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The reverse mortgage market in New Zealand: key drivers of loan determination

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The paper examines the drivers of loan principals in the reverse mortgage and equity release market under a hedonic price model (HPM) approach. Our analysis using New Zealand reverse mortgages data between 2004-2021 sourced from one major reverse mortgage bank provides four key findings. First, the term of payment for repaid reverse mortgages is positively associated with loan principals, implying that longer repayment terms allow applicants who were able to repay mortgages to borrow more. Second, there is partial evidence to suggest the presence of a positive linear impact of the value of the current property on its loan principal, in line with the previous house price modelling studies. Third, older applicants (age 75+) borrow less than younger applicants, which may be due to their repaying ability. Fourth, we confirm a positive effect of interest rates on reverse mortgage amounts, but reject the positive association between wider loan-to-value policy restrictions and equity release lending amounts. The results broadly highlight that the house price is more relevant than any individual characteristic of a property in determining loan principals, and that all drivers are relevant in the early stage of the development of the reverse mortgages market in New Zealand.

Keywords: Reverse Mortgages, Equity Release, Ageing Population, Housing Finance

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1. Introduction

According to the World Health Organisation (2022), by 2030, one in six people will be aged 60 or over and the number of people in this age bracket will double to 2.1 billion by 2050. In certain countries the situation is more acute: for example, one in 10 people in Japan are now aged 80 or over (Robine, 2021). The core reasons for an ageing population are declining fertility rates and increasing longevity due to medical advances. However, the evidence suggests that the proportion of life enjoyed in good health has remained broadly unchanged and that the additional longevity is likely to result in poor health (WHO, 2022). This change in demographic profile has implications for the type of housing required to support those in declining health and will impose extra costs on the health care system. In many advanced societies, the senior population cohort benefits from high levels of home ownership and are often mortgage free by the time they reach retirement

One financial option for those with housing assets, and wishing to release capital, is to take out an equity release, or reverse mortgage, which is now a widespread product in the international financial system. Reverse mortgages allow people close to, or in, retirement to borrow against the value of their home with the loan only required to be paid back once they sell the house or pass away. The interest is compounded during the life of the loan. Repayments can be at the point of death, moving into care, or as an early voluntary repayment. In essence, a reverse mortgage is a bank loan, secured on the value of the property. The amount borrowed is affected by the applicant's age and the market value of the home. Views on the reverse mortgage market cover both positive aspects, such as enabling greater access to cash when circumstances change, and negative aspects, such as a diminished estate and a burden of debt (Weber and Chang, 2006).

This study focuses on reverse mortgage lending in New Zealand. New Zealand has an ageing population profile, and an older generation with a high proportion of asset wealth in property (Squires and Webber, 2019). Lissington (2018) estimated that fewer than 47% of retirees in New Zealand were enjoying a lifestyle in retirement similar to pre-retirement levels. Therefore, many retirees might be looking for additional sources of finance to release cash to fund health and/or activities in retirement.

The reverse mortgage market in New Zealand has grown with over NZ$710m in issue and outstanding as of January 2023 (Newsroom, 2023), but is provided by only a handful of non-mainstream commercial banks. As of June 30, 2021, when the reverse mortgage portfolio was NZD$602m, the average loan size of NZD$109,417 (PWC, 2021). Such 'early stage' development of the reverse mortgage market in New Zealand, therefore, is worth examining to understand its characteristics and determinants, which help further develop the market.

Previous real-estate studies used the hedonic price model (HPM) to examine the impacts of the property's and borrower's characteristics on its price (Meese and Wallace, 1991; Chin and Chau, 2003; Ngo et al., 2023). In this study, we examine the reverse mortgage principal loan value and its determinants in New Zealand, with a particular focus on whether house prices are more important than borrowers' characteristics. The paper is structured as follows. In the next section, we review the literature surrounding reverse mortgages, explore its association with housing asset-based welfare, and consider the growth of reverse mortgages more broadly. Section 3 presents the methodology and data. Section 4 reports the results, followed by a discussion of the key findings in Section 5. Finally, in Section 6, we draw conclusions with implications for policy and practice.

2. Literature

Reverse Mortgages/Equity Release

The growth of homeownership has grown with government housing policies and developments in mortgage markets. The last 50 years has witnessed the financialization of the asset class, with homeowners enjoying high levels of capital gain through high house price inflation caused by housing shortage, low interest rates, and higher borrowing levels. The life-cycle theory of consumption and savings developed by Modigliani and Brumberg (1954) and Ando and Modigliani (1963) posits that individuals plan their consumption over their life-cycle, accumulating funds when they are earning, paying off their mortgage and putting aside money into pension schemes and savings accounts, and then spending their accumulated wealth when they retire

The expansion of the mortgage market using reverse mortgages in the United States has been significant (Chatterjee, 2016; Merrill, et al., 1994), with suggestions that higher house prices

will lead to more reverse mortgages (Shan, 2011). One interesting feature is that many of households used the reverse mortgage to hedge against any potential future house price decline (Haurin et al, 2014; Haurin et al., 2017; Moulton et al., 2017). In the US, there are also demographic patterns where the demand for reverse mortgages has experienced a higher rate of application from lower income and older age groups (Nakajima and Telyukova, 2017).

Reverse Mortgages/Equity Release and an Ageing Population

To understand the drivers involved of those taking out reverse mortgages, it is essential to frame reverse mortgage and equity release literature within the themes of an ageing population. An ageing population is argued by some to slow economic growth, given that there are fewer people in the labour force and with more people spending (rather than investing) their savings (Marešová et al., 2015). Moreover, an ageing population requires increased social care support which requires finances, and this raises issues around intergenerational resource distribution. For many single older people there is a preference to stay at home and 'age in place' (Tinker, 2002), which often requires structural adaptations to be made to homes to cater for the occupants physical and mental decline. For New Zealand, despite replacement fertility and younger net migration nationally, there are still reported ageing effects and an ageing population when measured at a sub-national level (Jackson and Cameron, 2018).

