Mathematics and Economics*, 85:15-34.

Shao, A. W., Hanewald, K., & Sherris, M. (2015). Reverse mortgage pricing and risk analysis allowing for idiosyncratic house price risk and longevity risk. *Insurance: Mathematics and Economics*, 63: 76–90.

Shefrin, H. M., & Thaler, R. H. (1988). The behavioral life-cycle hypothesis. *Economic Inquiry*, 26(4), 609–643.

Simpkins, S., (2021, September 17). Reverse mortgage lenders tapping 1.5% of market: Deloitte. *Mortgage Business*, Available at:

https://www.mortgagebusiness.com.au/breaking-news/16055-reverse-mortgage-lenders-tapping-1-5-of-market-deloitte, retrieved on 17 September 2021.

Sloan, F. A., & Norton, E. C. (1997). Adverse selection, bequests, crowding out, and private demand for insurance: evidence from the long-term care insurance market. *Journal of Risk and Uncertainty*, 15(3): 201-219.

Thaler, R. H. (1999). Mental accounting matters. *Journal of Behavioral Decision Making*, 12(3):, 183–206.

The Australian Government the Treasury (2020). *Retirement Income Review: Final Report*. Available at: https://treasury.gov.au/sites/default/files/2020-11/p2020-100554-complete-report.pdf, retrieved 21 November 2020.

Thomas, S., Sinclair, S., de Silva, A., & Leong, A. (2020). *Report Release: Reverse Mortgages: Financing Ageing in Place.* Available at: https://sites.rmit.edu.au/placemakingeconomicsgroup/2020/11/20/report-release-reverse-mortgages-financing-ageing-in-place/, retrieved 2 January 2021.

Thorp, S., Kingston, G., & Bateman, H. (2007). Financial engineering for Australian annuitants. *Retirement Provision in Scary Markets. Edward Elgar, Cheltenham*, 123-44.

Toussaint, J. (2011). Housing assets as a potential solution for financial hardship: Households' mental accounts of housing wealth in three European countries. *Housing, Theory and Society*, 28(4), 320–341.

United Nations. (2020). World Population Prospects 2019. Available at https://population.un.org/wpp/Download/Standard/Population/, retrieved on 17 August 2021.

United States Census Bureau: Table 17. *Quarterly Homeownership Rates by Family Income: 1994 to Present*. Available at https://www.census.gov/housing/hvs/data/histtab17.xlsx, retrieved on 2 January 2021.

Van Houtven, C. H., Coe, N. B., & Konetzka, R. T. (2015). Family Structure and Long-Term Care Insurance Purchase. *Health Economics*, 24: 58-73.

Villegas, A., Kaishev, V. K., & Millossovich, P. (2018). StMoMo: An R package for stochastic mortality modelling. *Journal of Statistical Software*, 84(1), 1-38.

Wang, F., & Ran, G. (2019). Excessive Financial Support, Real Estate Development and Macroeconomic Growth: Evidence from China. *Emerging Markets Finance and Trade*, 55(11): 2437-2447.

Wiener, J. M., Feng, Z., Zheng, N. T., & Song, J. (2018). In: Glinskaya, E., & Feng, Z. (Eds.). Long-term care financing: issues, options, and implications for China. *Options for Aged Care in China*, World Bank, Washington, DC (2018), 191-209.

Wu, S., Bateman, H., Stevens, R., & Thorp, S. (2021). Flexible insurance for informal long-term care: A study of stated preferences. *ARC Centre of Excellence in Population Ageing Research (CEPAR) Working Paper 2021/17*.

Yang, Z., Fan, Y., & Cheung, C. H. Y. (2017). Housing assets to the elderly in urban China: To fund or to hedge? *Housing Studies*, 32(5): 638–658.

Yeoh, Y., 2021. *Reverse Mortgage Providers in Australia*. Ibis World. https://www.ibisworld.com/au/industry/reverse-mortgage-providers/4206/, retrieved on 30 June 2021.

Yogo, M., (2016). Portfolio Choice in Retirement: Health Risk and the Demand for Annuities, Housing, and Risky Assets. *Journal of Monetary Economics*, 80, 17-34.

Yu, Y. (2021). The most updated list of China cities (17 May 2021). *China Business Network,* available at: https://www.yicai.com/news/101063860.html, retrieved on 13 August 2021. In Chinese.

Zeng, Y., & Hesketh, T. (2016). The effects of China's universal two-child policy. *The Lancet*, 388(10054): 1930-1938.

Zhang, C. Y., & Sussman, A. B. (2018). Perspectives on mental accounting: An exploration of budgeting and investing. *Financial Planning Review*: 1(1–2), e1011.

Zhang, X., & Lv, J. (2001). The state of institutionalization in Shanghai and its policy strategy. *Housing Technology*, 8: 28-30. [in Chinese]

Zimmer, Z. (2005). Health and living arrangement transitions among China's oldest-old. *Research on Aging*, 27(5): 526-555.

Zweifel, P., & Courbage, C. (2016). Long-Term Care: Is There Crowding Out of Informal Care, Private Insurance as Well as Saving? *Asia-Pacific Journal of Risk and Insurance*, 10(2): 107-132.

Zweifel, P., & Struwe, W. (1996). Long-Term Care Insurance and Bequests as Instruments for Shaping Intergenerational Relationships. *Journal of Risk and Uncertainty,* 12(1): 65-76.

Zweifel, P., & Struwe, W. (1998). Long-Term Care Insurance in a Two-Generation Model. *Journal of Risk and Insurance*, 12: 13-32.

Appendix A

Survey screenshots of Chapter 4: Demand for reverse

mortgages: Behavioral explanations

ONLINE PARTICIPATION INFORMATION STATEMENT
Reverse Mortgage Demand: The Role of Mental Accounting
Professor Hazel Bateman

1. What is the research study about?
You are invited to take part in this research study. The research study aims to analyse the demand for a reverse mortgage product. You have been invited because you meet the sample criteria, and your contact details were obtained from the web panel provider Pureprofile. The reverse mortgage product we study is a type of loan that allows you to borrow money using the equity in your home as security. The loan can be taken as a lump sum, a regular income stream, a line of credit or a combination of these options.

2. Who is conducting this research?
The study is being carried out by the following researchers:

Roles in this research	Name	University
Chief investigators	Professor Hazel Bateman	UNSW Sydney
	Dr Katja Hanewald	UNSW Sydney
Partner investigators	Dr Josh Funder	Household Capital
	Mr David Cash	Household Capital
Student investigator	Mr Tin Long Ho	UNSW Sydney

Research Funder: This research is being funded by UNSW Business School and Household Capital Pty Ltd.

3. Inclusion/Exclusion Criteria
Before you decide to participate in this research project, we need to ensure that it is ok for you to take part. The research study is looking to recruit people who meet the following criteria:
  ○ Aged 60-80
  ○ Own at least one residential property in Australia

4. Do I have to take part in this research study?
Participation in any research study is voluntary. If you do not want to take part, you do not have to.
  ○ Read the information carefully;
  ○ Complete the online questionnaire.

5. What does participation in this research require, and are there any risks involved?
If you decide to take part in the research study, we will ask you to complete an online questionnaire. The questionnaire will ask you to make a hypothetical choice concerning a reverse mortgage product and to answer some general questions. It should take approximately 25 minutes to complete.

You will be rewarded with an applicable amount of panel points for 25 minutes of your time. You will also be paid a bonus amount of between $0 and around $3 in panel points depending on your number of correct answers in a product comprehension check.

If you experience discomfort or feelings of distress while participating in the research and you require support, you can stop participating at any time

6. What are the possible benefits to participation?
We hope to use information we get from this research study to benefit others who are making financial plans for their retirement.

7. What will happen to information about me?
Submission of the online questionnaire is an indication of your consent. By ticking the 'I agree to participate' button you are providing your permission for the research team to collect and use information about you for the research study. Your data will be kept for a period of 5 years after the publication of the research results. We will store information about you in a non-identifiable format on a server at the University of New South Wales. Your questionnaire responses will only be used for academic research purposes.

8. How and when will I find out what the results of the research study are?
The research team intend to publish and report the results of the research study in a variety of ways. All information published will be done in a way that will not identify you.

The results will also be made available on the website of CEPAR:
http://www.cepar.edu.au/publications/working-papers

9. What if I want to withdraw from the research study?
If you do consent to participate, you may withdraw at any time. You can do this by closing the questionnaire. If you withdraw from the research, we will destroy any information that has already been collected. Once you have submitted the questionnaire however, we will not be able to withdraw your responses as the questionnaire is anonymous.

10. What should I do if I have further questions about my involvement in the research study?
The person you may need to contact will depend on the nature of your query. If you require further information regarding this study or if you have any problems which may be related to your involvement in the study, you can contact the following member/s of the research team:

Research Team Contact

Name	Professor Hazel Bateman
Position	Professor, UNSW Sydney
Telephone	+61 2 9385 3096
Email	h.bateman@unsw.edu.au

Name	Dr. Katja Hanewald
Position	Senior Lecturer, UNSW Sydney
Telephone	+61 2 9385 6174
Email	k.hanewald@unsw.edu.au

11. What if I have a complaint or any concerns about the research study?
If you have a complaint regarding any aspect of the study or the way it is being conducted, please contact the UNSW Human Ethics Coordinator:

Complaints Contact

Position	Human Research Ethics Coordinator
Telephone	+61 2 9385 6222
Email	humanethics@unsw.edu.au
HC Reference Number	HC190557

Consent Form - Participant providing own consent

Declaration by the participant

- I understand I am being asked to provide consent to participate in this research study;
- I have read the Participant Information Sheet or it has been provided to me in a language that I understand;
- I provide my consent for the information collected about me to be used for the purpose of this research study only.
- I freely agree to participate in this research study as described and understand that I am free to withdraw at any time during the study and withdrawal will not affect my relationship with any of the named organisations and/or research team members;
- I understand I can indicate my interest to receive a copy of the study results by submitting my details below and ask that they be used for this purpose only;

  ○ I agree to participate in this research and tick all boxes above to continue

  ○ I do not wish to participate in this research study

Welcome

The purpose of this survey is to learn more about how you make financial decisions for retirement.

