ISSN: 1648-715X / eISSN: 1648-9179

VILNIUS TECH
Vilnius Gediminas Technical University

INTERNATIONAL JOURNAL OF STRATEGIC PROPERTY MANAGEMENT

2024
Volume 28
Issue 5
Pages 272–285
https://doi.org/10.3846/ijspm.2024.22231

WILLINGNESS ANALYSIS OF MIDDLE-AGED AND OLDER PEOPLE'S PARTICIPATION IN REVERSE MORTGAGE SCHEMES

Ching-Yi CHEN[1], Hsi-Chuan WANG[2*]

[1] *Department of Living Science, National Open University, New Taipei City, Taiwan*
[2] *School of Public Affairs and Administration, University of Kansas, Lawrence, USA*

Article History:
- received 21 March 2024
- accepted 22 July 2024

Abstract. Enabling older adults to age at home is an urgent issue. This study focuses on the attitudes of middle-aged and older people (MAOP) in the capital cities of Taiwan, which are characterised by expensive housing prices and living costs, to examine their preferences for reverse mortgage (RM) schemes. The stated preference method and conditional multinomial logit model are utilised for analysis. The study simulates the total payment duration (TPD) and monthly payment amounts (MPA) to determine the market share of MAOPs' choices regarding terms. The results indicate that MAOPs tend to opt for RM schemes when they have children, partly enhancing the preference toward the long-term alternative (AL). Increasing the MPA has a positive effect on the market share of the AL scheme, but the amount must be increased to 90% to replace the market share of non-participation schemes significantly. The experimental design of this study could serve as a reference for future RM scheme designs. The findings suggest that there should be more alternative funding sources in an ageing society, particularly through revitalising housing assets, to promote ageing in place.

Keywords: reverse mortgage, quasi-experiment, stated preference, ageing at home, capital city.

*Corresponding author. E-mail: *andrewwang@wustl.edu*

1. Introduction

Financial planning within households is crucially linked to the quality of life in the later years of older adults and is highly correlated with the ability to age at home. Home attachment plays a vital role in helping older adults maintain a sense of continuity and identity (Marcus, 1997; Rowles, 1993; Sales et al., 2022; Stones & Gullifer, 2016). For a country with a high homeownership rate and many older adults residing in metropolitan areas with high housing prices, the exploration of whether reverse mortgage (RM) could serve as a source of income to support older adults' later years is essential. More research is needed to understand the willingness and timing of older adults' participation in RM.

It is worth noting that financial stress negatively affects the family (Friedline et al., 2021; Rhine et al., 2016; Rodrigues et al., 2023). Financial deprivation affects the household's health and well-being (Adams et al., 2016; Park et al., 2017; Rodrigues et al., 2023), and the stress linked to the desire for financial security could seriously influence well-being (Marshall et al., 2021; Rasul et al., 2005; Ryu & Fan, 2023). These rationales spurred the inquiry, asking if RM may be an alternative to balance ageing at home and assist cash-lacked older adults.

Such a background has made RM an attractive alternative for older adults to achieve the goal of ageing at home. RM is a financial instrument that allows homeowners to borrow against the equity in their homes, enabling the (often older) homeowners to take the money in a lump sum or monthly payments (Lauricella, 2014). Appropriately adopting RMs enables older homeowners to realise the residual value of their houses (arguably, the most critical component of wealth for older adults) before they die, to meet their income needs during their later years, and to increase the liquidity of their income and home equity (Bian & Lin, 2022; Chou et al., 2006; Mayer & Simons, 1994; Merrill et al., 1994; Naumanen & Ruonavaara, 2016; Warshawsky, 2018). In other words, RM allows MAOPs to redirect their savings – previously frozen in real estate – to their current affairs rather than using future assets for current affairs (Brown & Zhang, 2006). Activating real estate thus solves the problem of financial insecurity, ensures ageing at home (Johnson et al., 2015), and reduces the issue of unused housing resources when they are no longer alive (Fratantoni, 1999).

Previous RM studies have focused on the provider's (financial institutions) perspective, analysing the correlation between the individual's survival risk and repayment risk. They have used actuarial calculation methods, correlating these with factors such as generational life expectancy. These methods include financial-actuarial equilibrium (Atance et al., 2024; Cho et al., 2015; Huang et al., 2011;

Wang et al., 2008) and actuarial approaches (Boj et al., 2022; Debón et al., 2013). From a provider's perspective, there are four types of RM available in the industry based on the form of payment: (1) the 'lump-sum' scheme, which structures a payment of a fixed percentage of the future value of the property at the time of origination; (2) the 'income stream' scheme, which offers periodic payments from the initial time of the loan until the borrower's death; (3) the 'line of credit' scheme, which allows the borrower to make cash drawdowns up to a maximum amount; and (4) the 'combination' scheme, which mixes features of the above schemes (Atance et al., 2024; Wang et al., 2016). However, less research has been done from the demand side to understand potential borrowers' willingness to participate in RM (Davidoff et al., 2017), paving a new research direction.

The literature on the MAOPs' attitudes toward RM policies is still limited, with even fewer studies looking at Taiwan. In fact, conducting such research should significantly impact Taiwan and other places with similar socioeconomic challenges (continuous ageing, declining birth rate, and high economic pressure). For example, prior to the COVID-19 pandemic, one in six older adults in the United States participated in a wide range of needs-based assistance programs (Giefer & King, 2021). Findings by Giefer and King (2021) reveal the importance of a social safety net for economically vulnerable older adults. In Taiwan, after retirement, 55.4% of older adults aged 65 years and above rely on their pensions to support their living expenses; 24.3% rely on the younger generation; and 15.5% rely on government assistance (Ministry of Health and Welfare of Taiwan, Health Promotion Administration, 2018). However, 27% of Taipei houses are owned by seniors aged 60–69, comprising 13% of the total population (Cheng, 2017). Such a background makes Taiwan a worthwhile case study.

Taiwan introduced RM schemes in 2015. As of the end of December 2022, a combination of 6,697 commercial RM loans have been extended, with the total loan lent up to NTD 37.8 billion. These figures represent an increase of 1,071 RM loans and NTD 5.7 billion compared to the end of December 2021 (The Bankers Association of the Republic of China, 2022). By the end of 2023, a combined total of 8,064 RM loans had been approved, amounting to NTD 45.8 billion. However, in the first quarter of 2024, some public banks offering RM services reported zero cases (Kao, 2022), indicating room for growth in RM applications.

It should be noted that, like many other countries (Atance et al., 2024; Davidoff et al., 2017; Dillingh et al., 2013; Whait et al., 2019), the lack of financial knowledge among older adults has been a major issue affecting RM participation in Taiwan (Tsai et al., 2023; Wu & Hsiao, 2020). Meanwhile, legal considerations related to contracting RM in Taiwan – such as the Bank Law's limitations on real estate investment and loan duration, and the right to the mortgage specified by the Civil Law (Tsai et al., 2023) – are also developing subjects that highlight the importance of RM policy design. RM, an alternative expected to provide older adults with a stable income from the houses they own, is still a topic worth further exploration in Taiwan.

The primary focus of this study is to analyse the willingness of MAOPs to participate in RM schemes, considering factors such as the age of participation, monthly payment amounts, and duration of participation. It employs a quasi-experimental design with a discrete choice model to understand how the attributes of different RM schemes, such as the monthly payment amounts an older homeowner can receive, will affect older homeowners' willingness to participate in RM. The empirical objective is to identify the factors and sensitivity preferences that affect MAOPs' participation in RM and provide policy recommendations to facilitate ageing at home. The survey was focused on cities with higher housing prices, namely Taipei and New Taipei City.

The following sections are arranged: In section 2, this paper reviews earlier literature discussing the interaction between RM and the idea of ageing in place and the factors affecting MAOPs' preference toward RM schemes. It then illustrates the research design related to (1) the hypothesised RM policies designed to acquire MAOPs' preference, (2) the progress of data collection, and (3) the development of a Conditional Multinomial Logit (CMNL) model for statical analysis in section 3. The results are presented in section 4, followed by the discussion section that indicates the policy implications derived from the findings. Conclusions are provided in section 6.