These are several core models and concepts that link the ageing population with housing options and financial circumstances. There has been growth in the stock of retirement villages to meet the demand for an ageing population, and some incorporate care packages that enable at least partial independent living (Grant, 2006). For those that wish to remain in a home that they own, rather than say move into a retirement home, it is argued that there is a psychological health benefit. Particularly from the financial security of using housing equity in financial planning (Cutler, 2003). With respect to equity release, financial security may even extend to the option of reverse mortgaging rather than selling the house in later life (Costa-Font et al., 2010; Leviton, 2002).

In response to an ageing population, many governments raised the pension age and changed pension eligibility criteria. Riots erupted in France in January 2023 when their government announced an increase in the retirement age from 62 to 64 (BBC, 2023). Questions are raised over affordability in the UK where the state pension age of 66 is regularly under review, where

the Centre for Social Justice (2019) suggested raising the state pension age in the UK to 70 by 2028 and to 75 by 2035. There is the possibility that future eligibility for a state pension could be means tested against the total asset base of the retiree, although this may be rejected by the strong voting power of retirees.

In New Zealand, where the pension age is 65, there is a phased-in raising of the pensionable age to 67 by 2040 (Crown Copyright, 2017). For those of pensionable age, retirees can draw a state pension which is called 'NZ Super'. Constrained within the political and economic barriers to raising the pension age, there is a socio-economic welfare concern where many citizens will be unable to support themselves and cover housing costs in retirement. Fiscal policy commentary from the Retirement Commission (RC, 2023) states that 40 percent of those over 65 have no other means of income than the state pension, whilst another 20 percent have 'only a little more'.

Reverse Mortgages/Equity Release and Housing Asset-Based Welfare (HABW)

The demographic shift to an ageing population with consequent pressure on state pension provision and welfare services forced governments to consider asset-based welfare as a way of passing responsibility for services from the state to the private individual (Doling & Ronald, 2010). The asset involved is normally the individual's home and thus the term 'housing asset-based welfare' (HABW) more accurately reflects the reality in countries such as the UK (O'Mahony and Overton, 2014). There is some acceptance by homeowners that they may have to use their asset base to fund their own welfare, such as to pay for private health care when the state healthcare system is overburdened, and/or there are long delays when receiving treatment (Montgomerie & Büdenbender, 2015).

HABW to supplement (or even replace) the state pension has been discussed by many authors including Kemeny (1981), Castles (1998), Montgomerie & Büdenbender (2015), Lenarrtz and Ronald (2017) and Sendi et al. (2019). De Becker and Dewilde (2010) reflect that governments faced with the rising costs of state pensions will inevitably look to elderly homeowners to supplement their own income and public retirement pensions.

Toussaint and Elsinga (2009) raised three concerns regarding the use of HABW. First, the risk arising of connecting welfare levels with house prices, which may be volatile. Moreover, there

are issues concerning both housing and welfare: stable or rising house prices give reassurance to the value of the lending base, but welfare needs are often greater in a recession where house prices are likely in decline. Second, policy needs to be inclusive and yet lower income groups are excluded from entering homeownership thereby exacerbating social unfairness. Third, the use of equity release products can be more successful in countries where there is house price inflation, but this raises the prospect of negative equity in falling markets. Homeownership and subsequently equity release mortgage products therefore depend on affordability, which to some degree *inter alia* is affected by the long- and short-term macroeconomic interest rate environment (Squires and Webber, 2019; and Squires et al., 2022).

3. Methodology and Data

3.1. Data

Data were collected from a single major reverse mortgage bank provider in New Zealand, Heartland Bank[1]. The bank has been offering a reverse mortgage service to New Zealanders since 2004; and as of 30 September 2022, Heartland has maintained its position as the largest active provider with a market share of 35.9% and "has helped more than 20,000 New Zealanders to live a more comfortable retirement under a total of NZD$721 million of receivables" (Heartland Group, 2022). In this research, we use every successful, and now closed, reverse mortgage application as an observation, resulting in a cross-sectional sample of 10,584 approved applications between June 2004 and June 2021.[2] It is, therefore, the richest data on New Zealand reverse mortgage market.[3] Table 1 reports the descriptive statistics. The loan principal (RM, the actual loan that a mortgagee gets from the bank) of an average borrower was NZD$49,267.23, although it can range from as small as NZD$2,500 to as much as NZD$980,000. Consequently, the average value of RM is less than seven per cent of the value of the mortgaged property (which is NZ$718,526.80, see Table 1) and much lower than the permitted value accepted by the banks (which is 35.34 percent, see Table 1), suggesting that the mortgagees were either risk-averse or had only relatively limited capital requirements. This finding is interesting as, in comparison, Australian borrowers tend to apply for the maximum

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[1] There is only one other major provider in New Zealand which is the SBS Bank. As such, we argue that the reverse mortgage market in New Zealand is still in the early stage of its development'.

[2] Please note that we could not quantify the term for ongoing mortgages and thus, they cannot be used in our empirical analysis.

[3] Despite the size of the sample and the dominance of the provider, we have no means to test whether our sample is representative. However, anecdotal information from market agents suggests that it is.

limit that had been permitted by their lenders (Australian Securities and Investments Commission, 2018). An important particularity to the New Zealand Reverse Mortgage market is that the majority (95% in this sample) of loans are paid back prior to death. Meaning that many Reverse Mortgage loans are used as a substitute for short-term lending.