Please note that due to the nature of this survey you will be asked questions about your personal information such as your age and assets. To participate in this survey, you MUST answer these questions as we need your answers to be able to ask you only relevant questions. Your answers to these questions are confidential and cannot be used to identify you personally.

About you

What is your age?

[⌄]

What is your gender?

○ Male

○ Female

What is your martial status?

○ Married

○ Living in a long-term relationship

○ Never married and not living in a long term (de facto) relationship

○ Separated but not divorced

○ Divorced

○ Widowed

Do you?

○ Own (or are buying) your home

○ Rent your home

○ Other (Please specify:)

Survey Information

The rest of this survey consists of 4 parts:

- Part 1: Retirement financial planning decisions
- Part 2: Questions on planning and personality traits
- Part 3: Questions on financial skills and knowledge
- Part 4: Questions on personal characteristics

You will receive a **basic payment** in panel points for completing this survey. In addition, you can receive a **bonus payment** of up to $3.00 in panel points. Your bonus payment will depend on the answers you give in a product knowledge check at the end of Part 1. The questions will test your understanding of the information we introduce in the survey; they are not testing general knowledge.

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Part 1: Retirement financial planning decisions

In the next few screens, we will ask you to read some information about retirement financial planning and then answer a number of questions. **Please read this information carefully.**

Expenditure in retirement

Below are some expenditures people make in retirement.

Please think about your retirement and report in the Table below.

- Which of these expenditures can you easily cover in retirement?
- Which of these expenditures are difficult for you to cover in retirement?
- Which of these expenditures are not relevant for you to cover in retirement?

	Easy	Difficult	Not relevant
Regular expenses (on items such as food, clothing, transport, council rates, utility bills, household goods and services, leisure activities)	☐	☐	☐
Repay your home loan and/or other debts	☐	☐	☐
Renovate your home	☐	☐	☐
Support family members (such as providing home deposits or paying educational expenses)	☐	☐	☐
Pay for health insurance and/or medical expenses	☐	☐	☐
Pay for aged care, either in-home care and/or residential care	☐	☐	☐
Pay for holidays and travel	☐	☐	☐
Other (Please specify:)	☐	☐	☐

Household assets and debts

Below are some assets and income sources people can rely on to cover their expenditures in retirement.

Which of the following do you and your spouse or partner own?

	Own	Do not own
Own home	○	○
Superannuation	○	○
Financial assets such as **cash** including bank accounts, currency, CDs, notes; **fixed interest** investments such as bonds, debentures, term deposits and; **equities** such as shares, units in trusts, mutual funds, warrants, convertibles, derivatives	○	○
Investment properties and private businesses such as farms and family businesses	○	○
Other assets	○	○

Do you, or are you likely to receive the Age Pension?

- ⚪ Yes
- ⚪ No

Equity Release Product

Equity Release Product A is a type of loan that allows you to borrow money using the equity in your home as security. The loan can be taken as a lump sum, a regular income stream, a line of credit or a combination of these options.

Interest is charged like any other loan, except you don't have to make repayments while you live in your home - the interest compounds over time and is added to your loan balance. You remain the owner of your home and can stay in it for as long as you want.

You must repay the loan in full (including interest and fees) when you sell or move out of your home or, in most cases, if you move into aged care, or die.

While no income is required to qualify, credit providers are required by law to lend you money responsibly, so not everyone will be able to obtain this type of loan.

> **You may continue in 20 seconds**

Before taking this survey, had you ever heard of such an equity release product?

- ⚪ Yes
- ⚪ No

Do you have a reverse mortgage?

- ⚪ Yes
- ⚪ No

When did you take out this reverse mortgage?

[⌄]

What was the initial loan amount?

$ _____

How did you choose to take out the loan?
Please select all that apply.

- ☐ Lump sum
- ☐ Regular income stream
- ☐ Line of credit
- ☐ Other

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Example

The following example illustrates how Equity Release Product A works.

Judy and Michael are a retired couple both aged 70. To cover their expenditures in retirement, they can rely on their own home in Keilor, Victoria, the Age Pension and their superannuation.

Judy and Michael can easily cover regular expenses on items such as food, clothing, transport, and energy bills, but they have difficulties in covering other expenditures such as:

- Home renovations to make their home more 'age-friendly'.
- Helping their granddaughter pay the deposit for her first home.
- Travel to Europe

Judy and Michael decide to use their home as security to take out Equity Release Product A. They take the loan amount as a combination of a lump sum and a regular income stream.

These arrangements will not affect the Age Pension they receive.

When the couple move out and sell the property, they will use the payment to repay the loan. The couple or their estate never have to pay more than the value of the house to repay the loan.

> You may continue in 10 seconds

How do you rate your understanding of Equity Release Product A?

- ○ Completely clear
- ○ Mostly clear
- ○ Sometimes clear
- ○ Sometimes confusing
- ○ Mostly confusing
- ○ Completely confusing

Retirement financial planning

In retirement people can rely on their **wealth – INCLUDING THEIR HOME** – and the **Age Pension** (if eligible) to cover their expenditures.

You have indicated the following levels of difficulty to cover your expenditures in retirement:

Regular expenses (on items such as food, clothing, transport, energy bills, council rates, household goods and services, leisure activities)	Easy
Repay your home loan and/or other debts	Easy
Renovate your home	Easy
Support family members (such as providing home deposits or paying educational expenses)	Easy
Pay for health insurance and/or medical expenses	Easy
Pay for aged care, both in-home care and/or residential care	Easy
Pay for holidays and travel	Easy
N/A	Easy

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Equity release product choice task

Please read this information carefully

Assume that you are now offered Equity Release Product A described earlier to help cover your expenditures in retirement. The product allows you to borrow up to $400,000 of your home value and the loan amount can be taken as a lump sum, a regular income stream, a line of credit or a combination of these options. The current interest rate for Equity Release Product A is 5.15% p.a. An establishment fee of 1.5% of your loan amount is charged at the beginning of the agreement.

Assume that any Age Pension you receive (if eligible) is not affected by payments from Equity Release Product A.

How much (if at all) would you borrow from your home using Equity Release Product A?

Please use the slider below to indicate the amount you would choose to borrow. You can position the slider anywhere on the line, but you need to move it at least once before you can continue. **If you DON'T want to borrow from your home, please place the slider at $0.** The **outcome** of your decision will appear in a table below.

	$0	
Equity Release Product A:		
	$0	$400,000

	$0	
Equity Release Product A:		
	$0	$400,000

Outcome		
1. Amount you choose to borrow		**$0**
2. Use of loan amount	Income from Equity Release Product A, in addition to other income you receive in retirement such as the Age Pension (if eligible) OR	**$0**
	A payout as a lump sum from Equity Release Product A OR	**$0**
	A line of credit from Equity Release Product A OR	**$0**
3. Your projected home equity after 10 years (at age 76, assuming you take out your chosen loan amount)	Percentage of home equity remaining	**100%**
	Value of home equity	**$1,343,916**

Set 1 of 3

How would you use the payments you could receive from Equity Release Product A?

For the following possible expenditure categories in retirement, please indicate the most important and the least important to you:

	Most important	Least important
Regular expenses (on items such as food, clothing, transport, council rates, utility bills, household goods and services, leisure activities)	○	○
Repay your home loan and/or other debts	○	○
Renovate your home	○	○
Support family members (such as providing home deposits or paying educational expenses)	○	○
Pay for health insurance and/or medical expenses	○	○
Pay for aged care, either in-home care and/or residential care	○	○
Pay for holidays and travel	○	○

Set 2 of 3

How would you use the payments you could receive from Equity Release Product A?

Of the remaining 5 possible expenditure categories in retirement, please indicate the most important and the least important to you:

	Most important	Least important
Regular expenses (on items such as food, clothing, transport, council rates, utility bills, household goods and services, leisure activities)	○	○
Support family members (such as providing home deposits or paying educational expenses)	○	○
Pay for health insurance and/or medical expenses	○	○
Pay for aged care, either in-home care and/or residential care	○	○
Pay for holidays and travel	○	○

Set 3 of 3

How would you use the payments you could receive from Equity Release Product A?

Of the remaining 3 possible expenditure categories in retirement, please indicate the most important and the least important to you:

	Most important	Least important
Pay for health insurance and/or medical expenses	○	○
Pay for aged care, either in-home care and/or residential care	○	○
Pay for holidays and travel	○	○

Product knowledge check

We will now test your knowledge and understanding of **Equity Release Product A**.

Please indicate whether the following statements are **true** or **false**.

	True	False
The loan amount from Equity Release Product A can only be taken as a lump sum	○	○
The payments from Equity Release Product A can be used for many purposes, including to support children and/or grandchildren	○	○
You are required to make interest payments throughout the life of the loan	○	○
You have the right to live in your property while you are alive	○	○
The loan provider may sell your property after you (and your spouse or partner) have moved to aged care permanently and use the sale proceeds to repay the loan you borrowed	○	○
Your estate will be liable to pay any additional money if the sale of the proceeds are insufficient to cover the loan	○	○

Satisfaction with Equity Release Product A decision

You have chosen to borrow from your home with Equity Release Product A. Why didn't you choose a larger loan amount?

Please select all that apply to you.

- ☐ I do not need more money from Equity Release Product A to cover my expenditures in retirement
- ☐ The property has an emotional value to our family
- ☐ I want to leave my property to my children or grandchildren
- ☐ I am concerned that my children and/or grandchildren would not approve
- ☐ I want to have as little debt as possible
- ☐ I think this product is too complex
- ☐ I do not think this product is a good deal
- ☐ I think this product will make my financial situation riskier
- ☐ I have heard bad news about similar products
- ☐ I would worry about being evicted from my home
- ☐ Other (Please specify)

Please indicate the extent with which you agree with the statements below using a scale from 1 to 7 where 1 means "strongly disagree" and 7 means "strongly agree". You can also use the values in-between to indicate where you fall on the scale.

	1	2	3	4	5	6	7
	Strongly disagree						Strongly agree
The availability of Equity Release Product A makes me <u>less worried</u> about my long-term retirement funding	☐	☐	☐	☐	☐	☐	☐
The availability of Equity Release Product A makes me more <u>confident</u> that I can sustain my current lifestyle	☐	☐	☐	☐	☐	☐	☐

Part 2: Planning and personality traits

In this part of the survey we are going to ask you some questions about planning and your personality traits.