2. Literature review

2.1. Subscribing RMs to achieve ageing in place

According to the report by Knaack and others (2020, p. 11), RM has been introduced mainly in advanced economies, whereas their RM markets tend to be small. The United States has the oldest and largest RM market, while smaller RM markets exist in Canada, Australia, Spain, and the United Kingdom (Ong, 2008). Home equity represents a substantial share of retirement wealth for many MAOPs (Fong et al., 2021; Friedman & Sjogren, 1981), particularly in Taiwan, where national housing policies have encouraged home ownership. RM schemes were introduced to Taiwan through the Ministry of the Interior (Taiwan Today, 2009) and later with the first private RM program launched by Taiwan Cooperative Bank in 2015 (Oliva, 2015).

Although RM has grown since then, with the increasing number of approved loans (Clow, 2020), most older adults still have never heard of RM (Fong et al., 2021). The lack of knowledge about contracts (Di Lorenzo et al., 2020) can prevent older adults from utilising RM schemes. Even if they have heard of RM schemes, they do not wish to tap into their house equity, owing to reasons related to bequest (Nakajima & Telyukova, 2017; Naumanen &

Ruonavaara, 2016; Warshawsky, 2018) and concerns about their uncertain life expectancy, health risks, medical expenditure shocks, interest rate risk, and house price fluctuations (Costa-Font et al., 2010; Davidoff et al., 2017; Fehr & Hofmann, 2020; Nakajima & Telyukova, 2017). Due to the complexity, uncertainty, and risks – particularly the lack of discussion and implementation cases – many older adults have concerns about RM.

These considerations do not just apply to older adults in Taiwan. From a macro perspective, as Haurin and others (2016) have highlighted, as long as housing prices are stable, so is the demand for RM. This understanding leads to the perception that the RM scheme is an approach to activating real estate and creating new cash flow to improve living quality, which supports older adults in achieving ageing at home. It enables retired homeowners to borrow against their home equity without moving and make partial withdrawals from their choice of savings vehicles (Cocco & Lopes, 2020), leading to the possibility of ageing in place and making older adults independent and active. This paper then moves on to discuss the factors affecting RM participation.

2.2. RM factors and the willingness to participate

To make RMs work, financial institutions and MAOPs generally consider the risk components associated with such a financial instrument, including longevity risk, interest rate risk, and housing price risk (Atance et al., 2024). First, longevity risk centres on whether individuals will live longer than expected by the lending financial institutions; signing these loan applications is a decision intertwined with housing price determination and the individual's expected longevity (Costa-Font et al., 2010; Davidoff et al., 2017; Nakajima & Telyukova, 2017; Shao et al., 2015). Second, interest rate risk challenges financial institutions regarding whether the assumption of a fixed interest rate is appropriate when deciding their RM products. In contrast to house equity loans, the RM amount available to a borrower typically is inversely proportional to the prevailing interest rate because homeowners can often borrow more when interest rates fall and vice versa (Chatterjee, 2016). Volatile interest rates could be a concern to both financial institutions and MAOPs.

Third, the amount of RM loan available to a borrower depends not only on the borrower's age but also on the property's value (Chatterjee, 2016); housing price risk hence is a notable uncertainty to manage (Atance et al., 2024). The increased housing value of the collateral pledged decreases the likelihood of defaults on existing mortgages, motivating financial institutions to expand their lending (Knaack et al., 2020). This macro-financial mechanism suggests that higher housing prices would increase MAOPs' demand for RM. Simultaneously, higher housing valuations would render financial institutions' holdings of loans less risky, encouraging them to approve applications (Chen & Yang, 2020).

Various individual characteristics also influence MAOPs' preference toward RM schemes. For example, Yang and Yuh (2019) examined ways to alleviate longevity risk using the RM loan system in South Korea. They found that RM is especially beneficial for homeowners aged 67 years and older, and its benefits are enhanced when bequest value is included. According to Chatterjee (2016) and Salter et al. (2012), RM can be an effective estate planning tool since life expectancy has increased worldwide. Older adult households can use RM to borrow against their equity and make intergenerational transfers to their offspring (Chatterjee, 2016; Merton, 2007). These studies indicate the *long-term utilisation of houses* (how these poverties were acquired and whether they should be passed on). As such, *having more children* may hypothetically reduce the older homeowners' need to bequest his/her possessions.

Fong and colleagues (2021) took a further step in examining older adults regarding their financial conditions beyond personal characteristics. They found that having a mortgage, financial literacy, and preparedness for retirement can be positively associated with interest in RM. Of note, the interest in RM is higher among self-employed older adults (a significant increase of 14%), followed by those who (1) expect their pensions to be cut, (2) have higher expenditures, (3) have a high housing wealth relative to their income, or (4) already have more than one mortgage (Dillingh et al., 2017). Conversely, female older adults who have (1) (grand) children, (2) a lower socioeconomic status, (3) sufficient savings, and/or (4) deteriorating health are less interested in RM schemes (Chou et al., 2006; Dillingh et al., 2017). These features collectively reflect that older adults with *more financial knowledge* (*especially their capacity to understand/manage their decisions with RMs*) *and living expenses* in pursuing *their independence from the later generations* could consider RM schemes.

Such an idea is empirically revealed in the work of Moulton and others (2017), who looked at the various waves of US survey data that have counselled an RM to tease the assumption of older adults being 'house rich' and 'cash poor'. Here, physical health was an additional characteristic they further considered. As they noticed, some studies assumed that *poor health would drive older adults to sign up with RM* to reduce their medical expenses (Nakajima & Telyukova, 2017). Although Moulton et al. (2017) found a nuanced influence of health factors on RM decision-making, this feature is still worth exploring, considering that the healthcare systems vary significantly among countries (Hsu et al., 2023).

These studies have not thoroughly examined the older adults' preference toward RM schemes regarding the design of RM schemes. It thus presents a research gap in the literature (Moulton et al., 2017, p. 94). This study accordingly designs the subsequent simulation of the stated preference questionnaire on RMs, using the attributes of 'total payment duration' and 'monthly payment amounts' (Costa-Font et al., 2010; Shao et al., 2015) to examine the participation attitudes of MAOPs. The following section looks further into the research design of this study.

3. Research design and methodology

3.1. Research design and background of the RM policies

This study employs surveys to investigate the preferences of MAOP homeowners in Taipei City and New Taipei City regarding RM schemes. It uses a quasi-experimental design and a stated preference method (assigning different hypothetical RM schemes with designated attributes for the older adults to choose from. See the supplementary materials for more details) to analyse MAOPs' choice of behaviour. Following the research gap highlighted above, this study focuses on two core attributes that affect participation in the RM market: 'total payment duration (TPD)' and 'monthly payment amounts (MPA)'.

The TPD attributes consider the timing of participation, whereas the MPA comprises a combination of home equity value, payment duration, and market interest rate. The longer a MAOP's life expectancy is, the longer the payment duration will be, meaning the MPA will be relatively lower. For example, the low equity value of a house with a higher market interest rate implies a lower MPA. Conversely, a higher equity value with low market interest may result in a higher MPA. However, having a high or low MPA depends upon the participation timing and the payment duration.

Based on the above concepts, the TPD and MPA can generate various combinations of attribute values. Combining these level values makes it possible to simulate the market share of different RM schemes. In other words, TPD and MPA are crucial factors influencing whether MAOPs participate in RM schemes. These factors are essential for financial institutions when designing RM schemes to ensure they are sufficiently attractive.

Table 1 presents the simulated attributes' values for the attributes of the scheme. To discuss MAOPs' participation timing (age) preferences, three alternatives were designed based on the ages of those willing to participate: (1) The long-term alternative (AL), involving joining the RM schemes at the age of 60; (2) The mid-term alternative (AM), involving joining the RM schemes at the age of 70; and (3) The short-term alternative (AS), involving joining the RM schemes at the age of 80. It indicates that older MAOPs can choose to participate in preferred alternative combinations based on their socioeconomic background and needs as the attribute levels vary. Of course, older MAOPs also have the option to not participate (NP) in RM.

In doing so, the attribute levels of the TPD were set with a maximum of 45 years to capture the MAOPs' timing preferences. Although most terms are currently set at 30 years in Taiwan, we decided to extend the maximum term to 45 years, considering the extension of population longevity and the requirements of the stated preference method for setting attribute levels, which necessitates a sufficiently large variation to be accounted for in the RM scheme design (Hensher et al., 1988; OECD, 2018). The goal is to obtain effective coefficients. Therefore, the model set the maximum TPD at 45 years and the minimum at 10 years.