An initial look at the data shows that an applicant for a reverse mortgage is, on average, a 72 years old (single) female. There are many joint owners, accounting for about 40 percent of our sample (i.e., *joint*=0.4). The housing stock is likely to be a bungalow or house valued at around NZ$718,000. Most of the applicants exit their mortgages voluntarily (i.e., *exit_voluntary*=0.95) at 5.7 years (i.e., *term*=5.7).

Table 1. Descriptive statistics of the variables of interest

Variable	Unit	Mean	Standard deviation	Min	Max
Dependent variable					
RM	NZ$	49,267.23	47,365.26	2,500.00	980,000.00
Independent variables X (Bank assessment)					
term	year	5.70	4.63	0.00	17.23
permit	per cent	35.34	8.02	13.00	66.00
investment	dummy	0.00	0.04	0.00	1.00
Independent variables Y (Property characteristics)					
value	NZ$	718,526.80	489,981.10	76,773.00	10,736,415.00
apartment	dummy	0.01	0.12	0.00	1.00
bungalow	dummy	0.45	0.50	0.00	1.00
flat	dummy	0.09	0.29	0.00	1.00
house	dummy	0.31	0.46	0.00	1.00
lifestyle	dummy	0.01	0.10	0.00	1.00
terraced	dummy	0.00	0.04	0.00	1.00
other	dummy	0.13	0.33	0.00	1.00
Independent variables Z (Borrower characteristics)					
age_at_start	Years-old	71.64	6.44	55.00	98.00
male	dummy	0.18	0.38	0.00	1.00
female	dummy	0.42	0.49	0.00	1.00
joint	dummy	0.40	0.49	0.00	1.00
exit_deceased	dummy	0.00	0.05	0.00	1.00
exit_move2care	dummy	0.05	0.22	0.00	1.00
exit_voluntary	dummy	0.95	0.22	0.00	1.00
Control variables R					
gdppc	NZ$	47,977.46	12,327.89	23,923.00	81,147.00
rates	per cent	7.32	2.09	4.47	10.72

LTVrestrict	dummy	0.48	0.50	0.00	1.00

Number of Observations: 10,584

Notes: *RM*, loan principal; *term*, duration of the loan – all loans in the analyses have been completed/closed; *permit*, maximum proportion of RM allowed by the bank regarding the value of the property; *investment*, if the property is an investment; *value*, the value of the property accessed by the bank at time of application; *apartment*, *bungalow*, *flat*, *house*, *lifestyle*, *terraced*, and *other* represent the type of the property; *age_at_start*, age of the borrower at time of approval; *male*, *female*, and *joint* represent the gender of the borrowers, *exit_deceased*, *exit_move2care*, and *exit_voluntary* represent how borrowers exited the mortgages; *gdppc*, nominal GDP per capita; *rates*, 1-year floating mortgage lending rates; *LTVrestrict*, if the mortgages were approved after the Loan-To-Value restriction in October 2013.

3.2. Methods

Our baseline model has a form of

$$RM = \alpha + \beta_i X_i + \gamma_j Y_j + \delta_k Z_k + \delta_r R_r + \varepsilon \tag{1}$$

where *RM* is the loan principal (in natural logarithm) of an approved home-loan application; X is a vector of variables that represent the assessment of the bank regarding the application (such as loan term or permitted value for the loan-to-value (*LTV*) ratio); Y is a vector of variables that describe the characteristics of the property involved (such as house value or house type); Z is a vector representing the characteristics of the applicant (such as gender or age); R is a vector of control variables (such as regional income and regional fixed effects variables); and ε is the error component. In this sense, in terms of the variables X and Z, Equation (1) follows the bank risk and credit-scoring theories (Boyd and De Nicoló, 2005; Carter *et al.*, 2007; Laeven and Levine, 2009; Laufer and Paciorek, 2022). For variable Y, it is the hedonic price model (e.g., Meese and Wallace, 1991; Chin and Chau, 2003; Malpezzi, 2003; Sirmans *et al.*, 2005) being examined.

The X variables, representing the bank's assessment may be derived from the characteristics of the applicants and the relevant property. However, the bank's procedure is not transparent. Therefore, we test for multicollinearity among the X, Y, and Z variables in Section 4.3 below. Particularly, we first look at the *LTV* (i.e., *permit*) that an applicant is allowed to borrow. This represents the maximum *LTV* and thus, the maximum reverse mortgage principal that the bank allows a certain applicant to borrow. It mostly depends on the assessment of the bank regarding the risks associated with the loan. Therefore, it is not only the risk-aversion attitude of the bank that can influence *permit* (Boyd and De Nicoló, 2005; Laeven and Levine, 2009) but also the profile of the applicant (e.g., gender or borrowing purpose) (Carter *et al.*, 2007; Laufer and

Paciorek, 2022). For instance, Bubb and Kaufman (2014) and Laufer and Paciorek (2022) pointed out that the decision of a bank not to lend to borrowers below a certain credit score is because such mortgages are too risky to underwrite. In this sense, *permit* can even account for other factors that may be missing from our analysis, as they should have been efficiently assessed by the bank, and for which we do not have data. A higher *permit* indicates a lower 'price' of the reverse mortgage since it requires less (initial) deposits (Ebrahim *et al.*, 2011), allows higher leverages, and less demanding underwriting standards, and thus develops a mortgage-price spiral (Arsenault *et al.*, 2013).