People use different time horizons when they decide how much of their income to spend, and how much to save. Which of the time horizons mentioned below is in your household MOST important with regard to planning expenditures and savings?

- ○ The next fortnight/month
- ○ The next couple of months
- ○ The next year
- ○ The next one to 5 years
- ○ The next 5 to 10 years
- ○ More than 10 years from now

Which of the following best describes your current work status?

- ○ Retired
- ○ Employed full time
- ○ Employed part time
- ○ Unemployed
- ○ Not in the labour force - Stay-at-home parent or caregiver
- ○ Not in the labour force - Other

At what age did you retire?

[▽]

Which of the following best describes the current work status of your spouse or partner?

- ○ Retired
- ○ Employed full time
- ○ Employed part time
- ○ Unemployed
- ○ Not in the labour force - Stay-at-home parent or caregiver
- ○ Not in the labour force - Other

At what age did your spouse or partner retire?

[⌄]

Think about your knowledge of financial planning for retirement. Please indicate the extent with which you agree with the statements below using a scale from 1 to 7, where 1 means "strongly disagree" and 7 means "strongly agree". You can use the values in-between to indicate where you fall on the scale.

	1	2	3	4	5	6	7
	Strongly disagree						Strongly agree
I am very knowledgeable about financial planning for retirement							
When I have a need for financial services, I know exactly where to obtain information on what to do							
I am knowledgeable about how the Age Pension works							
I am knowledgeable about how superannuation and investments work							

For many households, overall spending changes upon retirement. Please indicate below what your experience has been:

- ○ My household had no change in spending at retirement
- ○ My household has spent more after retirement than before
- ○ My household has spent less after retirement than before

Do you think you can use your own home to cover your expenditures in retirement?

- ○ Yes
- ○ No

Over the last 5 years, do you think the value of your home:

- ○ Increased a lot (greater than 20%)
- ○ Increased moderately (between 5% and 20%)
- ○ Remained rather stable (between 5% and -5%)
- ○ Decreased moderately (between -5% and -20%)
- ○ Decreased a lot (greater than -20%)

In the next 5 years, do you think the value of your home will:

- ○ Increase a lot (greater than 20%)
- ○ Increase moderately (between 5% and 20%)
- ○ Remain rather stable (between 5% and -5%)
- ○ Decrease moderately (between -5% and -20%)
- ○ Decrease a lot (greater than -20%)

Read the following statements and indicate the extent to which you agree using a scale from 1 to 7, where 1 means 'strongly disagree' and 7 means 'strongly agree'. You can also use the values in-between to indicate where you fall on the scale.

	1	2	3	4	5	6	7
	Strongly disagee						Strongly agree
I follow the advice to save for a rainy day							
I enjoy thinking about how I will live years from now in the future							
The distance future is too uncertain to plan for							
The future seems very vague and uncertain to me							
I pretty much live on a day-to-day basis							
I enjoy living for the moment and not knowing what tomorrow will bring							

According to Australian Bureau of Statistics, Australian males at your age are on average expected to live to age 85. To what age do you think you will live?

[⌄]

According to Australian Bureau of Statistics, Australian males of the age of your spouse or partner are on average expected to live to age 81. To what age do you think your spouse of partner will live?

[⌄]

Does anyone ever help you...

	Yes	No
Dress, including putting on shoes and socks?	○	○
Bathe or take a shower?	○	○
Eat, such as cutting up your food?	○	○
Get in or out of bed?	○	○
Use the toilet, including getting up and down?	○	○

How would your describe your health?

○ Excellent
○ Very good
○ Good
○ Fair
○ Poor

How do you see yourself: Are you generally an impatient person or someone who always shows great patience?
Please select a response on the scale where 0 means 'very impatient' and 10 means 'very patient'.

0	1	2	3	4	5	6	7	8	9	10
Very impatient										Very patient

How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?
Please select a response on the scale where 0 means 'not prepared to take risks' and 10 means 'fully prepared to take risks'.

0	1	2	3	4	5	6	7	8	9	10
Not prepared to take risks										Fully prepared to take risks

How do you see yourself: Are you generally an optimistic person?
Please select a response on the scale where 0 means 'pessimistic' and 10 means 'optimistic'.

0	1	2	3	4	5	6	7	8	9	10
Pessimistic										Optimistic

In these questions we ask you to describe your own personality traits and habits.

Please indicate how well each of the following describes you.

	A lot	Somewhat	A little	Not at all
Organised	○	○	○	○
Responsible	○	○	○	○
Hardworking	○	○	○	○
Careless	○	○	○	○
Thorough	○	○	○	○

Please tell us how often you do each of the following:

	Very often	Often	Sometimes	Rarely	Never	Don't know
Spend too much money	○	○	○	○	○	○
Buy things on impulse	○	○	○	○	○	○
Buy things you hadn't planned to buy	○	○	○	○	○	○
Buy things you don't really need	○	○	○	○	○	○

Do you (and your spouse or partner)?

- ○ Own (or are buying) your home
- ○ Rent your home
- ○ Other (Please specify)

Have you seen this question before?

- ○ Yes
- ○ No

Part 3: Financial skills and knowledge

In this part of the survey, we will ask you questions about financial skills and knowledge.

On a scale of 1 to 7, where 1 means 'very low' and 7 means 'very high', how would you assess your understanding of finance?

Very low 1	2	3	About average 4	5	6	Very high 7

Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?

- ○ More than $102
- ○ Exactly $102
- ○ Less than $102
- ○ Do not know

Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?

- ○ More than today
- ○ Exactly the same
- ○ Less than today
- ○ Do not know

Please evaluate whether this statement is true or false. *'Buying shares in a single company usually provides a safer return than buying units in a managed share fund'.*

- ○ True
- ○ False
- ○ Do not know

Suppose you owe $1,000 on a loan and the interest rate you are charged is 20% per year compounded annually. If you didn't pay anything off, at this interest rate how many years would it take for the amount you owe to double?

- ○ Less than 2 years
- ○ At least 2 years but less than 5 years
- ○ At least 5 years but less than 10 years
- ○ At least 10 years
- ○ Do not know

Suppose you take out a loan of $100,000 at an interest rate of 7% per year compounded annually. How much will you owe the lender in 10 years?

- ○ About $100,000
- ○ About $107,000
- ○ About $170,000
- ○ About $200,000
- ○ About $250,000
- ○ Do not know

Imagine that we rolled a fair, six-sided die 1,000 times. Out of 1,000 rolls, how many times do you think the die would come up even?

[_____] times

In a lottery, the chance of winning a $500 prize is 1%. What is your best guess of how many people would win the prize if 1,000 people each buy a single ticket in the lottery?

[_____] people

In a raffle, the chance of winning a car is 1 in 1,000. What per cent of tickets in the raffle win a car?

[_____] %

Have you ever used any of the following financial products?

	Yes	No
Bank accounts	○	○
Fixed-term deposit	○	○
Government bonds	○	○
Shares (Stocks)	○	○
Managed share fund	○	○
Credit card	○	○
Superannuation	○	○
Account-based pension	○	○
Life insurance	○	○
Aged care insurance	○	○
Total and permanent disability insurance	○	○
Trauma insurance	○	○
Income protection insurance	○	○
Life annuity	○	○
Pension loan scheme	○	○
Private health insurance	○	○

Part 4: Questions on personal characteristics

We will now ask you questions on demographics and your personal characteristics.

Assets and debts

You previously nominated the following types of assets that you and your spouse or partner own.

For each type of asset, please enter the approximate value. You should report the current value of these assets, <u>without deducting</u> any debt and without including the income generated by the assets.

Please enter a whole number in each box with no $ sign, decimals or commas.

Your own home	$	1000000
Superannuation	$	
Financial assets	$	
Investment properties and private businesses	$	
Other assets	$	

Which of the following types of debt do you and your spouse or partner owe?
Please select all that apply.

- Home loan on own home (mortgage)
- Outstanding credit card or store card balances
- Car loans, hire purchase agreements or other personal loans
- Loans to purchase investment properties or other investment loans (such as loans to buy financial assets or shares)
- Overdrafts or business loans
- Other loans (such as, amounts you borrowed from family or friends)
- I don't have any debts

You have nominated the following types of debt that you and your spouse or partner have. **For each type of debt, please enter the approximate amount outstanding.**
Please enter a whole number in each box with no $ sign, decimals or commas.

Home loan on own home (mortgage)	$	

Part 4: Questions on personal characteristics

We will now ask you questions on demographics and your personal characteristics.

Which of the following categories best describes your home?

- ○ House
- ○ Apartment
- ○ Other

How long have you lived in your home?

- ○ Less than 1 year
- ○ 1-4 years
- ○ 5-10 years
- ○ 11-20 years
- ○ More than 20 years

How long do you intend to stay in your home?

- ○ Less than 1 year
- ○ 1-4 years
- ○ 5-10 years
- ○ 11-20 years
- ○ More than 20 years

Which of the following categories best describes your weekly (annual) gross personal income (before tax)?

[⌄]

Which of the following categories best describes your weekly (annual) gross household income (before tax)?

[⌄]

Do you and/or your spouse or partner receive the Age Pension?

- ○ Yes, full Age Pension
- ○ Yes, part Age Pension
- ○ No

How much Age Pension do you and/or your spouse or partner receive each fortnight?

$ [_____] per fortnight

What is the highest level of school you have completed?

- ○ Year 9 or below
- ○ Year 10 or equivalent
- ○ Year 11 or equivalent
- ○ Year 12 or equivalent
- ○ Certificate or equivalent from TAFE or equivalent
- ○ Advanced Diploma or Diploma from University/TAFE or equivalent
- ○ Bachelor Degree or equivalent
- ○ Graduate Diploma or Graduate Certificate from University or equivalent
- ○ Master Degree or equivalent
- ○ PhD

Who is most responsible for the everyday financial decisions in your household?

- ○ I am
- ○ Someone else
- ○ Someone else and I are equally responsible

Who is most responsible for the major financial decisions in your household?

- ○ I am
- ○ Someone else
- ○ Someone else and I are equally responsible

How many people in your household do you fully or partially support financially?