Regarding the MPA, reasonable loan levels, representing 70–80% of the housing price, were determined based on the condition of the houses and housing prices in the study cities' market. The evaluation of MPA considered various recovery periods for the loan and interest rates, which were calculated using the present value of annuity and deducting monthly interest. In this study, the market value of houses was set between approximately 4 million NTD (about $130,000) and 40 million NTD (about $1.3 million), including several intermediate values to determine the corresponding monthly payment amounts. The monthly payments are also listed in Table 1.

Notably, all attribute levels are required to be presented randomly in the questionnaires with *independent* and *identical frequency* in each specified alternative. To capture the MAOPs' preferences, establishing significantly variant level values to enable different settings would allow us to simulate market share and understand their behavioural preferences. This is a crucial insight for the scheme design of the stated preference method. On that note, the attribute values for the NP scheme, the comparative alternative for the MAOPs, were set at 0.

3.2. Survey design and basic assumptions

As participation in RM schemes involves specific target groups and asset holdings, purposive sampling was used to conduct the survey. Interviewers were asked to go to places where MAOPs met more often and conduct interviews with respondents who met the following criteria:

Table 1. Simulation of the scheme name, attributes, and level values

Alternative	Level values	
	TPD	MPA (NTD/ten thousand)
The Long-term Alternative (AL)	45, 35, 30	6, 4, 3, 2, 0.7
The Mid-term Alternative (AM)	40, 30, 20	7, 5, 3, 2.5, 1.5
The Short-term Alternative (AS)	30, 25, 10	8.5, 6, 3.5, 2.8, 1.6
Non-participation (NP)	0	0

Note: 1) Two combinations of attribute levels were randomized by Excel programming to ensure that they were independent of each other and occurred with equal frequency (OECD, 2018). 2) Average exchange rate in 2021: 1 USD ~ 28 NTD.

'owning a house' and 'being 55 years old or older'. The simulated question was:

> *With your current family conditions, given that you own your house without a mortgage while facing insufficient income in the foreseeable future. You saw an advertisement from a bank for AL, AM, and AS reverse mortgage schemes, which are available at the ages of 60, 70, and 80, respectively. You can choose a specific time, mortgage your house to the bank, and after deducting interest, you can obtain a reasonable income. Considering the above setting, which of the following combination schemes is the most preferred from your perspective? Depending on your preferences, you can also choose 'I do not want to participate'.*

Each interview questionnaire was designed with three identical questions, each featuring various level values of the attribute. Such a design aimed to increase the sample size for calibration and expand the scheme variation presented to the respondents (refer to the supplementary materials for sample questions). Respondents could then choose the most preferred scheme based on their socio-economic conditions, financial status, health, and other relevant factors.

The survey locations occurred around a university campus (with a completed sample size of 149); we also collected the inputs of the retired personnel from the police and business sectors (a sample size of 50) and interviewed the older adults from selective communal dining venues (a sample size of 41). A total of 240 respondents were interviewed, and 240 questionnaires were collected. The surveys were conducted in January 2020. After eliminating unqualified samples, 237 responses and 711 simulated samples were analysed. The research framework and survey design of the study are presented in Figure 1.

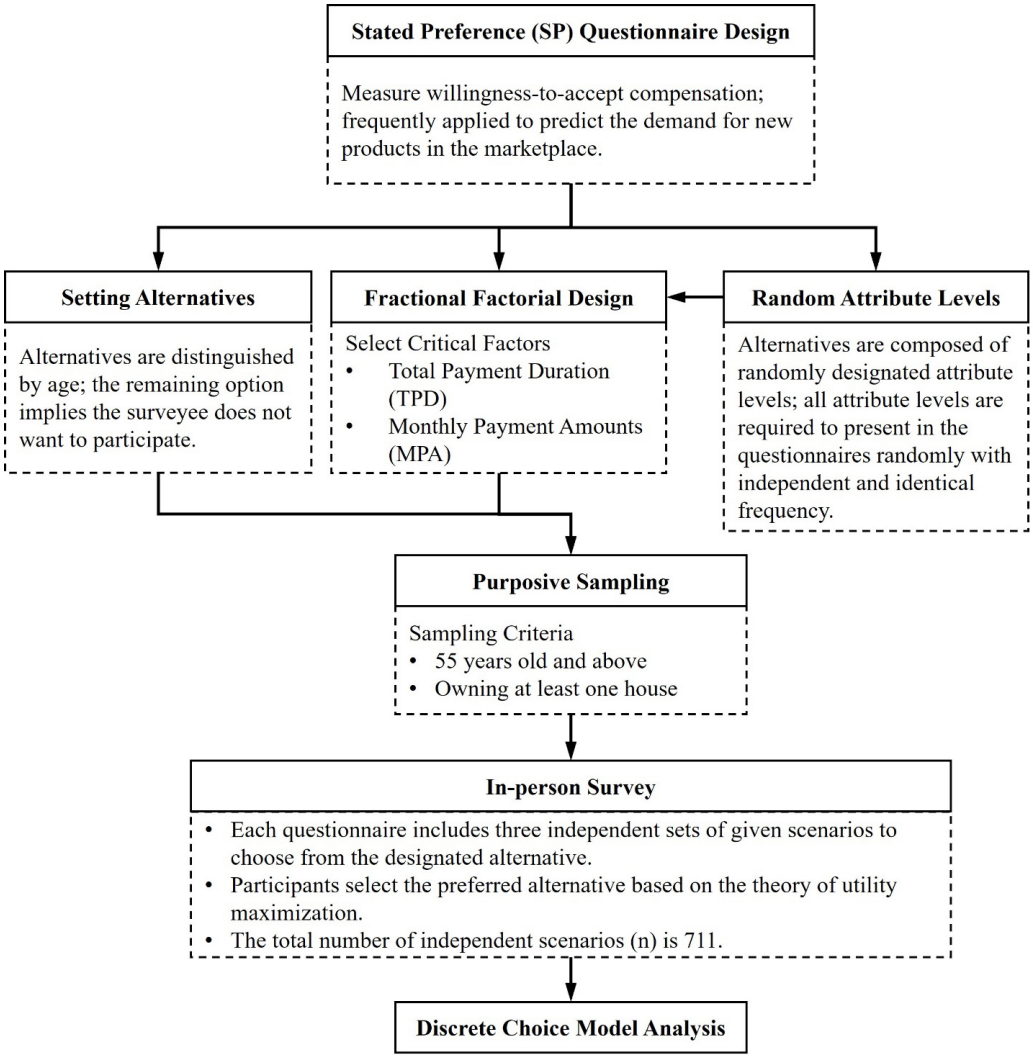

Figure 1. Research framework and survey design

3.3. Discrete choice model

With the independence of irrelevant alternatives (Ben-Akiva & Lerman, 1985), a discrete choice model could be used to examine empirically how the attribute variables (like TPD) would affect an MAOP's preference toward the presented alternative (such as an RM scheme promoted by a financial institution). The model was constructed so that the probability (P_j^i) of an MAOP (i) choosing an RM scheme (j) depends on the utility of the scheme to the MAOP (U_j^i). Based on utility maximisation theory (Greene, 2000; Maddala, 1989), the higher the utility of the scheme, the greater the chance that it will be selected by an MAOP. The utilities of the alternatives can be divided into measurable (V_j^i) and random utilities (ε_j^i). This can be expressed mathematically, as in Equation (1).

$$U_j^i = V_j^i + \varepsilon_j^i. \tag{1}$$

In line with McFadden's advice (1981), it is assumed that the measurable utility (V_j^i) is a linear combination scheme of attribute variables (X_j^i) (e.g., TPD and MPA) and socioeconomic attribute variables (S_j^i) (e.g., number of children and income). The β and φ are estimation coefficients. K and M are the mean attribute variables, as in Equation (2).

$$V_j^i = f\left(X_j^i, S_j^i\right) = \sum_{k=1}^{K} \beta_k X_{jk}^i + \sum_{m=1}^{M} \varphi_m S_{jm}^i. \tag{2}$$

Different choice models can be obtained with different probability allocation assumptions for random utility. According to the first type of extreme value distribution, when (ε_j^i) embodies the IID characteristic (i.e., a Gumbel distribution), a conditional multinomial logit (CMNL) model can be derived (see the supplementary materials). The mathematical formula is shown in Equation (3).

$$P_j^i = \exp\left(V_j^i\right) * \left[\sum_{j=1}^{J} \exp\left(V_j^i\right)\right]^{-1}. \tag{3}$$

3.4. Descriptive statistics

Table 2 lists the variable symbols and specific operational definitions. Some variables were used as composite variables to calibrate the model. This was done to highlight the willingness and economic significance of the MAOP to participate in RM schemes.