Given the role of *permit*, the two additional X variables that are also being examined include the calculated term of the reverse mortgage (i.e., *term*) and the type of the current mortgage (i.e., *investment*). It is noted that there is no pre-fixed due date for a reverse mortgage; the mortgage is due only when the borrowers move out or die (Nakajima and Telyukova, 2017). In this sense, if the value of *term* is greater than zero, it indicates that the reverse mortgage has been paid, so normally a lower reverse mortgage would be accompanied by a shorter repayment term (Rasmussen *et al.*, 1997). Besides, if the current mortgage can generate some income for the borrowers (i.e., in the form of an investment property), a higher *RM* is expected. We accordingly propose our first hypothesis as follows:

H1: There is a positive relationship between the X variables (i.e., *permit, term,* and *investment*) **and *RM*.**

The Y variables of the characteristics of the current property affect a property's *value*, which affects the amount of the reverse mortgage. However, we also expect that different types of the property have different impacts on *RM*, following the hedonic price model (Chin and Chau, 2003; McCord *et al.*, 2018; Ngo *et al.*, 2023). For instance, Nicholas *et al.* (2001) argued that the property type reflects its architectural style (e.g., brick or cement, vintage or modern) which can affect its value, whilst Rehm and Filippova (2008) found that, in Auckland, a bungalow was worth $85,000 less than the normal (modern) house. Different from those studies, however, we are unable to analyse the detailed house characteristics (e.g., size, school zone, or distance to shopping centres) but examine whether property type plays any role in the borrowing decision of the mortgagees. We argue that the detailed information has been captured in value, but the *RM* is still influenced by the borrowers' own evaluation of the property, and their expectations on the repayment ability depending on the type of the current mortgage (Chinloy

et al., 2014; Park and Bang, 2014; Kelly *et al.*, 2018). For instance, if an applicant believes that their property has high value (e.g., being a house or apartment), they will have more incentive to apply for (a higher) loan principal. Consequently, our hypothesis regarding the Y variables is as follows.

H2: There is a positive relationship between the value of the current property (i.e., *value*) **and** *RM,* **but its characteristics** (e.g., *house, flat,* and *lifestyle*) **have different impacts on** *RM***.**

Regarding Z variables, the bank risk and credit-scoring theories (LaCour-Little, 1999; Demyanyk and Van Hemert, 2009; Laeven and Levine, 2009) also suggest that borrower characteristics are important factors that influence the mortgage decisions of both borrowers and the lenders. For instance, Goldsmith-Pinkham and Shue (2023) found a gap in housing returns between male and female investors in the United States, suggesting that their earning and thus, mortgage repayment abilities, are different. Consequently, there should be differences in the decision to borrow across male, female, and joint applicants. Using Indian microdata, Saha *et al.* (2022) argued that the housing loan default, which is important to the lenders, is associated with the nature of employment, gender, socio-religious, and age of the borrowers. Brown *et al.* (2019) found that the risk tolerance reduces for higher age groups (i.e., 60-64, 65-69, and 70+). Since reverse mortgages are only available to people aged over 55 (Heartland Bank, 2023), we are more interested in the gender of the applicants, their age (at the time of applying), and more importantly, how the reverse mortgage was repaid (e.g., exit via repayment or through death). Our third hypothesis is, therefore:

H3: The impacts of the Z variables of borrower characteristics regarding their gender (i.e., *male*, *female*, and *joint* applicants), **their age** (i.e., *age_at_start*), **and their exit strategies** (i.e., through *death*, *move to care* or *voluntarily)* **have different impacts on** *RM***.**

We further control for the intrinsic characteristics across the reverse mortgages. Firstly, as pointed out by Ngo *et al.* (2023), house prices and values vary across regions in New Zealand, we also include the regional dummy variables (e.g., Auckland, Wellington, and Christchurch) in the R variables to control for such fixed effects. Secondly, the demand of reverse mortgages is proxied via the regional GDP per capita. Thirdly, following Rasmussen *et al.* (1997) and Nakajima and Telyukova (2017), we argue that people living in high-income regions are less

likely to have to rely on reverse mortgages, i.e., a negative association between *gdppc* and *RM*. Fourthly, we also control for the changes in the 1-year floating mortgage lending rates (i.e., *rates*), which can also capture the macroprudential policy regarding the reverse mortgage market (Hargreaves, 2016; Funke *et al.*, 2018).

It is argued that *rates* also reflects inflation, the latter could affect the consumption level of the applicants and may require them to adjust their *RM* accordingly (Kearl, 1979; Pfau, 2016; Tsai *et al.*, 2023). Among the macroprudential policies, the Reserve Bank of New Zealand (RBNZ) had notably decided to limit its financial institutions to have their high LTV (>80 per cent) home loans to be at most 10 per cent share of their total new loans in October 2013 ((Hargreaves, 2016; Reserve Bank of New Zealand, 2023). Such 'speed limit' restrictions helped ease the 'bubbly episodes' in the national housing market (Greenaway-McGrevy and Phillips, 2016). We, therefore, also include a dummy variable *LTVrestrict* (which has the value of unity for the years after 2013 and zero otherwise) in the set of R control variables to account for that policy. Consequently, our fourth hypothesis can be stated as follows:

H4: The control variables R (i.e., *gdppc, rates,* and *LTVrestrict*) **have different impacts on *RM*, in which the first two variables positively increase *RM* while the last one has a negative effect on *RM*.**

4. Empirical results

4.1. House valuations, Loan principals, and LTV's trend

The patterns or geometric growth in most markets throughout the study period are clear in Figure 1. The national average valuation at the time of the reverse mortgage application rose from NZD$200,000 in 2004 to NZD$800,000 in 2021 (Figure 1A). It is also clear that house price valuations have risen at different rates in different regions, although the mechanism for such increases needs to be examined in detail (see the following Section). For instance, Auckland had the steepest rise while the more sparsely populated West Coast region had the flattest valuation rise (Figure 1B).