- ○ 1 (myself)
- ○ 2
- ○ 3
- ○ 4 or more

Thinking about the past year, how does your income compare with your expenses?

- ○ My expenses were far greater than my income
- ○ My expenses were slightly greater than my income
- ○ My expenses and my income were about equal
- ○ My income was slightly greater than my expenses
- ○ My income was far greater than my expenses

Do you use a financial advisor?

- ○ Yes
- ○ No

How many children do you have?

[⌄]

Please answer the following questions about each child:

	Age	Gender	Where does this child live?
Child 1	⌄	⌄	⌄
Child 2	⌄	⌄	⌄
Child 3	⌄	⌄	⌄

Have you set aside part of your wealth that you will definitely give away to family or other beneficiaries <u>while you are alive</u>?

- ○ Yes
- ○ No

Have you set aside part of your wealth that you will definitely give away to family or other beneficiaries <u>after you pass away</u>?

- ○ Yes
- ○ No

On a scale from 1 to 7, where 1 means 'don't trust at all' and 7 means 'fully trust', how much trust do you have in each of the following:

	1	2	3	4	5	6	7
	Don't trust at all						Fully trust
Your bank							
Non-bank mortgage lenders							
Your financial advisor							
The Government							
Your main superannuation fund							

Please provide the postcode of your home address:

[   ]

On a scale from 1 to 7, where 1 means 'no impact' and 7 means 'large impact', how do you assess the impact of the coronavirus on your financial situation?

No impact						Large impact
1	2	3	4	5	6	7

On a scale from 1 to 7, where 1 means 'no impact' and 7 means 'large impact', how do you assess the impact of coronavirus on your health and wellbeing?

No impact						Large impact
1	2	3	4	5	6	7

How clear do you think the questions in this survey are?

- ○ Completely clear
- ○ Mostly clear
- ○ Sometimes clear
- ○ Sometimes confusing
- ○ Mostly confusing
- ○ Completely confusing

Questionnaire feedback and submission

Before you submit the survey, if you have any opinions regarding this survey, please type in the box below. This will help us to improve our future surveys. Thank you very much for participating.

Note: Your details are not linked to your survey responses and are saved in a separate database. They will only be retained for the purpose of sending a copy of the study results in the future.

Name: _____

Address: _____

Email Address: _____

Submit

Appendix B

Survey screenshots of Chapter 5: Long-term care insurance financing using home equity release: Evidence from an experimental study

cepar ARC CENTRE OF EXCELLENCE IN POPULATION AGEING RESEARCH			**UNSW** SYDNEY
ARC Centre of Excellence in Population Ageing Research (CEPAR)			
ONLINE PARTICIPANT INFORMATION STATEMENT			
Long-term care financing using home equity release			
Professor Hazel Bateman			

Participant Information Statement

1.What is the research study about?

You are invited to take part in this research study. The research study aims to analyse a new method to finance long-term care cost using housing wealth. You have been invited because you meet the sample criteria, and your contact details were obtained from the research company dataSpring.

2.Who is conducting this research?

The study is being carried out by the following researchers:

Roles in this research	Name	University
Chief investigator	*Professor Hazel Bateman*	*University of New South Wales (Australia)*
Partner investigators	*Professor Hanming Fang* *Dr Katja Hanewald*	*University of Pennsylvania (USA)* *University of New South Wales (Australia)*
Student investigator	*Mr Tin Long Ho*	*University of New South Wales (Australia)*

Research Funder: This research is being funded by the University of Pennsylvania.

3.Inclusion/Exclusion Criteria

Before you decide to participate in this research project, we need to ensure that it is ok for you to take part. The research study is looking recruit people who meet the following criteria:

- Aged 45-64
- No difficulties in performing any of the activities of daily living
  - Bathing
  - Dressing
  - Toileting
  - Transferring
  - Continence
  - Feeding
- Own at least 1 residential property in a major city in China
- Have the urban "hukou" of the city that you live in

4.Do I have to take part in this research study?

Participation in any research study is voluntary. If you do not want to take part, you do not have to.

If you decide you want to take part in the research study, you will be asked to:
- Read the information carefully;
- Complete the online questionnaire.

5.What does participation in this research require, and are there any risks involved?

If you decide to take part in the research study, we will ask you to complete an online questionnaire. The questionnaire will ask you to undertake several hypothetical tasks concerning products to finance long-term care and to answer some general questions. It should take approximately 25 minutes to complete.

You will be given a certain amount of incentives for your participation in the online survey. You may also be paid bonus incentives depending on the number of correct answers given in a quiz in the survey.

If you experience discomfort or feelings of distress while participating in the research and you require support, you can stop participating at any time.

6.What are the possible benefits to participation?

We hope to use information we get from this research study to benefit others who are making financial plans for their retirement.

7.What will happen to information about me?

Submission of the online questionnaire is an indication of your consent. By clicking the 'I agree to participate' button you are providing your permission for the research team to collect and use information about you for the research study. Your data will be kept for a period of 5 years after the publication of the research results. We will store information about you in an in a non-identifiable format on a server at the University of New South Wales. Your questionnaire responses will only be used for academic research purposes. The information collected for this research project may be made available to other research projects in non-identified form only.

8.How and when will I find out what the results of the research study are?

The research team intend to publish and report the results of the research study in a variety of ways. All information published will be done in a way that will not identify you.

If you would like to receive a copy of the results you can let the research team know by adding your email or postal address within the consent form. We will only use these details to send you the results of the research. The results will also be made available via the website of CEPAR:
http://www.cepar.edu.au/publications/working-papers.

9.What if I want to withdraw from the research study?

If you do consent to participate, you may withdraw at any time. You can do this by closing the questionnaire. If you withdraw from the research, we will destroy any information that has already been collected. Once you have submitted the questionnaire however, we will not be able to withdraw your responses as the questionnaire is anonymous.

10.What should I do if I have further questions about my involvement in the research study?

The person you may need to contact will depend on the nature of your query. If you require further information regarding this study or if you have any problems which may be related to your involvement in the study, you can contact the following member/s of the research team:

Research Team Contact

Name	Dr. Katja Hanewald
Position	Senior Research Fellow, CEPAR, University of New South Wales
Telephone	+61 2 9385 6174
Email	k.hanewald@unsw.edu.au

What if I have a complaint or any concerns about the research study?

If you have a complaint regarding any aspect of the study or the way it is being conducted, please contact the UNSW Human Ethics Coordinator:

Complaints Contact

Position	Human Research Ethics Coordinator
Telephone	+ 61 2 9385 6222
Email	humanethics@unsw.edu.au
HC Reference Number	HC190103

1%	Next >>

Consent Form – Participant providing own consent

You are invited to take part in this research study. The research study aims to analyse a new method to finance long-term care cost using housing wealth.

To participate in the survey, you MUST answer these questions as we need your answers to be able to ask you only relevant questions. Your answers to these questions are confidential, and cannot be used to identify you personally.

Declaration by the participant

☑ I understand I am being asked to provide consent to participate in this research study;

☑ I have read the Participant Information Sheet or it has been provided to me in a language that I understand;

☑ I provide my consent for the information collected about me to be used for the purpose of this research study only;

☑ I understand that if necessary I can ask questions and the research team will respond to my questions;

☑ I freely agree to participate in this research study as described and understand t hat I am free to withdraw at any time during the study and withdrawal will not affect my relationship with any of the named organisations and/or research team members;

☑ I understand that I can download a copy of this consent form from www.cepar.edu.au.

☐ I agree, tick all box and continue

◯ I do not wish to participate

2%   << Prev   Next >>

What was your age at your last birthday?

[   ] years old

3%   << Prev   Next >>

Which city do you live in?

Choose an option ▾

4%   << Prev   Next >>

Do you have urban hukou of the city you live in?

○ Yes

○ No

5%   << Prev   Next >>

Do you or your spouse own at least one property? (Exclude any properties without an owner certificate)

○ Yes

○ No

6%   << Prev   Next >>

What is your gender?

○ Male

○ Female

7%　　　　　　　　　　　　　　　　　　　　　<< Prev　　Next >>

What is the highest level of education you have attained?

○ No schooling

○ Primary School

○ Junior middle school

○ High school (高中) or Specialised secondary school (中專)

○ Two-Year College degree or Diploma (大专)

○ Bachelor degree from Four-Year University (大学本科)

○ Master or above

8%　　　　　　　　　　　　　　　　　　　　　<< Prev　　Next >>

Do you have any difficulties in performing any of these activities? (Please select all the boxes that are applicable)

☐ Bathing

☐ Dressing

☐ Toileting

☐ Transferring

☐ Continence

☐ Feeding

○ None of the above

8%　　　　　　　　　　　　　　　　　　　　　<< Prev　　Next >>

Introductory slide

Thank you for agreeing to participate in this survey about financing long-term care.

Please take as much time as you need to answer the questions. All your answers to the questions are strictly anonymous – that is, no one involved in this study can identify you personally, no one will contact you after the survey and no sales solicitation is involved. Your answers will be used only for academic research.

Please answer each question as honestly as possible. The aim of the survey is to provide a reliable and accurate picture of how people like you feel about the new financial products described in the survey. Please do not use any other sources of information to answer the questions because our research focuses on how you (and others like you) would answer them. Please answer all of the survey questions.

Please DO NOT USE the "back" and "forward" buttons in your browser. Instead, please use the buttons at the bottom of each screen. If you would like to pause the survey to return to it later, simply close the window and click on the original link in the invitation when you are ready to resume. It will return you to the last point of entry in the survey.

9%   << Prev   Next >>

Introductory questions

In answering these questions, please exclude any properties for which you do not have an owner certificate (房产证).

Excluding all properties that you own, what is the total value of your household savings (including, for example, saving accounts, term deposits, government bonds, stocks, shares in investment funds)?

◯ RMB 0-50,000

◯ RMB 50,001-500,000

◯ RMB 500,001 or more

10%   << Prev   Next >>

Please provide more details about your household savings. Excluding all properties that you own, what is the total value of your household savings (including, for example, saving accounts, term deposits, government bonds, stocks, shares in investment funds)?

◯ RMB 500,001-1,000,000

◯ RMB 1,000,001-1,500,000

◯ RMB 1,500,001-2,000,000

◯ RMB 2,000,001 or more

11%   << Prev   Next >>

You indicated at the start of the survey that you own a property. For this property (if you own more than one, please focus on the one with the highest current market value). In which year did you receive/purchase it?