Table 3 presents the descriptive statistics of continuous variables. According to Chatterjee (2016) and Davidoff et al. (2017), knowledge of the RM policy or having peers participating in RM schemes affects the MAOPs' willingness to participate. The results of this survey demonstrate that the mean score of the MAOPs' self-rated awareness of RM policies was 2.85, indicating that the respondents' awareness of the policy ranged from 'I know it superficially' [score 2]

Table 2. Variable symbols and definitions

Variable name	Operational definition of variable	Symbol
Generic variables		
Total payment duration	Total payment duration	TPD
Monthly payment amounts (Ten thousand)	A positive expectation sign means that the higher the scheme's monthly payment, the more the MAOP prefer to choose it	MPA
Total payment amounts (Ten thousand)	The MPA multiplied by 12 months, multiplied by the TPD. A positive expectation sign indicates that the higher the scheme's total entitlement amount, the more the MAOP prefer it	TPA
TPD* with children	Take the Ln of TPD* irrespective of whether the respondent has children, and then substitute it into the formula The value is given for the respondents with children, whereas, for those without children, the value is 0 The economic significance is the marginal effect of the TPD with or without children on the scheme choice. A positive expectation sign indicates that MAOP with children prefer a scheme with a longer period	C_TPD
Individual status		
Male	0 denotes the percentage of male respondents to this survey (30.80%).	Male
Female	1 denotes the percentage of female respondents to this survey (69.20%).	Female
Disposable income (Ten thousand/month)	The average monthly disposable income of the respondents	M_incomes
Number of years of education (year)	The number of years of education received by the respondents	Edu
Age (year)	The respondent's year of birth	P_age
Marital status		
Unmarried/divorced	1 denotes the percentage of unmarried or divorced respondents (8.02%)	Alone
Married	1 denotes the percentage of married respondents (80.17%)	Married
Others	0 denotes the percentage of respondents with other statuses (11.81%).	Others
Number of children (persons)	The total number of children of the respondents	Child

End of Table 2

Variable name	Operational definition of variable	Symbol
Subjective indicator measurement scale for self-assessment		
Self-assessment of health conditions	With a five-point Likert scale for the questions. 1: very unclear, very bad, or very unsatisfied; 5: very clear, very good, or very satisfied	Health
Self-assessment perception of RM policies		Congi
Self-assessment of the house's external environment		Outdoor
Self-assessment of the house's internal environment		Indoor
Self-assessed health condition* Married	A composite variable. 1 denotes a married respondent, and 0 indicates other statuses, then multiplied by the self-assessed health status score. The better the self-assessed health condition, the higher the score. Otherwise, it is 0	M_health
Self-assessment perception of RM policies* Investment	A composite variable. The purpose of house ownership. 1 for investment, 0 for other purposes, then multiplied by the self-assessed awareness score for the RM policy. The deeper a respondent's understanding of the RM policy, with a clear investment intention, the higher their score will be. Otherwise, it is 0	In_congi
Self-assessment perception of RM policies* Inheritance	A composite variable. The purpose of house ownership. 1 for inheritance, 0 for other purposes, then multiplied by the self-assessed awareness score for the RM policy. The deeper understanding a respondent has of the RM policy, with the house being an inheritance, the higher their score will be. Otherwise, it is 0	Inh_congi
Housing status		
Number of houses owned (households)	The total number of homes owned by the respondents. 24% of the respondents owned more than two houses	M_housing
Roof age	The annual number of dwellings from completion to 2019	H_age

Table 3. Descriptive statistics of the continuous variable

Variable	Minimum value	Maximum value	Average value	Variance value
P_age	55	88	63.58	45.16
M_housing	1	3	1.27	0.246
Child	0	5	2.26	0.95
M_incomes	1	19	4.67	58,821.59
Edu	3	18	12.66	12.65
Congi	1	5	2.85	1.35
In_ Congi	0	4	0.13	0.35
Inh_ Congi	0	4	0.11	0.31
Health	1	5	3.69	0.61
M_health	0	5	2.98	2.67
Outdoor	1	5	3.78	0.50
Indoor	1	5	3.70	0.47
Hage	5	55	29.32	116.67
Respondents' size (*N*)			237	

Table 4. Distribution of schemes by age

Scheme \ Age	55–59 (%)	60–64 (%)	65–69 (%)	70–74 (%)	75–79 (%)	80–84 (%)	85+ (%)	Total (%)
AL	69 (9.7)	29 (4.1)	40 (5.6)	14 (2.0)	4 (0.6)	3 (0.4)	0 (0.0)	159 (22.4)
AM	78 (11.0)	52 (7.3)	60 (8.4)	23 (3.2)	7 (1.0)	3 (0.4)	1 (0.1)	224 (31.5)
AS	40 (5.6)	24 (3.4)	25 (3.5)	26 (3.7)	5 (0.7)	0 (0.0)	2 (0.3)	122 (17.2)
NP	32 (4.5)	54 (7.6)	40 (5.6)	57 (8.0)	11 (1.5)	9 (1.3)	3 (0.4)	206 (29.0)
Simulation sample size (*n*)	219 (30.8)	159 (22.4)	165 (23.2)	120 (16.9)	27 (3.8)	15 (2.1)	6 (0.8)	711 (100.0)

to 'I know around 50% of the content' [score 3]. Further, only 26.7% of MAOP thought that they knew 'most of the content' [score 4] or 'all of the content' [score 5] regarding the self-rated awareness of RM. The results of self-assessment of the internal/external environment of the residence ranged from 'fair' [score 3] to 'satisfied' [score 4].

Table 4 presents the selection of schemes by age. Among them, the AM scheme was chosen most frequently, accounting for 31.5%, followed by the NP and AL schemes, accounting for 29.0% and 22.4%, respectively. The finding shows that the attribute values of the AM scheme are more likely to be preferred by MAOPs.

4. Results

Table 5 presents the empirical results of CMNL models. The economic implications of these variables are described below.

4.1. Generic variables

Models 1 and 2 show that, without considering the socioeconomic background of MAOPs, they attach great importance to the monthly payment amount and do not care about the length of the payment duration. MAOPs are particularly interested in getting the total amount back. Such a finding implies that MAOPs care more about the residual value of the house. Models 3 and 4 further consider the socioeconomic variables of MAOPs, and the presence or absence of children becomes a crucial factor forcing MAOPs to reconsider the importance of the payment duration.