Figure 1: Valuation of House at Application of Reverse Mortgage by Year
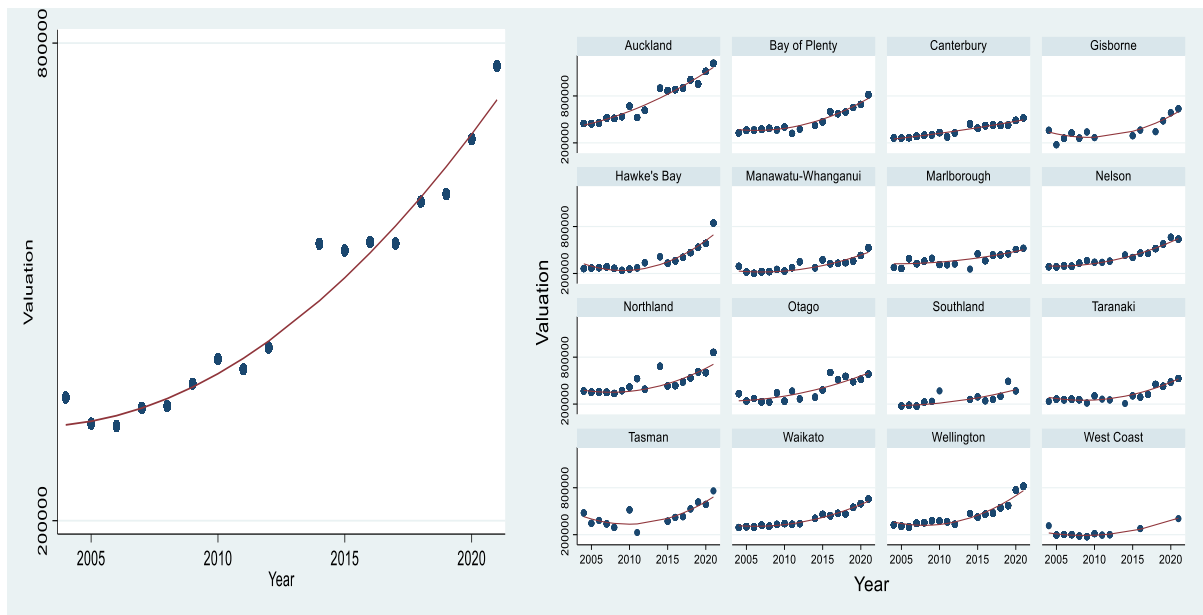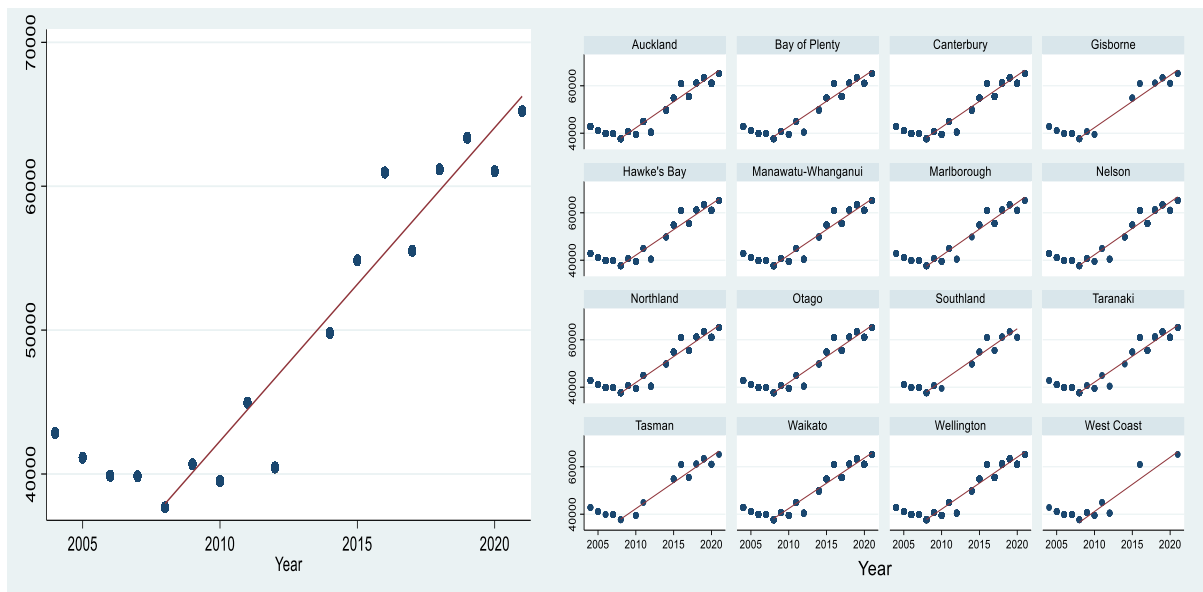