---请选择--- ∨

12%   << Prev   Next >>

How much did the property cost when you received/purchased it?

For example, if the value you want to tell us is RMB 1,000,000, please enter 100

[　　　] (in RMB 10,000)

13%   << Prev   Next >>

How much do you think this property is worth now?

For example, if the value you want to tell us is RMB 1,000,000, please enter 100

[　　　] (in RMB 10,000)

13%   << Prev   Next >>

Do you still have a mortgage on this property?

○ Yes

○ No

14%   << Prev   Next >>

What is the outstanding mortgage loan balance?

For example, if the value you want to tell us is RMB 1,000,000, please enter 100

[   ] (in RMB 10,000)

15%   << Prev   Next >>

Do you still have outstanding debt owed to family and friends for the purchase of this property?

○ Yes

○ No

16%   << Prev   Next >>

What is the outstanding loan amount from family and friends?

For example, if the value you want to tell us is RMB 1,000,000, please enter 100

[   ] (in RMB 10,000)

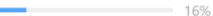17%   << Prev   Next >>

How many properties do you or your spouse own in total, including the one you just told us about?

[   ]

18%   << Prev   Next >>

Facts about health states and long-term care

Hover your mouse over the blue text for more information.

As people get older, they are more likely to need help with **activities of daily living** such as bathing or dressing.

In this survey, we refer to an older person as **disabled** if they need help **permanently** with **three or more** of the following six activities of daily living: bathing, dressing, toileting, transferring, continence, or feeding. We refer to this help as **long-term care**.

We refer to older persons as **non-disabled** if they only need help with **two or less** of the six activities of daily living.

On average,
3 out of 10 men aged 60 will eventually become disabled and will need long-term care as they get older, while
4 out of 10 women aged 55 will eventually become disabled and will need long-term care as they get older.

There are two types of long-term care:
Informal care: long-term care provided by the family and/or friends.
Formal care: long-term care provided by professional caring personnel. Formal care in a basic **residential nursing home** costs about RMB **11,500** per month in today's prices.
When you are disabled, you can receive formal care, informal care or a combination of the two.

Long-term care income refers to the regular monthly income you can receive when you and/or your spouse are disabled and need long-term care.

You can click ">>" to continue after 20 seconds.

▬▬▬ 18%   << Prev   Next >>

New Long-term Care Income Products

In this survey we will ask you to make some choices about three new financial products designed to fund long-term care. Each of these products will provide you with an income when you require long-term care.

For each of the three long-term care income products we will describe the product and show you a case study. We will then ask you to complete a choice task. Finally we will ask you to choose your most preferred and least preferred of the three choices. In total you will complete four (4) choice tasks.
Please read the product descriptions carefully because your understanding will affect the bonus amount that you can earn from the survey.

▬▬▬ 20%   << Prev   Next >>

Long-term care income choice tasks

In each of the choice tasks you will be asked you to choose how much long-term care income you would like to buy. Ignoring your own financial circumstances, we want you to imagine that:

- you are aged 60,
- you are married and your spouse is aged 55,
- you are about to retire,
- you own your own home in the city you live in, which is currently worth **RMB 5,000,000**
- you have **RMB 750,000** in your savings account,
- you have no other assets.

21%

<< Prev Next >>

Long-term Care Income Product S

Hover your mouse over the blue text for more information.

We would like to introduce you to Long-term Care Income Product S.
You buy Long-term Care Income Product S with a single payment from your **savings account**. When you and/or your spouse need long-term care you receive a regular monthly income.
Please read the product description carefully as your product understanding will be tested in a quiz.
The first column lists the product properties. The second column explains these properties for Long-term Care Income Product S.

Product Properties	Long-term Care Income Product S
Who offers this product?	A state-owned bank.
How much do you need to pay at the start of the contract?	The amount of the **single payment** you make at the **start of the contract** depends on the size of the monthly income you/your spouse want to receive when you/your spouse need long-term care.
How much long-term care income can you buy at most?	Depends on: Your **age**, your **spouse's age**, your **gender**; and the **amount you wish to pay** at the start of the contract.
When can you purchase this product?	When you and your spouse are aged **55-65** and **non-disabled**.
What are your benefits?	You/your spouse **receive a monthly income** when you/your spouse are **disabled**, for as long as you/your spouse **are alive**.
How do you receive the income?	The product provider **transfers the income** into **your savings account** each month.
Do you receive any income when you and your spouse are non-disabled?	No.
What happens when one spouse is disabled, and the other spouse is non-disabled?	The disabled spouse can **choose** to move to a **residential nursing home** or to **stay at home**. You can **use** the monthly income **for any purpose**, including but **not limited** to pay for **formal care** or to **compensate family members/friends** for informal care.
What happens when both spouses are disabled, or one spouse is disabled, and the other spouse is deceased?	You/your spouse will **need** to move to a **residential nursing home**. You can **use** the monthly income **for any purpose**, including but **not limited** to pay for **formal care** or to **compensate family members/friends** for informal care at the residential nursing home.
Who will determine your health status?	You **choose** a doctor from a list of doctors **appointed by the government**. The doctor **determines** whether you/your spouse are **non-disabled or disabled**. **Once** you/your spouse are **disabled**, you/your spouse will be **entitled to receive** the monthly income benefits for **as long as** you/your spouse are **alive**.
Do you have to make a claim to receive the monthly income when you need long-term care?	No. The doctor will **inform** the product provider to **transfer the monthly income** to you.
When do you pay the product provider?	You make a **single payment** at the **start** of the contract.
When does the contract terminate?	When you and your spouse **pass away**.
Can you terminate the contract earlier?	Yes, but you will **not receive** the regular income if you later need long-term care.

You can click ">>" to continue after 20 seconds.

Case study for Long-term Care Income Product S

Hover your mouse over the blue text for more information.

Please read the following case study which illustrates how Long-term Care Income Product S works.

Mr. Wang is aged 60 and Mrs. Wang is aged 55 in 2019. They live in their own apartment in Beijing which is worth RMB 5,000,000 and have RMB 750,000 in their savings account. They decide to buy Long-term Care Income Product S to cover their future long-term care needs.

• They choose to **use** RMB 200,000 **from their savings account** to buy long-term care income with Long-term Care Income Product S.
• If one or both are disabled, they will receive a **monthly income** according to the following table:

Both non-disabled/deceased	1 non-disabled/deceased, 1 disabled	Both disabled
RMB 0/month	RMB 3,514/month	RMB 7,028 /month

• The couple **fully own their apartment**, including all growth in its value, if any.

This contract will **terminate** when **both** Mr. and Mrs. Wang **pass away**.

Assume that Mr. Wang remains **non-disabled** and **passes away in 2044**. In the **same** year, Mrs. Wang becomes **disabled** and **permanently moves** into a **residential nursing home**. She will receive a long-term care income of RMB 3,514/month **until she passes away**. When she passes away, their daughter inherits the apartment.

How do you rate your understanding of Long-term Care Income Product S?

○ Completely clear

○ Mostly clear

○ Generally clear

○ Mostly confusing

○ Completely confusing

You can click ">>" to continue after 20 seconds.

25%   << Prev   Next >>

Task 1 of 4: Long-term Care Income Product S

Hover your mouse over the blue text for more information.

In this choice task, assume you have **RMB 750,000** in your savings account and your home is worth **RMB 5,000,000**. You can use the money in your savings account to purchase long-term care income with Long-term Care Income Product S.

The decision you have to make is:

Would you like to buy long-term care income with Long-term Care Income Product S? And if you do

How much of your savings do you want to use to buy long-term care income ?

Use the slider below to indicate your choice. The outcomes of your choice are summarised in the table below.

You can position the slider anywhere on the line, but you need to move it at least once before you can continue. **If you DON'T want to buy Long Term Care Product S place the slider at RMB 0.**

Long-term Care Income Product S ⬜
RMB 0   RMB 750,000

	Outcome
Regular income when you and your spouse are non-disabled	**RMB 0** per month
Regular income when one spouse is disabled, and the other spouse is non-disabled or deceased	**RMB 0** per month This would cover **0%** of the cost of formal care in a residential nursing home for one person or compensate your family/friends who take care of you.
Regular income when both spouses are disabled	**RMB 0** per month This would cover **0%** of the cost of formal care in a residential nursing home for you and your spouse or compensate your family/friends who take care of you.
Total payment for long-term care income	Single payment of **RMB 0** at the start of the contract
Payment for long-term care income from your savings account	Single payment of **RMB 0** at the start of the contract
Remaining money in your savings account	**RMB 0**
Your remaining housing wealth	**RMB 5,000,000**
Your remaining total wealth	**RMB 0**
Additional features:	You receive the monthly income for as long as you/your spouse are disabled

Why did you not purchase more long-term care income with Long-term Care Income Product S? Please only choose the main reason.

○ I think I can manage long-term care risk.

○ My children/grandchildren will care for me when I am old.

○ I think the product is too complex.

○ I do not think the product is a good deal.

○ I do not trust the product provider.

27%   < < Prev   Next > >

261

Long-term Care Income Product R

Hover your mouse over the blue text for more information.

We would like to introduce you to Long-term Care Income Product R.

You buy Long-term Care Income Product R by **borrowing against your home**. When you and/or your spouse need long-term care, you receive a regular monthly income.

Please read the product description carefully as your product understanding will be tested in a quiz.

The first column lists the product properties. The second column explains these properties for Long-term Care Income Product R.