The TPD in models 3 and 4 were multiplied by 'with children', and the corresponding logarithm was considered. The coefficients showed positive significance (0.340 and 0.392), indicating that the longer the years of payment, the more likely MAOPs are to participate in RM schemes when they have children. This result is different from the findings of Dillingh et al. (2017), Chou et al. (2006), and Fong et al. (2021). It indicates that those with children are

Table 5. Conditional MNL model results

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	$\hat{\beta}$ (t value)	$\hat{\beta}$ (t value)	$\hat{\beta}$ (t value)	$\hat{\beta}$ (t value)	$\hat{\beta}$ (t value)	$\hat{\beta}$ (t value)
Constant_AL	–0.564* (–2.019)	–0.559*** (–4.100)	3.316** (2.789)	4.131** (3.064)	5.987*** (5.543)	5.676*** (4.363)
Constant_AM	–0.278 (–1.145)	–0.216 (–1.673)	4.063*** (3.427)	4.826*** (3.581)	6.496*** (5.955)	6.392*** (4.962)
Constant_AS	–0.957*** (–4.298)	–0.795*** (–5.714)	3.574** (3.048)	5.102*** (3.624)	4.843*** (4.224)	5.184*** (3.768)
Constant_NP	*Ref.*					
Generic variables						
TPD	0.005 (0.073)			–		
C_TPD		–	0.340*** (3.492)	0.392*** (4.082)	–	
MPA	0.0911*** (3.634)	–	0.095*** (3.662)	0.095*** (3.683)	–	
TPA	–	0.216*** (3.577)	–		0.235*** (3.770)	0.243*** (3.897)
Gender						
Female [ASDV_ AL]		–	0.645** (3.000)	0.605** (2.822)	0.577** (2.709)	0.639** (2.989)
Male	*Ref.*					
M_incomes [ASV_NP]		–	–0.197*** (–4.213)		–	
M_incomes [ASV_AS]		–			0.097* (2.478)	0.096* (2.439)
Edu [ASV_AM]		–		–0.568* (–1.979)	–	
P_age [ASV_NP]		–	0.738*** (5.275)	0.879*** (6.397)	0.804*** (6.045)	0.919*** (5.973)
M_health [ASV_AM]		–	0.003 (0.062)	0.014 (0.260)	0.055 (1.024)	–

End of Table 5

Variable		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		$\hat{\beta}$ (t value)	$\hat{\beta}$ (t value)	$\hat{\beta}$ (t value)	$\hat{\beta}$ (t value)	$\hat{\beta}$ (t value)	$\hat{\beta}$ (t value)
Marital status							
Alone [ASDV_AS]				–			0.166 (0.393)
Married [ASDV_AS]				–			–0.138 (-0.490)
Others					*Ref.*		
Child [ASV_AS]				–		0.217* (1.970)	–
Child [ASV_NP]				–			–0.310*** (–2.964)
Health [ASV_AS]					–		0.065 (0.493)
Self-assessed perception of RMs							
In_congi [ASV_AM]			–	0.553*** (3.804)	0.584*** (4.006)	0.583*** (3.986)	0.603*** (4.123)
Inh_congi [ASV_AL]			–	0.194 (1.364)	0.164 (1.152)	–	
M_housing [ASV_NP]			–	0.763*** (4.564)	0.753*** (4.524)	0.792*** (4.788)	0.803*** (4.818)
Residential attributes							
Outdoor [ASV_NP]			–	–0.166 (–0.963)	–0.230 (–1.371)	–0.199 (–1.212)	–0.116 (–0.674)
Indoor [ASV_NP]			–	0.440* (2.432)	0.413* (2.396)	0.411** (2.397)	0.342* (1.958)
H_age [ASV_NP]			–	–0.133 (–1.509)	–2.529 (–1.220)	–	–0.095 (–1.107)
H_age [ASV_AS]				–		0.117 (1.229)	–
Statistics	LL(β)	–960.514	–960.787	–891.116	–899.281	–904.184	–899.635
	AIC	1931.027	1929.575	1812.231	1828.561	1836.367	1831.270
	BIC	1953.861	1947.841	1880.753	1897.062	1900.302	1904.336
Sample size	*N*				237		
	n				711		

Note: 1) *, **, and *** indicate that the two-tailed test results are significant at the 5%, 1%, and 0.1% levels, respectively. 2) '–' indicates that the variable is not included in the model. 3) ASV_AL = alternative specific variable_AL; ASV_AM = alternative specific variable_AM; ASV_AS = alternative specific variable_AS; ASV_NP = alternative specific variable_NP; ASDV_AL = alternative specific dummy variable_AL; and ASDV_AS = alternative specific dummy variable_AS.

more likely to enter an RM arrangement to increase their financial income and avoid dependence on their children. Furthermore, those who do not live with their children are more likely to apply for RMs than those who live with their children. When parents live separately from their children, they enjoy independent living spaces, giving them more freedom to dispose of their property. They are thus more willing to apply for RMs.

The coefficients of models 3 and 4 revealed that the higher the monthly payment (0.095 and 0.095), the higher the MAOPs' intention to apply for RM. Models 5 and 6 include total payment amounts (TPA). The coefficients were significant (0.235 and 0.243), implying that the higher the TPA could be claimed through RM, the more the MAOPs are willing to apply for RM.

4.2. Socioeconomic attributes

The women variable was set in the AL scheme. The hypothesis states that women may be less well-off than men; therefore, they prefer to participate in the scheme earlier than men. The results from models 3 to 6 demonstrated that the coefficients were all significant (0.645, 0.605, 0.577, and 0.639), indicating that women are more likely to participate in RM schemes earlier than men.

Model 3 sets the monthly disposable income as a specific variable of the NP scheme. The hypothesis claims that higher-income people would not participate in RM schemes. The coefficients were negatively significant (–0.197), indicating that MAOPs with higher disposable incomes do not prefer the NP scheme. Furthermore, the coefficient was positively significant (0.097 and 0.096) in

models 5 and 6, wherein monthly disposable income was set as a specific variable in the AS scheme. This setting indicates that MAOPs with higher monthly disposable income are more likely to participate in the scheme later. Combining the results of the three models, we find that MAOPs with higher disposable income are less likely to opt out of the scheme because they might be used to spending more money. However, they prefer to participate in the RM scheme later because of their higher income. Older MAOPs thus may be more conservative and psychologically more dependent on a house for shelter and security. Moreover, they may not apply for RM owing to insufficient knowledge about RM schemes.

The empirical coefficients (0.003, 0.014, and 0.055) in models 3, 4, and 5 are insignificant for the self-rated health conditions multiplied by marital status. In model 6, marital status and self-rated health conditions are set as variables in the AS scheme. The coefficients are insignificant, indicating that they do not affect MAOPs' willingness to participate in RM schemes. This result differs from Chou et al. (2006) and Dillingh et al. (2017), who found that those in poor health are less likely to apply for RMs.

Models 5 and 6 include the number of children as a specific variable in the AS and NP schemes, respectively, assuming that MAOPs with more children would prefer to participate in RM schemes later. The coefficient (0.217) is significantly positive, indicating a willingness to participate in the scheme. In addition, the coefficient (–0.310) for the variable in model 6 is significantly negative, meaning that MAOPs with children have a higher probability of skipping the NP scheme (i.e., more likely to join RM schemes). Comparing these results indicates that MAOPs with more children prefer to participate in the scheme later. This result aligns with the interaction between the 'number of children' and 'TPD' in the aforementioned scheme attributes.

This finding implies that children influence the MAOPs' willingness to participate in RM schemes, presumably because the former have a higher expenditure level and financial needs in both cities. Hence, they prefer to participate in the scheme later, wherein RMs are perceived as the last resort for financial independence.

4.3. Self-assessed perception of RMs

The self-assessed perception of RM schemes is multiplied by the intent of owning a house as an investment. It assumes that MAOPs are more likely to participate in the AM scheme if they are investment-oriented and more aware of RM policies. Empirically, the coefficients of models 3 to 6 are significant (0.553, 0.584, 0.583, and 0.603, respectively), indicating that MAOPs who are investment-oriented and more aware of RM policies are more likely to participate in the AM scheme. This finding is similar to that of Davidoff et al. (2017), who concluded that the more financially motivated people are, the more aware they are of RM schemes and the more willing they are to participate. The self-rated perception of RM was multiplied by inherited housing and set as the variable in the AL scheme. The empirical results showed that none of the coefficients (0.194 and 0.164) are significant, suggesting that when houses are inherited, awareness of RM schemes does not affect the behaviour of MAOPs.

4.4. Multi-housing and residential attributes

The number of dwellings is set as a specific variable in the NP scheme. It is assumed that those who own more houses prefer house ownership and high wealth capacity; therefore, they do not participate in RM schemes. The empirical results show that the coefficients for models 3 to 6 are significant (0.763, 0.753, 0.792, and 0.803), indicating a significant non-preference for participating in the RM schemes. This result is similar to that of Chou et al. (2006), who found a negative correlation between financial assets and the intention to apply for RM. This result implies that MAOPs who have accumulated substantial real estate assets owing to their wealth are not financially deprived and prefer not to participate in RM schemes.

Regarding housing attributes, external environments have a non-significant impact on participation in RM schemes. The better a house's internal environment, the less likely the owner is to participate in RM schemes. This result could be attributed to the psychological orientation that makes them value their home; consequently, they develop a distinctive preference for not participating in RM schemes. This finding contradicts that of Costa-Font et al. (2010).