| A. National | B. Regional |

Source: Authors

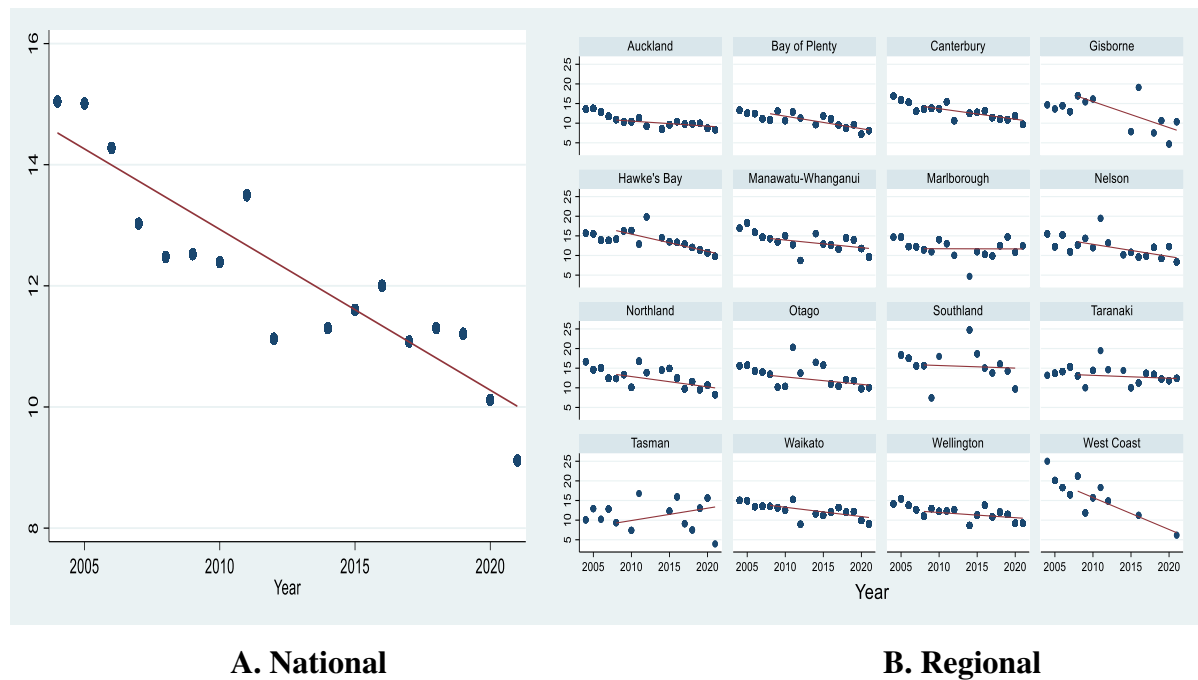**Figure 2:** Loan Principals at Application of Reverse Mortgage by Year

| A. National | B. Regional |

Source: Authors

Figure 3: LTV at Application of Reverse Mortgage by Year

A. National	B. Regional

Source: Authors

Figure 2 shows that the loan principals taken out as a reverse mortgage follow a national trajectory of decline towards the GFC of 2007-08, followed by a continual increase from NZD\$37,000 in 2008 to NZD\$65,000 in 2021 (Figure 2A). We also observe the same common trend across all regions during the same periods (Figure 2B). Simultaneously, Figure 3A shows a decline of the LTV ratios over the examined period (2004-21), although the LTV trend varies across regions: the West Coast region finds a steep decline in LTV, whilst Auckland experienced a more gradual decline, and the Tasman region has an increase but with more variance (Figure 3B). Such variance was largely due to fewer mortgages taken out in the less populous Tasman region, which has a wide range of property values in its sub-market. Overall, the variances presented in Figures 1B, 2B, and 3B reflect that the sample of houses varies from year to year, and the changes in values may reflect more than general market movements, but also the composition (such as size and type) of the applications.

4.2. Results and Discussions

We start our estimation of Equation (1) with Model 1 using all variables as in Table 1. To further test for the non-linear effects of *permit* and *value*, we first include the squares of only *permit* (i.e., *permit²*) into Model 2, the squares of only *value* (i.e., *value²*) into Model 3, and both *permit²* and *value²* into Model 4 of the analysis. Monetary variables (e.g., *value* and *gdppc*)

have been deflated before estimation. Estimated results from those models are reported in Table 2, where it can be observed that the results for the X, Y, Z, and R variables are generally consistent across the models, showing that the bank's assessment, house value, age over 75, interest rates and government policy are significant factors in the New Zealand reverse mortgage market. It is also noted that, although the R^2 statistics of our models are not high, this is common for regressions with thousands of observations (Pérez-Rave *et al.*, 2019; Rafei *et al.*, 2020; Lin and Wiegand, 2023).

Table 2: Estimation results from OLS regressions.

Dependent variable: *RM*	Model 1		Model 2		Model 3		Model 4	
X variables (Bank assessment)								
term	0.004	**	0.004	**	0.004	**	0.004	**
permit	0.531	***	-0.040		0.532	***	-0.054	
permit²			0.086				0.088	
investment	0.215		0.213		0.216		0.215	
Y variables (Property characteristics)								
value	0.515	***	0.516	***	0.554	***	0.566	***
value²					-0.003		-0.004	
Base_type: House								
apartment	-0.052		-0.052		-0.052		-0.051	
flat	-0.036		-0.036		-0.036		-0.036	
lifestyle	0.082		0.081		0.083		0.082	
terraced	-0.068		-0.066		-0.068		-0.066	
bungalow	-0.023		-0.023		-0.023		-0.023	
others	-0.033		-0.033		-0.033		-0.033	
Z variables (Borrower characteristics)								
Base_Age_Group: 55-59 years old								
60-64 years old	-0.058		-0.062		-0.059		-0.063	
65-69 years old	-0.028		-0.033		-0.028		-0.033	
70-74 years old	-0.090		-0.099		-0.090		-0.099	
75-79 years old	-0.177	**	-0.192	**	-0.177	**	-0.193	**
80+ years old	-0.215	**	-0.240	***	-0.216	**	-0.241	***
Base_Gender: Joint applicants								
male	0.023		0.022		0.023		0.022	
female	-0.008		-0.009		-0.008		-0.009	
Base_Exit: exit_deceased								
exit_move2care	0.031		0.033		0.031		0.033	
exit_voluntary	-0.069		-0.067		-0.069		-0.067	
R variables (Control)								
gdppc	-0.046		-0.046		-0.046		-0.046	