	Long-term Care Income Product R
Who offers this product?	A state-owned bank.
Product properties when you are alive	
How much do you need to pay at the start of the contract?	No payments required.
Is your home used as a collateral?	Yes.
Can you continue to live in your home?	Yes. You and your spouse have a guaranteed right to live in your home while at least one of you is non-disabled.
Do you retain the full legal right of your home	Yes. For example, you can rent out your home.
How much long-term care income can you buy at most?	Depends on: Your **age**, your **spouse's age**, your **gender**, the **amount you wish to pay** at the start of the contract and the value of your home at the start of the contract
How is the home value assessed?	The value of your home is assessed by an **independent, authorized appraiser**.
When can you purchase this product?	When you and your spouse are aged **55-65** and **non-disabled**.
What are your benefits?	You/your spouse **receive a monthly income** when you/your spouse are **disabled**, for as long as you/your spouse **are alive**.
How do you receive the income?	The product provider **transfers the income** into **your savings account** each month.
Do you receive any income when you and your spouse are non-disabled?	No.
What happens when one spouse is disabled, and the other spouse is non-disabled?	The disabled spouse can **choose** to move to a **residential nursing home** or to **stay at home**. You can **use** the monthly income **for any purpose**, including but **not limited** to pay for **formal care** or to **compensate family members/friends** for informal care.
What happens when both spouses are disabled, or one spouse is disabled, and the other spouse is deceased?	You/your spouse will **need** to move to a **residential nursing home**. You can **use** the monthly income **for any purpose**, including but **not limited** to pay for **formal care** or to **compensate family members/friends** for informal care at the residential nursing home.
Who will determine your health status?	You **choose** a doctor from a list of doctors **appointed by the government**. The doctor **determines** whether you/your spouse are **non-disabled** or **disabled**. **Once** you/your spouse are **disabled**, you/your spouse will be **entitled to receive** the monthly income benefits for **as long as** you/your spouse are **alive**.
Do you have to make a claim to receive the monthly income when you need long-term care?	No. The doctor will **inform** the product provider to **transfer the monthly income** to you.
Will this product incur any loan?	Yes, but **no repayments** are required while you/your spouse **live in your home**.
What is the debt amount?	The **cost** of the long-term care income becomes a debt which **accumulates interest**.
What is the interest rate on the loan?	5.80% p.a. **Set** by the government. **Fixed** at the **start** of the contract.
Can you terminate the contract earlier?	Yes, you can.
What do you need to do to terminate the contract earlier?	**Repay** the loan
Product properties when both of you are deceased/move to a residential nursing home	
What happens after you and your spouse have both passed away or moved into a residential nursing home?	The product provider will **sell your property** at the **highest possible market price**.
What happens to the sale proceeds?	The sale proceeds are used to repay the loan. If the sale proceeds **exceed** the loan amount, you/your spouse/your heirs can **retain** the difference. If the sale proceeds are **insufficient** to **cover** the debt, you/your spouse/your heirs are **not** required to make an extra payment.
Can your heirs remain in the property when you and your spouse pass away?	Yes. Your heirs have **the option** to **repay** the debt and **keep your home**.
When does the contract terminate?	When **you and your spouse** are deceased.

You can click ">>" to continue after 20 seconds.

Case study for Long-term Care Income Product R

Hover your mouse over the blue text for more information.

Please read the following case study which illustrates how Long-term Care Income Product R works.

Mr. Wang is aged 60 and Mrs. Wang is aged 55 in 2019. They have an adult daughter. They live in their own apartment in Beijing which is worth RMB 5,000,000 and have RMB 750,000 in their savings account. They decide to buy Long-term Care Income Product R to cover their future long-term care needs.

• They choose to **borrow RMB 600,000 against their apartment** to buy long-term care income with Long-term Care Income Product R. The amount becomes a debt which accumulates interest at the fixed interest rate of 5.8% p.a
• If one or both are disabled, they will receive a **monthly income** according to the following table:

Both non-disabled/deceased	1 non-disabled/deceased, 1 disabled	Both disabled
RMB 0/month	RMB 10,542/month	RMB 21,085 /month

• They do **not have to repay anything** while **at least one of them** still **lives at home**.
• The couple **fully own their apartment**, including all growth in its value, if any.

This contract will **terminate** when **both** Mr. and Mrs. Wang **pass away.**

Assume that Mr. Wang remains **non-disabled** and **passes away in 2044**. In the **same** year, Mrs. Wang becomes **disabled** and **permanently moves** into a **residential nursing home**. The **outstanding debt** amount in **2044** accumulated from the **initial loan** is RMB 2,456,000. Below are **three** possible **scenarios** in 2044:

• Scenario A: The product provider **sells the home at the highest possible market price** of RMB 10,000,000. The sale proceeds are used to **repay** the debt. Mrs. Wang **receives the remaining RMB 7,544,000.** She will receive a long-term care income of RMB 10,542/month **until she passes away.**
• Scenario B: The product provider **sells the home at the highest possible market price** of only RMB 1,000,000. All sale proceeds **are used to repay** the debt. Mrs. Wang will **receive nothing from the sale**, but she is **not required to make an extra payment**. The difference is a loss to the product provider. Mrs. Wang will receive a long-term care income of RMB 10,542/month **until she passes away.**
• Scenario C: Their daughter decides to **repay the debt herself** and **keep** their property. Mrs. Wang will receive a long-term care income of RMB 10,542/month **until she passes away.**

How do you rate your understanding of Long-term Care Income Product R?

○ Completely clear

○ Mostly clear

○ Generally clear

○ Mostly confusing

○ Completely confusing

You can click ">>" to continue after 20 seconds.

33%   << Prev   Next >>

263

Task 2 of 4: Long-term Care Income Product R

Hover your mouse over the blue text for more information.

In this choice task, assume, you have **RMB 750,000** in your savings account and your home is worth **RMB 5,000,000**. You can use the money in your savings account to purchase long-term care income with Long-term Care Income Product S. You can also borrow against your home to purchase long-term care income with Long-term Care Income Product R.

Use the two sliders below to indicate your choices. You can buy long-term care income with your savings (Long-term Care Income Product S) and/or borrow against your home (Long-term Care Income Product R). The outcomes of your choice are summarised in the table below.

The decisions you have to make are:

Would you like to buy long-term care income? And if you do

MRa. How much of your savings do you want to use to buy long-term care income with Long-term Care Income Product S?

You can position the slider anywhere on the line, but you need to move it at least once before you can continue. **If you DON'T want to buy Long Term Care Product S place the slider at RMB 0.**

☞

Long-term Care Income Product S:

RMB 0   RMB 750,000

MRb. How much do you want to borrow against your home to buy long-term care income with Long-term Care Income Product R?

You can position the slider anywhere on the line, but you need to move it at least once before you can continue. **If you DON'T want to buy Long Term Care Product R place the slider at RMB 0.**

☞

Long-term Care Income Product R:

RMB 0   RMB 2,000,000

	Outcome
Regular income when you and your spouse are **non-disabled**	**RMB 0** per month
Regular income when one spouse is disabled, and the other spouse is **non-disabled** or deceased	**RMB 0** per month This would cover **0.00%** of the cost of **formal care in a residential nursing home** for **one person** or **compensate** your **family/friends** who take care of you.
Regular income when both spouses are **disabled**	**RMB 0** per month This would cover **0.00%** of the cost of **formal care in a residential nursing home** for **you and your spouse** or **compensate your family/friends** who take care of you.
Total payment for **long-term care income**	**RMB 0**
Payment for **long-term care income** from your savings account	**RMB 0**
Payment for **long-term care income** from **Long-term Care Income Product R**	**RMB 0** loan with annual interest rate 5.80% p.a.
Remaining money in your savings account	**RMB 0**
Your remaining housing wealth	**RMB 0**
Your remaining total wealth	**RMB 0**
Additional features:	You receive the monthly income for as long as you/your spouse are disabled

Why did you not purchase more of Long-term Care Income Product R to pay for the long-term care income? Please only choose the main reason.

○ I think I can manage long-term care risk.

○ My children/grandchildren will care for me when I am old.

○ I think the product is too complex.

○ I do not think the product is a good deal.

○ I do not trust the product provider.

○ I do not want to have a (higher) loan.

○ I am worried that I would be evicted from my property.

36%   << Prev   Next >>

Long-term Care Income Product H

Hover your mouse over the blue text for more information.

We would like to introduce you to Long-term Care Income Product H.

You buy Long-term Care Income Product H by selling part of your home. When you and/or your spouse need long-term care, you receive a regular monthly income.

Please read the product description carefully as your product understanding will be tested in a quiz.

The first column lists the product properties. The second column explains these properties for Long-term Care Income Product H.

	Long-term Care Income Product H
Who offers this product?	A state-owned bank.
Product properties when you are alive	
How much do you need to pay at the start of the contract?	No payments required.
Is your home used as a collateral?	No, a **part of your home** is **sold** to the product provider.
Can you continue to live in your home?	Yes. You and your spouse have a guaranteed right to live in your home while at least one of you is non-disabled.
Do you retain the full legal right of your home	No, but you can still rent out your home.
How much long-term care income can you buy at most?	Depends on: Your **age**, your **spouse's age**, your **gender**, the **amount you wish to pay** at the start of the contract and the value of your home at the start of the contract
How is the home value assessed?	The value of your home is assessed by an **independent, authorized appraiser**.
When can you purchase this product?	When you and your spouse are aged **55-65** and **non-disabled**.
What are your benefits?	You/your spouse **receive a monthly income** when you/your spouse are **disabled**, for as long as you/your spouse **are alive**.
How do you receive the income?	The product provider **transfers the income** into **your savings account** each month.
Do you receive any income when you and your spouse are non-disabled?	No.
What happens when one spouse is disabled, and the other spouse is non-disabled?	The disabled spouse can **choose** to move to a **residential nursing home** or to **stay at home**. You can **use** the monthly income **for any purpose**, including but **not limited** to pay for **formal care** or to **compensate family members/friends** for informal care.
What happens when both spouses are disabled, or one spouse is disabled, and the other spouse is deceased?	You/your spouse will **need** to move to a **residential nursing home**. You can **use** the monthly income **for any purpose**, including but not limited to pay for **formal care** or to **compensate family members/friends** for informal care at the residential nursing home.
Who will determine your health status?	You **choose** a doctor from a list of doctors **appointed by the government**. The doctor **determines** whether you/your spouse are non-disabled or disabled. **Once** you/your spouse are **disabled**, you/your spouse will be **entitled to receive** the monthly income benefits for **as long as** you/your spouse are **alive**.
Do you have to make a claim to receive the monthly income when you need long-term care?	No. The doctor will **inform** the product provider to **transfer the monthly income** to you.
Can you terminate the contract earlier?	Yes, you can.
What do you need to do to terminate the contract earlier?	**Buy back** the proportion you sold to the product provider
Product properties when both of you are deceased/move to a residential nursing home	
What happens after you and your spouse have both passed away or moved into a residential nursing home?	The product provider will **sell your property** at the **highest possible market price**.
What happens to the sale proceeds?	The sale proceeds are **split** into two parts. The product provider **keeps** the sale proceeds of the **proportion** you sold. You/your spouse/your heirs **receive** the **sale proceeds** from the **proportion you own**.
Can your heirs remain in the property when you and your spouse pass away?	Yes. Your heirs have the **option to buy back** the proportion you sold and **keep your home**.
When does the contract terminate?	When **you and your spouse** are deceased.