5. Discussion

5.1. Market share simulation analysis

This study investigates the MAOPs' preferred timing to participate in RM. The stated preference serves as a flexible method for anticipating the demand for MAOPs in advance (Bonekamp & van Soest, 2022). By designing attributes and conducting market share simulations, we can monitor the behavioural changes/patterns of MAOPs.

In Figure 2, the simulation model shows that TPD increases from 1% to 100%. The results indicate that, without any interference from other factors, the AM scheme has the highest market share, followed by the AS scheme. Since TPD in model 1 is not a significant variable, further changes in market share could be tested by looking at other variables, like combining TPD with children.

Figure 3 simulates the change in the market share of schemes when MAOPs have children, with TPD increases from 1% to 100%. We utilise the coefficient of model 3 since it has higher explanatory power than other models. The results demonstrate that the market share of the AL scheme exceeded that of the NP and AM schemes when MAOPs have children and TPD increased to approximately 25–30%. However, the AS scheme did not follow this tendency. Regarding the concepts of 'financial independence', 'longer life expectancy', and 'no burden on children', the

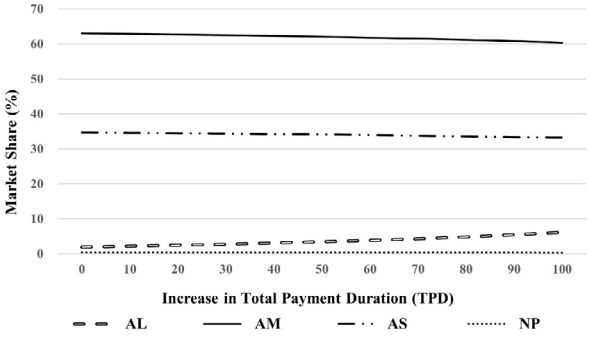

Figure 2. Simulation of the scheme market share considering the increase in TPD

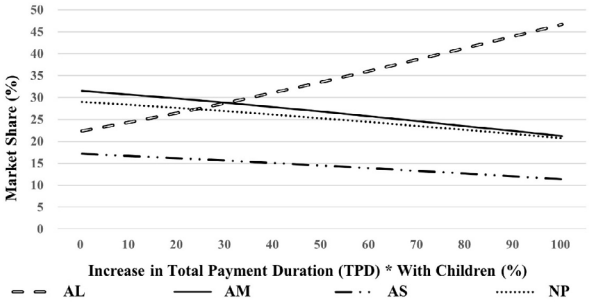

Figure 3. Simulation of the scheme market share considering the increase in TPD with children

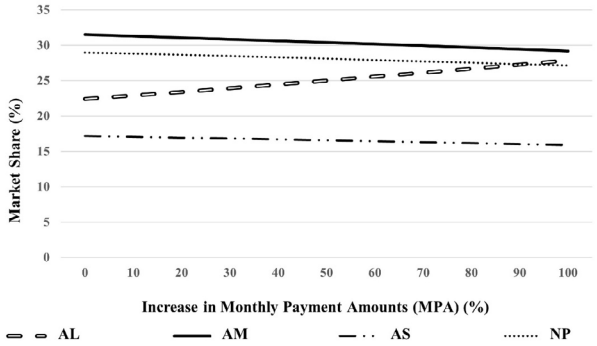

Figure 4. Simulation of the scheme market share considering the increase in MPA

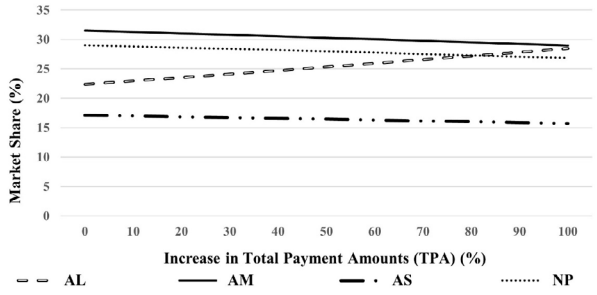

Figure 5. Simulation of the scheme market share considering the increase in TPA

MAOPs with children showed their willingness to participate in early bird RM schemes with TPD increases.

Figure 4 presents a simulation of the market share for MPA, utilising the coefficients drawn from model 3. The market shares of the four schemes were relatively stable with the changing MPA, except for AL, which could overtake the market share of the NP scheme if the MPA increased by 90%. The market share of the AM scheme is relatively high, indicating that the MPA values designed in this quasi-experiment fulfil the financial needs of the MAOPs. Therefore, the continued increase in the amount does not affect the market share of each scheme.

Figure 5 shows a simulation of the change in the market share of the TPA based on the coefficient of model 5. The market share of the AL scheme overtakes the NP scheme only when the total claim amount increases by 75%. Simultaneously, the market share of the AM scheme decreases slightly. Otherwise, the AM scheme had a higher market share than other schemes.

5.2. Policy implications

Older adults are more likely to face various economic and financial dilemmas, and well-developed systems are crucial for providing them with viable options. This study reveals that nearly 30% of the MAOPs interviewed hesitate to participate in RM schemes. The current hypothesised MPA is deemed suitable, with the AM scheme found to be rather popular (see Figure 4).

MAOPs with more children tend to participate in an RM scheme. Following the concept of altruism (the MAOPs ease the financial burden on children by increasing their own funds), the market share of AL will increase if the total payment duration extends. The role of children conceived in this study differs significantly from the perspective provided by Chou et al. (2006) and Dillingh et al. (2017), who emphasised that having (grand) children would diminish the MAOPs' interest in RM by about 30%. Our finding implies that *MAOPs tend to shift from 'raising children as a guarantee against old age' to being willing to accept RM*. In other words, MAOPs' participation in RM schemes can be explained by their desire for financial independence to avoid burdening their children. This finding suggests *a shift in parents' intergenerational altruism patterns, with MAOPs preferring to utilise their house for RM schemes rather than relying on their children for financial support in exchange for receiving a bequest*. As a result, MAOPs consider RM schemes a viable financial management system, viewing RMs as the 'last resort' to maintain independence (Leviton, 2002).

The awareness of RM significantly influences MAOPs' willingness to participate in the schemes. This finding aligns with the literature on countries other than Taiwan (Atance et al., 2024; Chatterjee, 2016; Davidoff et al., 2017; Fong et al., 2021; Whait et al., 2019). When MAOPs are more aware of various RM contents or intend to purchase a home for investment purposes, they are more willing to

participate in RM schemes. Such a finding underscores the importance of promoting information about RM (accessibility of information) and making the scheme's content explicit (transparency of information) to increase MAOPs' willingness to participate. Doing so will reduce RM information asymmetry risk and ensure quality ageing at home by converting real estate assets from static to dynamic. Further efforts are needed to promote and normalise RM schemes. Such a policy implication is particularly crucial in an environment with a high homeownership rate where older individuals own many homes. A robust system should be established to provide older adults with more choices in addressing economic challenges in their later years, simultaneously meeting the vital ageing-at-home policy for older care.

However, concerns persist about issues related to RMs, especially the 'predatory lending' aspect (Crossney, 2017; Lindsey-Taliefero & Kelly, 2021). These concerns may be mitigated by providing transparent and accessible RM information. Making these adjustments mitigates the need to consider bequest risks because the legal heir can choose to procure the house or settle the remaining RM entitlement amount upon the MAOPs' death.

6. Conclusions

This study explores the MAOPs' preference for participating in RM schemes through a quasi-experimental design, enabling a crucial effort to examine RM studies from the demand side other than the previous work focusing mainly on the provider's perspective. The empirical results show that the TPA and the MPA are important explanatory variables affecting the MAOPs' participation in RM schemes. This study makes the following contributions to the existing literature.

First, children significantly impact MAOPs' willingness to participate in RM schemes, although they prefer to join these schemes later. Notably, the MAOPs' tendency to hold real estate assets for family heirloom purposes is gradually influenced by increasing financial demands resulting from the higher costs of living, enhanced physical needs, and the MAOPs' longer life expectancy. The intergenerational altruism pattern is changing, prompting MAOPs' participation in RM schemes.