rates	0.025	***	0.025	***	0.025	***	0.025	***
LTVrestrict	0.126	***	0.137	***	0.127	***	0.136	***
Base_Region: Auckland								
Bay of Plenty	-0.121	***	-0.121	***	-0.122	***	-0.122	***
Canterbury	-0.001		0.000	*	-0.001		0.000	
Gisborne	0.010		0.011		0.010		0.011	
Hawke's Bay	0.006		0.007		0.006		0.007	
Manawatu-Whanganui	-0.015		-0.014		-0.015		-0.013	
Marlborough	-0.022		-0.021		-0.022		-0.021	
Nelson	-0.048		-0.049		-0.049		-0.049	
Northland	-0.006		-0.005		-0.007		-0.006	
Otago	-0.045		-0.044		-0.045		-0.043	
Southland	0.031		0.033		0.032		0.035	
Taranaki	0.023		0.024		0.023		0.024	
Tasman	-0.028		-0.028		-0.029		-0.029	
Waikato	0.009		0.010		0.009		0.010	
Wellington	-0.035		-0.034		-0.035		-0.034	
West Coast	0.061		0.062		0.063		0.064	

Model statistics								
Intercept	-1.023	***	-0.077		-1.145	*	-0.210	
F-statistic	69.61		67.80		67.77		66.06	
R^2	0.196		0.196		0.196		0.197	

Notes: *, **, and *** denote the significance level of 1%, 5%, and 10%, respectively.

The key results of Table 2 can be summarised as follows. Firstly, among the X variables of bank assessment, the term of payment for repaid reversed mortgages (i.e., *term*) is positively and statistically associated with the loan principals, i.e., for applicants who were able to repay their mortgages, a longer term allows them to borrow more from the banks. It is noted that most borrowers can repay their mortgages (see the statistics of *exit_voluntary* in Table 1) and hence, most of them are enjoying such longer term of borrowing. We consequently argue that many of those mortgages are used as a substitute for short-term lending. Meanwhile, the role of LTV permission (i.e., *permit*) can positively affect the loan principals but only in a linear relationship (e.g., Models 1 and 3); when we tried to examine the quadratic relationship, both *permit* and *permit²* became insignificant (Models 2 and 4). On the other hand, the variable *investment* shows no statistical relationship with RM, suggesting that our hypothesis H1 is only partially supported. Nevertheless, it is confirmed that the borrowing ability and decision of the applicants depend on the assessments of the banks (Rasmussen *et al.*, 1997; Boyd and De Nicoló, 2005; Carter *et al.*, 2007; Ebrahim *et al.*, 2011; Arsenault *et al.*, 2013; Bubb and

Kaufman, 2014). Given the booming real estate market in New Zealand in the past decade (Johnson *et al.*, 2018; Rehm and Yang, 2021; Ngo *et al.*, 2023), we expect that the banks at times will tighten their control on the reverse mortgage market to reduce and monitor the loan principals, especially relevant along with other governmental controls of the national housing market.

Secondly, we also (partially) found the positive but linear impact of the value of the current property (i.e., *value*) on its loan principal, in line with the previous HPM studies of Chin and Chau (2003), Kelly *et al.* (2018), and Ngo *et al.* (2023), among others. However, there is no significant difference between the type of the properties, i.e., they were treated equally by the applicants and the banks regarding their reverse mortgages. This finding contradicts Chinloy *et al.* (2014) and Pfau (2016) because their studies either focused on the housing market but not the reverse mortgage segment, or did not focus on the New Zealand market itself. We argue that the reverse mortgage market in New Zealand is small and less competitive with only two major providers – none of them belong to any big banks such as ANZ or ASB (Heartland Group, 2022; SBS Bank, 2023).

In a similar setting in China when the reverse mortgage market was underdeveloped (2012-2014), it was argued that the market participants paid more attention on the value rather than the type of house/property; only when the market was developed in 2016 that the type of residential real estate started to play a more important role (Li, 2023). These findings are important as it shows that in New Zealand currently, the only characteristic of the property that makes sense in a reverse mortgage application is its value. Thus demonstrating that mortgagees often feel free to approach the banks when they need the loan, regardless of the type of the property that they own. While it is encouraging for borrowers to easily access the mortgages, from the viewpoint of the lenders, we suggest that the banks could start looking at the characteristics of the property for a better monitoring mechanism. Nevertheless, the hypothesis H2 is largely confirmed.

Thirdly, regarding the Z variables of the applicant's characteristics, it is statistically proven that older applicants at the ages of 75+ can borrow less than applicants from "younger" ages. This finding is supported by the evidence of higher ages and higher risks in previous studies (Bandyopadhyay and Saha, 2011; Brown *et al.*, 2019; Saha *et al.*, 2022). For instance,

Nakajima and Telyukova (2013) and Nakajima and Telyukova (2017) found that older homeowners face many borrowing constraints as they age (e.g., medical expenses and living costs), which makes their mortgage repayments more difficult. It is also supported from the view of the banks as reverse mortgage lenders because those applicants are expected to have a shorter repayment term and consequently a low RM is easier to monitor than higher ones (Cho *et al.*, 2015). As such, these findings partly confirm our hypothesis H3. On the one hand, we agree that the practice of the banks regarding the loan principals to 75+ mortgagees has been reasonable. On the other hand, we further argue that more concentration should be put on 'younger" applicants (55-74 years old) to encourage their (reverse mortgage) borrowing activities.