You can click ">>" to continue after 20 seconds.

<< Prev   Next >>

Case study for Long-term Care Income Product H

Hover your mouse over the blue text for more information.

Please read the following case study which illustrates how Long-term Care Income Product H works.

Mr. Wang is aged 60 and Mrs. Wang is aged 55 in 2019. They have an adult daughter. They live in their own apartment in Beijing which is worth RMB 5,000,000 and have RMB 750,000 in their savings account. They decide to buy Long-term Care Income Product H to cover their future long-term care needs.

• They choose to **sell** RMB 2,044,000 **of their apartment** to buy long-term care income with Long-term Care Income Product H.
• If one or both are disabled, they will receive a **monthly income** according to the following table:

Both non-disabled/deceased	1 non-disabled/deceased, 1 disabled	Both disabled
RMB 0/month	RMB 10,542/month	RMB 21,085/month

• They do **not have to pay anything** while **at least one of them** still **lives at home**.
• They still **own a part** of the apartment.

This contract will **terminate** when **both** Mr. and Mrs. Wang **pass away**.

Assume that Mr. Wang remains **non-disabled** and **passes away in 2044**. In the **same** year, Mrs. Wang becomes **disabled** and **permanently moves** into a **residential nursing home**. Below are **three** possible **scenarios** in 2044:

• Scenario A: The product provider **sells the home at the highest possible market price** of RMB 10,000,000. Mrs. Wang receives RMB 5,912,000 from the sale proceeds. She will receive a long-term care income of RMB 10,542/month **until she passes away**.
• Scenario B: The product provider **sells the home at the highest possible market price** of only RMB 1,000,000. Mrs. Wang receives RMB 591,000 from the sale proceeds. Mrs. Wang will receive a long-term care income of RMB 10,542/month **until she passes away**.
• Scenario C: Their daughter decides to **buy back** and **keep** their property. Mrs. Wang will receive a long-term care income of RMB 10,542/month **until she passes away**.

How do you rate your understanding of Long-term Care Income Product H?

○ Completely clear

○ Mostly clear

○ Generally clear

○ Mostly confusing

○ Completely confusing

You can click ">>" to continue after 20 seconds.

43%   << Prev   Next >>

Hover your mouse over the blue text for more information.

In this choice task, assume, you have **RMB 750,000** in your savings account and your home is worth **RMB 5,000,000**. You can use the money in your savings account to purchase long-term care income with Long-term Care Income Product S. You can also borrow against your home to purchase long-term care income with Long-term Care Income Product H.

Use the two sliders below to indicate your choices. You can buy long-term care income with your savings (Long-term Care Income Product S) and/or borrow against your home (Long-term Care Income Product H). The outcomes of your choice are summarised in the table below.

The decisions you have to make are:

Would you like to buy long-term care income? And if you do

MHa.How much of your savings do you want to use to buy long-term care income with Long-term Care Income Product S?

You can position the slider anywhere on the line, but you need to move it at least once before you can continue. **If you DON'T want to buy Long Term Care Product S place the slider at RMB 0.**

Long-term Care Income Product S:

RMB 0   RMB 750,000

MHb.How much of your home do you want to sell to buy long-term care income with Long-term Care Income Product H?

You can position the slider anywhere on the line, but you need to move it at least once before you can continue. **If you DON'T want to buy Long Term Care Product H place the slider at RMB 0.**

Long-term Care Income Product H:

RMB 0   RMB 5,000,000

	Outcome
Regular income when you and your spouse are non-disabled	**RMB 0** per month
Regular income when one spouse is disabled, and the other spouse is non-disabled or deceased	**RMB 0** per month This would cover **0.00%** of the cost of **formal care in a residential nursing home** for **one person** or **compensate** your **family/friends** who take care of you.
Regular income when both spouses are disabled	**RMB 0** per month This would cover **0.00%** of the cost of **formal care in a residential nursing home** for **you and your spouse** or **compensate your family/friends** who take care of you.
Total payment for long-term care income	**RMB 0**
Payment for long-term care income from your savings account	**RMB 0**
Payment for long-term care income from Long-term Care Income Product H	**RMB 0** is sold
Remaining money in your savings account	**RMB 0**
Your remaining housing wealth	**RMB 0**
Your remaining total wealth	**RMB 0**
Additional features:	You receive the monthly income for as long as you/your spouse are disabled

Why did you not purchase more of Long-term Care Income Product H to pay for the long-term care income? Please only choose the main reason.

○ I think I can manage long-term care risk.

○ My children/grandchildren will care for me when I am old.

○ I think the product is too complex.

○ I do not think the product is a good deal.

○ I do not trust the product provider.

○ I do not want to sell (more) part of the property.

○ I am worried that I would be evicted from my property.

47%   << Prev   Next >>

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Task 4 of 4: Which of the following choices do you prefer?

Hover your mouse over the blue text for more information.

The following table summarises the three choices you have just made to buy long-term care income. We now ask you to choose which of the three choices would be BEST for you and which of the three choices would be WORST for you.

Product Properties	A Task 1 choice Long-term Care Income Product S	B Task 2 choice Long-term Care Income Product R	C Task 3 choice Long-term Care Income Product H
Regular income when you and your spouse are **non-disabled**	0 per month		
Regular income when **one** spouse is **disabled** and the **other** spouse is **non-disabled** or deceased	RMB 1,757 per month	RMB 4,393 per month	RMB 2,508 per month
Regular income when **both** spouses are **disabled**	RMB 3,514 per month	RMB 8,786 per month	RMB 5,016 per month
Total payment for long-term care income	Single payment of RMB 100,000 at the beginning of the contract	RMB 250,000	RMB 142,734
Payment for long-term care income from your **savings account**	RMB 100,000	RMB 50,000	RMB 40,000
Payment for long-term care income from Long-term Care Income Product R	Not applicable	RMB 200,000 loan with annual interest rate 5.8% p.a.	Not applicable
Value of home sold through Long-term Care Income Product H	Not applicable	Not applicable	RMB 350,000 is sold
Remaining money in your **savings account**	RMB 650,000	RMB 700,000	RMB 710,000
Your **remaining housing** wealth	RMB 5,000,000	RMB 5,000,000	RMB 4,650,000
Your **remaining total** wealth	RMB 5,650,000	RMB 5,700,000	RMB 5,360,000
Additional comments:	You receive the monthly income for as long as you/your spouse are disabled		
Which one of A, B or C would be **BEST** for you?	○	○	○
Which one of A, B or C would be **WORST** for you?	○	○	○

47%

<< Prev   Next >>

268

Product knowledge

Hover your mouse over the blue text for more information.

Now we would like to review your knowledge of the three Long-term Care Income Products.
Which of the following statement(s) apply to each of the products –Long-term Care Income Product S, R and H? Please tick the boxes to indicate to which product or products a statement applies. Your bonus payment depends on the number of correct answers in this quiz. Scores are awarded for each correct answer.

	Long-term Care Income Product S	Long-term Care Income Product R	Long-term Care Income Product H
You can receive a monthly income as long as you are alive, even when you are non-disabled.	☐	☐	☐
You pay a lump sum but nothing else at the start of the contract to purchase this product.	☐	☐	☐
You can use the income from the product to compensate your family/friends who take care of you	☐	☐	☐
At the end of the contract, if the house price is higher than the loan amount, you (or your heirs) can receive the difference between the house price and loan amount.	☐	☐	☐
At the end of the contract, you (or your heirs) will receive a percentage from the sale of the residential property.	☐	☐	☐
The interest rate charged in this contract is fixed during the term of the contract.	☐	☐	☐
At the start of the contract, you will need to choose the percentage of your property to sell.	☐	☐	☐
At the end of the contract, you/your spouse/your heirs will have a chance of receiving nothing when your property is sold.	☐	☐	☐

49%   << Prev   Next >>

You have 24 correct answers out of 24.

51%   << Prev   Next >>

You have now completed the choice tasks. Next we will ask you three sets of standard survey questions on:

1.Demographics and health
2.Financial competence and retirement planning
3.Preferences and expectations

52%   << Prev   Next >>

1.Demographics and health

The next set of questions with cover employment, marital status, children, income and debt

Which of the following best describes your current employment situation?

○ Employed by someone else

○ Self-employed

○ Unemployed including structurally unemployed (Xia Gang)

○ Retired

○ Not in the labour force - stay-at-home parent or caregiver

○ Not in the labour force - other reasons

53%   << Prev   Next >>

1.Demographics and health

Who are you working for? If you are retired or not in the labour force, please answer according to your most recent previous job.

- ○ Government (政府机构)
- ○ Public institution (事业单位)
- ○ Non-government organisation (非政府组织, 社团, 协会, 学会, 等等)
- ○ State-owned enterprise (国有企业)
- ○ Private company including foreign firm (私营企业, 包括外资企业)
- ○ Individual firm and freelancer (个体户)
- ○ Farmer (农户)
- ○ Never worked
- ○ Other

55%

<< Prev   Next >>

1.Demographics and health

What is your marital status?

- ○ Never married
- ○ Married (including living in a long-term partnership)
- ○ Divorced
- ○ Separated
- ○ Widowed

56%

<< Prev   Next >>

1.Demographics and health

What is your spouse's age? Answer: [ ] years

<< Prev   Next >>

1.Demographics and health

How many children do you have that are still alive? Answer: [ ] children

58%   << Prev   Next >>

1.Demographics and health

Please provide the following information on your child(ren)

	Gender	Age	Residence of child	Personal income (annual) of the child
1st child	Male ▼	31	Live in the same household ▼	More than 120,000 ▼

59%   << Prev   Next >>

1.Demographics and health

How many grandchildren do you have that are still alive? Answer: [   ] grandchildren

60%   << Prev   Next >>

1.Demographics and health

Please provide the following information on your grandchild(ren)

	Gender	Age	Residence of grandchild	Personal income (annual) of the grandchild
1st grandchild	Female ▼	1	Live in the same household ▼	Less than RMB 40,000 ▼

61%   << Prev   Next >>

1.Demographics and health

Do you/your spouse have social health insurance?