Second, MAOPs tend to see RM as a financial tool for their old age if they have a clear investment objective and an understanding of the RM policies. As global population structures move toward a super-aged society, countries with high homeownership rates should accelerate the improvement and transparency of information on RM schemes, allowing the RM system to become a viable option for MAOPs to maintain economic independence. This quasi-experimental design process and its results can be used as an important reference for RM scheme design. With more MAOPs considering RM, cities similar to Taipei and New Taipei City may better address their housing and ageing challenges and deliver more effective progress in urban redevelopment (Knaack et al., 2020).

This study has several limitations. It focused on exploring the willingness of MAOPs to participate in RM schemes without addressing RM-related risks (such as risk aversion) and the legal issues tied to RM contracting, considering that they are beyond our research scope. Since incorporating too many simulated factors in a single survey could lead to high refusal rates and respondent fatigue, this research did not exhaustedly address the RM–related risks. Such a limitation could be common for research with a quasi-experimental design; further investigation should be conducted in multiple phases to address this constraint. Future studies could include collecting responses from rural areas. Comparing rural and urban areas would facilitate the observation of whether changes in the concept of 'raising children as a guarantee against old age' are consistent between urban and rural areas. Future studies could also seek to include the changes in MAOPs' intention to join after observing changes in the claimable amount when the interest rate hikes suddenly. Such research findings can effectively capture the behavioural changes of the MAOPs. Lastly, beyond the case of Taiwan, it should also be noticed that the potential influence of other socioeconomic factors (such as lifestyle, geographic location, or race) may play a significant role in the decision-making process regarding RM. Varying results might be found when the same research design is applied in other countries. Exploring these other factors presents an excellent opportunity for future studies.

Funding

This work was supported by the National Science and Technology Council of Taiwan (MOST 109-2410-H-180-005-).

References

Adams, D. R., Meyers, S. A., & Beidas, R. S. (2016). The relationship between financial strain, perceived stress, psychological symptoms, and academic and social integration in undergraduate students. *Journal of American College Health*, *64*(5), 362–370. https://doi.org/10.1080/07448481.2016.1154559

Atance, D., Debón, A., & De La Fuente, I. (2024). Valuation of reverse mortgages in the Spanish market for foreign residents. *Technological and Economic Development of Economy*, *30*(1), 46–73. https://doi.org/10.3846/tede.2023.20159

Ben-Akiva, M., & Lerman, S. (1985). *Discrete choice analysis: Theory and application to travel demand*. MIT Press.

Bian, X., & Lin, Z. (2022). Housing debt and elderly housing tenure choices. *Real Estate Economics*, *50*(5), 1360–1397. https://doi.org/10.1111/1540-6229.12373

Boj, E., Claramunt, M. M., & Varea, X. (2022). Reverse mortgage and financial sustainability. *Technological and Economic Development of Economy*, *28*(4), 872–892. https://doi.org/10.3846/tede.2022.16617

Bonekamp, J., & van Soest, A. (2022). Evidence of behavioural life-cycle features in spending patterns after retirement. *The Journal of the Economics of Ageing*, *23*, Article 100408. https://doi.org/10.1016/j.jeoa.2022.100408

Brown, R., & Zhang, Y. (2006). Senior housing. *Journal of Housing For the Elderly*, *20*(1–2), 75–96. https://doi.org/10.1300/J081v20n01_05

Chatterjee, S. (2016). Reverse mortgage participation in the United States: Evidence from a national study. *International Journal of Financial Studies*, *4*(1), Article 5. https://doi.org/10.3390/ijfs4010005

Chen, K. S., & Yang, J. J. (2020). Housing price dynamics, mortgage credit and reverse mortgage demand: Theory and empirical evidence. *Real Estate Economics*, *48*(2), 599–632. https://doi.org/10.1111/1540-6229.12230

Cheng, Y. A. (2017). *An aging analysis of housing owned in Taipei*. Department of Land Administration, Taipei City Government.

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. https://doi.org/10.1515/apjri-2014-0012

Chou, K. L., Chow, N. W. S., & Chi, I. (2006). Willingness to consider applying for reverse mortgage in Hong Kong Chinese middle-aged homeowners. *Habitat International*, *30*(3), 716–727. https://doi.org/10.1016/j.habitatint.2005.04.008

Clow, C. (2020, January 30). Reverse mortgages surge by double digits in Taiwan. *Reverse Mortgage Daily*. https://reversemortgagedaily.com/articles/reverse-mortgages-surge-by-double-digits-in-taiwan/

Cocco, J. F., & Lopes, P. (2020). Aging in place, housing maintenance, and reverse mortgages. *The Review of Economic Studies*, *87*(4), 1799–1836. https://doi.org/10.1093/restud/rdz047

Costa-Font, J., Gil, J., & Mascarilla, O. (2010). Housing wealth and housing decisions in old age: Sale and reversion. *Housing Studies*, *25*(3), 375–395. https://doi.org/10.1080/02673031003711014

Crossney, K. B. (2017). Who's at-risk? A case study of the demographic and socioeconomic characteristics of census tracts experiencing predatory and abusive mortgage lending in Philadelphia. *Geoforum*, *81*, 129–143. https://doi.org/10.1016/j.geoforum.2017.02.013

Davidoff, T., Gerhard, P., & Post, T. (2017). Reverse mortgages: What homeowners (don't) know and how it matters. *Journal of Economic Behavior & Organization*, *133*, 151–171. https://doi.org/10.1016/j.jebo.2016.11.007

Debón, A., Montes, F., & Sala, R. (2013). Pricing reverse mortgages in Spain. *European Actuarial Journal*, *3*(1), 23–43. https://doi.org/10.1007/s13385-013-0071-y

Di Lorenzo, G., Orlando, A., & Politano, M. (2020). The security mortgage valuation in a stochastic perspective. *Electronic Journal of Applied Statistical Analysis*, *13*(1), 256–267.

Dillingh, R., Prast, H., Rossi, M., & Brancati, C. U. (2013). *The psychology and economics of reverse mortgage attitudes: Evidence from the Netherlands* (CeRP Working Papers No. 135). Center for Research on Pensions and Welfare Policies, Turin, Italy.

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. https://doi.org/10.1016/j.jhe.2017.09.002

Fehr, H., & Hofmann, M. (2020). Tenure choice, portfolio structure and long-term care – Optimal risk management in retirement. *The Journal of the Economics of Ageing*, *17*, Article 100240. https://doi.org/10.1016/j.jeoa.2020.100240

Fong, J. H., Mitchell, O. S., & Koh, B. S. K. (2021). Asset-rich and cash-poor: Which older adults value reverse mortgages? *Ageing & Society*, *43*(5), 1104–1121. https://doi.org/10.1017/S0144686X21001045

Fratantoni, M. (1999). Reverse mortgage choices: A theoretical and empirical analysis of the borrowing decisions of elderly homeowners. *Journal of Housing Research*, *10*(2), 189–208. https://doi.org/10.1080/10835547.1999.12091949

Friedline, T., Chen, Z., & Morrow, S. (2021). Families' financial stress & well-being: The importance of the economy and economic environments. *Journal of Family and Economic Issues*, *42*(Suppl. 1), 34–51. https://doi.org/10.1007/s10834-020-09694-9

Friedman, J., & Sjogren, J. (1981). Assets of the elderly as they retire. *Social Security Bulletin*, *44*(1), 16–31.

Giefer, K. G., & King, M. D. (2021). *One in six older Americans received needs-based assistance even before pandemic*. https://www.census.gov/library/stories/2021/10/what-happens-when-older-adults-struggle-to-make-ends-meet.html

Greene, W. H. (2000). *Econometric analysis*. Pearson Education.

Haurin, D., Ma, C., Moulton, S., Schmeiser, M., Seligman, J., & Shi, W. (2016). Spatial variation in reverse mortgages usage: House price dynamics and consumer selection. *The Journal of Real Estate Finance and Economics*, *53*(3), 392–417. https://doi.org/10.1007/s11146-014-9463-2

Hensher, D. A., Barnard, P. O., & Truong, T. P. (1988). The role of stated preference methods in studies of travel choice. *Journal of Transport Economics and Policy*, *22*(1), 45–58.