For the fourth group of control variables Z, we do not see the statistical evidence on the relationship between the regional per capita income (*gdppc*) and loan principals (*RM*), although the coefficients of this variable are consistently negative across the four models. More importantly, we found that the other two control variables (i.e., *rates* and *LTVrestrict*) have a positive impact on *RM*. Regarding *rates*, when the interest rate rises, the amount of interest payments to be accumulated will rise. Thus, other things being equal, an interest rate increase lowers the loan principal amount available for the *RM*. Regarding *LTVrestrict*, we consider the 1 October 2013 reserve bank policy to restrict new residential mortgage lending at LVRs over 80% (a deposit of less than 20%) to no more than 10% of the dollar value of their total new residential mortgage lending. From our analysis it is found that after the restriction was applied in late-2013, the amount of loan principals in the reverse mortgage market in New Zealand significantly increased by 0.126-0.137 percentage points, compared to the pre-2013 period. This adverse effect of the policy introduction may be due to the booming New Zealand housing market discussed above, which made it more secure (from the banks' viewpoint) to increase their mortgage loans.

Regarding our hypothesis H4, we then confirm the positive effect of *rates* but reject the positive association between *LTVrestrict* and *RM*; no statistical conclusion can be made for *gdppc*. Consequently, we argue that the direct control through interest rates or restriction policy has higher effects than indirect ones via regional economic development and GDP per capita. To some extent, it may be due to the early stage of development of the reverse mortgage market in New Zealand as discussed above. We expect that alongside the development of this market,

the role of indirect interventions will become more important – we leave this task for the future studies.

4.3. Further robustness testing

Our results in Table 2 are robust across different models and settings. However, there still are a couple of issues regarding our estimations. We consequently conduct a couple of robustness tests to strengthen our results.

As previously discussed in Section 3.1 above, one may argue that since the type of the property (e.g., *house* or *flat*) has been accounted in its *value*, the multicollinearity issue between those variables may bias the estimated results. For this concern, we examine the variance inflation factor (VIF) of our models regarding the multicollinearity of the Y variables. The results reported in Table 3 suggests that multicollinearity should not be a problem in our analysis since none of the reported VIF value exceeds the threshold of ten (Hair *et al.*, 2009).

Table 3: Variance Inflation Factor (VIF) analysis.

Property characteristics	VIF	1/VIF
value	2.30	0.436
apartment	1.04	0.960
flat	1.26	0.791
lifestyle	1.04	0.958
terraced	1.01	0.993
bungalow	1.43	0.701
others	1.28	0.780
Mean VIF (all variables)	**5.02**	

More importantly, one may further argue that the variable *value* should be treated as an endogenous variable and thus, a two-stage approach would be better in this case. Following the two-stage least squares (2SLS) approach (Tsui *et al.*, 2017; Ngo *et al.*, 2022), we then use those characteristics as instrumental variables (IVs) to firstly estimate *value* (i.e., the first-stage regression) and re-run Models 1 and 3 using the estimated figures of value (i.e., the second-

stage regression) whereas *value* plays a linear relationship with RM[4]. Table 4 presents the 2SLS results for the key variables which are consistent with those previously reported and discussed in Table 2. Consequently, we argue that our findings are still valid and not affected by the multicollinearity and endogeneity issues.

Table 4: 2SLS estimation results for key variables.

Variables	Model 1		Model 3	
term	0.005	***	0.005	***
permit	0.642	***	0.334	
permit²			0.147	
investment	0.169		0.167	
value	0.650	***	0.650	***
gdppc	-0.041		-0.041	
rates	0.017	***	0.017	***
LTVrestrict	0.097	***	0.114	***

Notes: *, **, and *** denote the significance level of 1%, 5%, and 10%, respectively.

5. Conclusions

This study focussed on reverse mortgage lending in New Zealand, a country with an ageing population profile, where the older generation have a greater proportion of asset wealth in property. The reverse mortgage market in New Zealand has grown, albeit that it remains in the early stage of development and operated by a handful of non-mainstream commercial banks. It is, therefore, important to understand the drivers of such reverse mortgage and equity release market to provide context for its development.

Using a rich dataset on the New Zealand reverse mortgage market with a cross-sectional sample of 10,584 approved applications between June 2004 and June 2021, we confirmed the hypothesis on the roles of the banks' assessment, property characteristics, applicant's characteristics, and regional/national control variables on the loan principals in the reverse mortgage market. These are the drivers that are relevant in the early stage of the development of the reverse mortgages market.

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[4] Since we could not proxy for *value²* via those IVs, it is not possible to re-run Models 2 and 4.

We also showed that the house price/value is more important than the type of property; and that only direct factors, such as interest rates, rather than indirect ones, such as the characteristics of the applicant, affect the amount of borrowing decision. However, the banks and even the government need to start looking at a broader picture as the reverse mortgage market in New Zealand develops. One such consideration is the wider public concerns of an ageing population relying on Housing Asset-Based Welfare (HABW), particularly given the evidence in this research that there is an increase in housing-debt through wider use of reverse mortgage and equity release specialist products.

Further research could explore the relationship between prospects for the market and future house prices, such as falling and/or more volatile house price change. A specific issue is whether the life-cycle theory is appropriate for the study of younger homeowners, with evidence from the UK that greater numbers of homeowners will be unable to pay off their original mortgage by the age of 65.[5] Similarly, in New Zealand, the Retirement Commission reported that even those retirees that are mortgage free are still spending 20 percent of their state pension (NZ Super) on housing (RC, 2023). More generally, research could focus on international comparisons, and potential lessons from reverse mortgage markets in other countries such as the United States, Australia, and the UK.

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[5] https://www.lvadviser.com/knowledge-centre/news-hub/third-of-mortgage-holders-unlikely-to-pay-off-mortgage-by-65

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