	Yes	No
Myself:	○	○
Spouse:	○	○

63%   << Prev   Next >>

1.Demographics and health

Excluding all mortgages, what is the total value of your household debt? (including for example money borrowed from relatives, friends, or using credit cards, and bank loans other than mortgages)

- ◯ RMB 0-2,000
- ◯ RMB 2,000-9,999
- ◯ RMB 10,000-49,999
- ◯ RMB 50,000-99,999
- ◯ RMB 100,000-249,999
- ◯ RMB 250,000-499,999
- ◯ RMB 500,000-999,999
- ◯ RMB 1,000,000 or more

64%　　　　< < Prev　　Next > >

1.Demographics and health

What was your household income (including bonuses and pension income) in the last year after paying tax and social security contributions?

- ◯ RMB 0-39,999 per year
- ◯ RMB 40,000-69,999 per year
- ◯ RMB 70,000-119,999 per year
- ◯ RMB 120,000 or more per year

65%　　　　< < Prev　　Next > >

1.Demographics and health

Please provide more details about your household income. What was your household income (including bonuses and pension income) in the last year after paying tax and social security contributions?

- ◯ RMB 120,000-149,999 per year
- ◯ RMB 150,000-199,999 per year
- ◯ RMB 200,000-299,999 per year
- ◯ RMB 300,000 or more per year

66%　　　　< < Prev　　Next > >

1.Demographics and health

Do you smoke now?

○ Ever smoked, currently smoking

○ Ever smoked, currently not smoking

○ Never smoked

67%

<< Prev   Next >>

1.Demographics and health

Compared to the population, what do you think are the chances you will ever need formal care at home?

○ Higher probability of needing formal care at home than the average for people of your age and gender

○ Lower probability of needing formal care at home than the average for people of your age and gender

68%

<< Prev   Next >>

1.Demographics and health

Compared to the population, what do you think are the chances you will ever need formal care in a residential nursing home?

○ Higher probability of needing formal care in a residential nursing home than the average for people of your age and gender

○ Lower probability of needing formal care in a residential nursing home than the average for people of your age and gender

69%

<< Prev   Next >>

1.Demographics and health

Would you say your/your spouse's health is excellent, very good, good, fair, or poor?

	Excellent	Very good	Good	Fair	Poor
Myself:	○	○	○	○	○
Spouse:	○	○	○	○	○

70%

<< Prev   Next >>

1.Demographics and health

Compared to one year ago, how would you rate your health in general now?

○ Much better now

○ Somewhat better now

○ About the same

○ Somewhat worse now

○ Much worse now

72%

<< Prev   Next >>

1.Demographics and health

What is the highest level of education you have attained?

- ○ No schooling
- ○ Primary School
- ○ Junior middle school
- ○ High school (高中) or Specialised secondary schools (中專)
- ○ Two-Year College degree or Diploma (大专)
- ○ Bachelor degree from Four-Year University (大学本科)
- ○ Master or above

Have you seen this question before?

- ○ Yes
- ○ No

74% << Prev Next >>

1.Demographics and health

To what age do you think you are going to live? Answer: [   ] years

75% << Prev Next >>

1.Demographics and health

To what age do you think your spouse is going to live? Answer: [   ] years

2. Financial Competence and Planning

This set of questions covers financial literacy, numeracy, knowledge of financial products and retirement planning

Financial literacy

Suppose you had RMB 100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?

◯ More than RMB 102

◯ Exactly RMB 102

◯ Less than RMB 102

◯ Do not know

Imagine the interest rate in your savings account is 1% per year and inflation is 2% per year. After 1 year, how much would you be able to buy with the money in this account?

◯ More than today

◯ Exactly the same

◯ Less than today

◯ Do not know

Please evaluate whether this statement is true or false.　"Buying shares of a single company usually provides a safer return than buying units in a managed share funds"．

◯ True

◯ False

◯ Do not know

2. Financial Competence and Planning

Numeracy

Imagine that we rolled a fair, six-sided die 1,000 times. Out of 1,000 rolls, how many times do you think the die would come up even (2, 4, or 6)?
Please enter a number between 0 and 1,000 in the box.

Answer: [＿＿＿＿] times

In a lottery, the chances of winning a RMB 500 prize is 1%. What is your best guess about how many people would win the prize if 1,000 people each buy a single ticket to the lottery?
Please enter a number between 0 and 1,000 in the box.

Answer: [＿＿＿＿] people

In a raffle, the chance of winning a car is 1 in 1,000. What percent of tickets in the raffle win a car?
Please enter a percentage in the box.

Answer: [＿＿＿＿] percentage

83% << Prev   Next >>

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2. Financial Competence and Planning

Financial product knowledge

Before participating in this survey, had you heard of any of the following financial products?

	Yes	No
Bank accounts	○	○
Fixed term deposit	○	○
Government bonds	○	○
Shares (Stocks)	○	○
Shares in an investment fund (基金)	○	○
Credit card	○	○
Money market fund (e.g., Yu'eBao)	○	○
Commercial health insurance	○	○
Life insurance	○	○
Long-term care insurance	○	○
Critical illness insurance	○	○
Commercial pension	○	○
Life annuity	○	○
Enterprise annuity	○	○
"House for Pension" (Reverse mortgage in China)	○	○

84% << Prev   Next >>

2. Financial Competence and Planning

Retirement planning

At what age do you plan to retire? (Or at what age did you retire if you are already retired)

Answer: [   ] years old

85%

<< Prev   Next >>

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2. Financial Competence and Planning

Which of the following statements best describes your thoughts about the financial aspects of retirement?

○ I've not thought about what savings I will need for retirement.

○ I've checked out my current savings position and started to think about what I will need for retirement.

○ I've a firm idea of what I need for retirement and I'm not on track to reach my savings goal.

○ I've a firm idea of what I need for retirement and I'm on track to reach my savings goal.

86%

<< Prev   Next >>

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2. Financial Competence and Planning

For many households, overall spending changes dramatically upon retirement. Please indicate below what your experience has been (if you are retired), or what your expectations are (if not retired)

○ My household had (or expects to have) no change in spending at retirement

○ My household has spent (or will spend) more after retirement than before

○ My household has spent (or will spend) less after retirement than before

88%

<< Prev   Next >>

2. Financial Competence and Planning

Have you given a thought about how you will pay for long-term-care expenses before you participated in this survey?

- ○ Yes
- ○ No

<< Prev   Next >>

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2. Financial Competence and Planning

To what extent do the following statements apply to you? Please tick one box on the scale where 0 means 'certainly not' and 10 means 'certainly yes'.

	certainly not										certainly yes
I have/expect to have enough retirement income.	0	1	2	3	4	5	6	7	8	9	10
I have enough savings.	0	1	2	3	4	5	6	7	8	9	10
I would like to leave an inheritance.	0	1	2	3	4	5	6	7	8	9	10

<< Prev   Next >>

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3. Preferences and expectations

The final set of questions covers risk preferences, patience, expectations about needing long-term care and house price expectations

Risk preferences

How do you see yourself: Are you generally a person who is fully prepared to take risks in financial matters or do you try to avoid taking risks in financial matters? Please tick one box on the scale where 0 means 'not prepared to take risks' and 10 means 'fully prepared to take risks.

Not prepared to take risks									fully prepared to take risks	
0	1	2	3	4	5	6	7	8	9	10

<< Prev   Next >>

3.Preferences and expectations

Patience and trust

Are you generally an impatient person or someone who always shows great patience? Please tick one box on the scale where 0 means 'very impatient' and 10 means 'very patient'.

very impatient										very patient
0	1	2	3	4	5	6	7	8	9	10

92% << Prev Next >>

3.Preferences and expectations

In these questions, we ask you to describe your own personality traits. Please indicate how well each of the following describes you.

	Not at all	A little	somewhat	good
Organized	○	○	○	○
Responsible	○	○	○	○
Hardworking	○	○	○	○
Careless	○	○	○	○
Thorough	○	○	○	○

93% << Prev Next >>

3.Preferences and expectations

Please indicate how much you agree with the following statements. Please tick one box on the scale where 0 means 'totally disagree' and 10 means 'totally agree'.

	totally disagree										totally agree
Banks can generally be trusted.	0	1	2	3	4	5	6	7	8	9	10
Insurance companies can generally be trusted.	0	1	2	3	4	5	6	7	8	9	10
Being in debt is never a good thing.	0	1	2	3	4	5	6	7	8	9	10

94% << Prev Next >>

3.Preferences and expectations

Long-term care expectations and preferences

In the future when you are getting older, you may need someone to care for you and help you with your activities of daily living. In the following table, please tick all answers that apply to you.

	Spouse	Children and/or gr andchildren	Caregiver living in home	Caregiver visiting h ome	Nursing home
Who is the most likely to provide care for you?	○	○	○	○	○
Who do you prefer to pro vide care for you?	○	○	○	○	○

95%   << Prev   Next >>

3.Preferences and expectations

House price expectations

Over the last five years, do you think the value of your home:

○ Increased a lot (greater than 20%)

○ Increased moderately (between 5% and 20%)

○ Remained rather stable (between 5% and -5%)

○ Decreased moderately (between -5% and -20%)

○ Decreased a lot (greater than -20%)

97%   << Prev   Next >>

3.Preferences and expectations

In the next 5 years do you think the value of your home:

○ Increased a lot (greater than 20%)

○ Increased moderately (between 5% and 20%)

○ Remained rather stable (between 5% and -5%)

○ Decreased moderately (between -5% and -20%)

○ Decreased a lot (greater than -20%)

98%   << Prev   Next >>

Survey feedback

How clear do you think the questions in this survey are?

- ○ Completely clear
- ○ Mostly clear
- ○ Sometimes clear
- ○ Sometimes confusing
- ○ Mostly confusing
- ○ Completely confusing

99%

<< Prev   Next >>