Hsu, H. C., Chong, Y., & Osawa, E. (2023). Comparison of Asian countries and age groups in the attitudes toward active aging and impression of older adults. *Journal of Aging & Social Policy*, *35*(4), 422–439. https://doi.org/10.1080/08959420.2022.2055418

Huang, H.-C., Wang, C.-W., & Miao, Y.-C. (2011). Securitisation of crossover risk in reverse mortgages. *The Geneva Papers on Risk and Insurance. Issues and Practice*, *36*(4), 622–647. https://doi.org/10.1057/gpp.2011.23

Johnson, D., Worthington, A., & Brimble, M. (2015). The potential role of housing equity in a looming baby boomer retirement cash-flow crisis: An Australian perspective. *Housing, Theory and Society*, *32*(3), 266–288. https://doi.org/10.1080/14036096.2015.1012275

Kao, S.-C. (2022, October 18). Reverse mortgage value increases less due to rate hikes. *Taipei Times*. https://www.taipeitimes.com/News/biz/archives/2022/10/18/2003787221

Knaack, P., Miller, M., & Stewart, F. (2020). *Reverse mortgages, financial inclusion, and economic development: Potential benefit and risks* (SSRN Scholarly Paper). Rochester, NY. https://doi.org/10.1596/1813-9450-9134

Lauricella, T. (2014). A kinder, gentler reverse mortgage? *The Wall Street Journal*. https://search.proquest.com/docview/1509230583?pq-origsite=primo

Leviton, R. (2002). Reverse mortgage decision-making. *Journal of Aging & Social Policy*, *13*(4), 1–16. https://doi.org/10.1300/J031v13n04_01

Lindsey-Taliefero, D., & Kelly, L. (2021). Reverse mortgage lending disparities and the economically vulnerable. *International Advances in Economic Research*, *27*(3), 159–169. https://doi.org/10.1007/s11294-021-09831-6

Maddala, G. S. (1989). *Limited-dependent and qualitative variables in econometrics*. Cambridge University Press.

Marcus, C. C. (1997). *House as a mirror of self: Exploring the deeper meaning of home*. Conari Press.

Marshall, G. L., Kahana, E., Gallo, W. T., Stansbury, K. L., & Thielke, S. (2021). The price of mental well-being in later life: The role of financial hardship and debt. *Aging & Mental Health*, *25*(7), 1338–1344. https://doi.org/10.1080/13607863.2020.1758902

Mayer, C. J., & Simons, K. V. (1994). Reverse mortgages and the liquidity of housing wealth. *Real Estate Economics*, *22*(2), 235–255. https://doi.org/10.1111/1540-6229.00634

McFadden, D. (1981). Econometric models of probabilistic choice. In *Structural analysis of discrete data with econometric applications*. MIT Press.

Merrill, S. R., Finkel, M., & Kutty, N. K. (1994). Potential beneficiaries from reverse mortgage products for elderly homeowners: An analysis of American housing survey data. *Real Estate Economics*, *22*(2), 257–299. https://doi.org/10.1111/1540-6229.00635

Merton, R. C. (2007). The future of retirement planning. In *The future of life-cycle saving and investing*. Charlottesville, Va.

Ministry of Health and Welfare of Taiwan, Health Promotion Administration. (2018). *Report of the senior citizen condition survey 2017*.

Moulton, S., Loibl, C., & Haurin, D. (2017). Reverse mortgage motivations and outcomes: Insights from survey data. *Cityscape*, *19*(1), 73–98.

Nakajima, M., & Telyukova, I. A. (2017). Reverse mortgage loans: A quantitative analysis. *The Journal of Finance*, *72*(2), 911–950. https://doi.org/10.1111/jofi.12489

Naumanen, P., & Ruonavaara, H. (2016). Why not cash out home equity? Reflections on the Finnish case. *Housing, Theory and Society*, *33*(2), 162–177. https://doi.org/10.1080/14036096.2015.1095234

OECD. (2018). *Cost-benefit analysis and the environment: Further developments and policy use*. OECD Publishing. https://doi.org/10.1787/9789264085169-en

Oliva, J. (2015, December 21). Taiwan Bank unveils first private reverse mortgage program. *Reverse Mortgage Daily*. https://www.housingwire.com/articles/taiwan-bank-unveils-first-private-reverse-mortgage-program/

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. https://doi.org/10.1080/14616710701817166

Park, N., Heo, W., Ruiz-Menjivar, J., & Grable, J. E. (2017). Financial hardship, social support, and perceived stress. *Journal of Financial Counseling and Planning*, *28*(2), 322–332. https://doi.org/10.1891/1052-3073.28.2.322

Rasul, F., Stansfeld, S. A., Hart, C. L., & Davey Smith, G. (2005). Psychological distress, physical illness, and risk of coronary heart disease. *Journal of Epidemiology and Community Health*, *59*(2), 140–145. https://doi.org/10.1136/jech.2004.019786

Rhine, S. L. W., Di, W., Greene, W. H., & Perlmeter, E. (2016). Savings account ownership during the great recession. *Journal of Family and Economic Issues*, *37*(3), 333–348. https://doi.org/10.1007/s10834-016-9489-0

Rodrigues, M., Silva, R., & Franco, M. (2023). COVID-19: Financial stress and well-being in families. *Journal of Family Issues*, *44*(5), 1254–1275. https://doi.org/10.1177/0192513X211057009

Rowles, G. D. (1993). Evolving images of place in aging and 'aging in place'. *Generations: Journal of the American Society on Aging*, *17*(2), 65–70.

Ryu, S., & Fan, L. (2023). The relationship between financial worries and psychological distress among U.S. adults. *Journal of Family and Economic Issues*, *44*(1), 16–33. https://doi.org/10.1007/s10834-022-09820-9

Sales, A., Pinazo-Hernandis, S., & Martinez, D. (2022). Effects of a reminiscence program on meaning of life, sense of coherence and coping in older women living in nursing homes during COVID-19. *Healthcare*, *10*(2), Article 188. https://doi.org/10.3390/healthcare10020188

Salter, J., Pfeiffer, S., & Evensky, H. (2012). Standby reverse mortgages: A risk management tool for retirement distributions. *Journal of Financial Planning*, *25*(8), 40–48.

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. https://doi.org/10.1016/j.insmatheco.2015.03.026

Stones, D., & Gullifer, J. (2016). 'At home it's just so much easier to be yourself': Older adults' perceptions of ageing in place. *Ageing & Society*, *36*(3), 449–481. https://doi.org/10.1017/S0144686X14001214

Taiwan Today. (2009, December 17). *Reverse mortgage scheme now on the table*. Ministry of Foreign Affairs, Republic of China (Taiwan). https://taiwantoday.tw/news.php?unit=10&post=16145

The Bankers Association of the Republic of China. (2022). *Annual report 2022*. https://www.ba.org.tw/

Tsai, P.-H., Wang, Y.-W., & Chang, W.-C. (2023). Hybrid MADM-based study of key risk factors in house-for-pension reverse mortgage lending in Taiwan's banking industry. *Socio-Economic Planning Sciences*, *86*, Article 101460. https://doi.org/10.1016/j.seps.2022.101460

Wang, C.-W., Huang, H.-C., & Lee, Y.-T. (2016). On the valuation of reverse mortgage insurance. *Scandinavian Actuarial Journal*, *2016*(4), 293–318. https://doi.org/10.1080/03461238.2014.925967

Wang, L., Valdez, E. A., & Piggott, J. (2008). Securitization of longevity risk in reverse mortgages. *North American Actuarial Journal*, *12*(4), 345–371. https://doi.org/10.1080/10920277.2008.10597529

Warshawsky, M. J. (2018). Retire on the house: The possible use of reverse mortgages to enhance retirement security. *The Journal of Retirement*, *5*(3), 10–31. https://doi.org/10.3905/jor.2018.5.3.010

Whait, R. B., Lowies, B., Rossini, P., McGreal, W. S., & Dimovski, B. (2019). The reverse mortgage conundrum: Perspectives of older households in Australia. *Habitat International*, *94*, Article 102073. https://doi.org/10.1016/j.habitatint.2019.102073

Wu, P.-C., & Hsiao, J.-M. (2020). Risk management policy of reverse mortgage loan. *Review of Integrative Business and Economics Research*, *9*, 399–421.

Yang, J., & Yuh, Y. (2019). Reverse mortgages for managing longevity risk in Korea. *Hitotsubashi Journal of Economics*, *60*(1), 21–40.