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HOUSE PRICE APPRECIATION AMONG ELDERLY HOME OWNERS IN AUSTRALIA

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Abstract:
This paper investigates whether the houses of elderly home owners appreciate at the same rate as the average house price appreciation rate in the market. For most elderly home owners, their wellbeing is strongly underpinned by their home ownership status, the value of their homes generally representing their most significant asset in old age. The viability of financial instruments such as reverse mortgages where elderly home owners effectively borrow against their housing equity also depend strongly on house prices appreciating enough to offset the outstanding loan balance at the end of the reverse mortgage tenure. This study employs the use of a panel dataset, the 2001-07 HILDA Survey, in order to examine the appreciation rates of the houses of elderly home owners compared to younger home owners. Ordinary least squares regression models are employed to estimate the impact of home owner's age on house price appreciation rates. The findings indicate that a home owner aged 65 or over suffers from a 5 percentage point discount in house price appreciation rate compared to younger home owners over the average sample observation period of 5.5 years. The annual appreciation rate is lowered by 0.13 (0.16) percentage points for each additional year a home owner is aged 65-74 (75 or over). The findings of this paper have important implications for the viability of housing asset-based instruments as retirement funding strategies in old age.

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1. Introduction

This paper investigates whether the houses of elderly home owners appreciate at the same rate as the average house price appreciation rate in the market. This research question is of vital importance to the wellbeing of the elderly because while they have on average lower incomes than younger persons, the elderly are asset-rich group, among whom the majority are home owners who have paid off all or most of their mortgage. Two-thirds (three-quarters) of elderly Australian couples (singles) rely on social security payments as their principal income source. However, 85% (74%) own their homes outright, that is, they have paid off their entire mortgage (Australian Bureau of Statistics, 2007). Clearly, for most elderly home owners, their wellbeing is strongly underpinned by their home ownership status, the value of their homes generally representing their most significant asset in old age.

The rapid ageing of the population and the concerns over fiscal expenditure on health care and income support that accompany this significant demographic trend have prompted the development of new financial instruments that are designed to unlock illiquid wealth tied up in the elderly's housing equity in order to generate income. The development of instruments such as reverse mortgages in Australia and overseas, for example, have been fuelled by the house price boom that took place during the late 1990s and early 2000s. The viability of such instruments, where elderly home owners effectively borrow against their housing equity with no repayments being made until the house is sold or the elderly borrow dies, depends strongly on house prices appreciating enough to offset the outstanding loan balance at the end of the reverse mortgage tenure (Ong, 2008).

While assessing the viability of entering into a reverse mortgage loan, it is logical for an elderly home owner to assume that his/her house will appreciate at the average house price appreciation rate in the housing market. However, if elderly home owners' houses appreciate slower than houses owned by younger home owners, then elderly home owners who make decisions to borrow against their housing equity on the basis of average house price trends run the risk of being left with little housing equity to draw on for financial emergencies or bequest purposes when they pass away.

The hypothesis that elderly home owners' houses appreciate at below-average rates has been supported by empirical findings in overseas studies that have found that elderly home owners are likely to spend less on routine home maintenance than younger home owners. In a United States study of elderly home owners' expenditure on home maintenance, Davidoff (2004) found that home owners aged over 75 years spend approximately USD270 per year less on routine home maintenance and USD1100 less on all home improvement than younger owners of similar properties. Elderly home owners are also less likely to have updated the style of their house resulting in the house becoming atypical relative to other houses in the market. This can lower demand and increase search costs associated with finding a buyer. Appraisers may then have difficulty finding comparable houses in the neighbourhood. As a result, the appraised value of the house may be discounted (Rodda and Patrabansh, 2007).

A small number of overseas studies have produced empirical estimates of elderly homeowners' house price appreciation rates as compared to the general home owner population. Using the Health and Retirement Study, Rodda and Patrabansh (2007) found that the houses of American elderly homeowners aged 75 years and over appreciate in real dollars at a rate of 1 to 1.2 percentage points less per year than the houses of middle-aged homeowners aged 50 to 74 years old. They also found that the houses of elderly homeowners appreciate at a rate 2.4 percentage points less per year than do those of younger homeowners using the American Census Bureau's Public User Microdata Sample. Davidoff (2004) estimated that American elderly homeowners' house price appreciation rates were in general 3 percentage points lower than younger home owners using the American Housing Survey.

To date no study has examined whether house price appreciation rates among elderly home owners in Australian are systematically lower than those of their younger counterparts. This paper seeks to fill an important gap in the literature by empirically examining whether the houses of elderly home owners appreciate at lower rates than the average in the housing market. Section 2 contains a description of the data. House price appreciation rate measures are discussed in section 3. Sections 4 and 5 present the model description and key findings respectively. Section 6 concludes.

2. Data

The study employs the use of the 2001-07 Household, Income and Labour Dynamics in Australia (HILDA) Survey to examine the appreciation rates of the houses of elderly home owners compared to younger home owners. The HILDA Survey is a comprehensive and nationally representative panel survey of Australian households and individuals. The panel was established through the wave 1 interviews of a randomly selected sample of 7682 households in 2001. The survey contains rich information on socio-demographic and economic characteristics of the interviewees, along with their housing-related characteristics, such as house values, dwelling type and geographical locations. As far as possible, the 2001 respondents are interviewed in each subsequent year. The latest wave of survey currently available is wave 7. The use of a panel dataset is of crucial importance to the present analysis as it allows fixed personal and property-specific characteristics to be controlled for so that changes in house prices are not confounded by compositional changes in the housing market and population of home owners.

The sample comprises owner-occupied houses, each of which is owned by a responding interviewee in 2001 and owned by the same interviewee in at least one other wave in order to provide house values for the same home owner at two distinct points in time. The term 'house' covers separate, semi-detached, row or terrace houses, townhouses, flats, apartments and units, but excludes mobile dwellings and dwellings that are built as attachments to other buildings. Examples of mobile dwellings are caravans, tents, cabins or houseboats and attachments include flats that are attached to shops. The resulting sample comprises 4106 owner-occupied homes. Of these, 1310 or 32% are owned by elderly home owners, defined as home owners aged 65 and over.[1] Among the 1310 elderly home owners, about half or 623 home owner are aged 65 to 74 years, and 687 are aged 75 years and over. The HILDA Survey does not provide data on have market resale values, so the study relies on self-reported house values in 2001 and the end year of observation. House prices are converted to real 2001 dollars using the Australian Bureau of Statistics' capital city Consumer Price Index (CPI) series.

3. House Price Appreciation Rates

House price changes between two points in time can be measured using various measures. This study employs two common measures used to measure house price changes. The first is the logarithmic difference in the house value in 2001 and the end year of observation, representing the growth rate of the house price between 2001 and the end year of observation:

$$Y_1 = [\ln V_t - \ln(V_0)] * 100 \qquad (1)$$

where V_0 is the value when the house is first observed (in 2001) and V_t is the real value when the house is last observed.

The second related measure is the house price annual growth rate:

[1] The minimum Age Pension age for men is currently 65 years and the minimum Age Pension age for women is being increased by six months every two years till it reaches 65 years in July 2013 (Ong, 2004).

$Y_2 = [\exp(Y_1/n) - 1]*100$ (2)
where n is the number of intervening years between time periods 0 and t.

Table 1 reports the house price appreciation rates of home owners by the proportion of time spent as elderly home owners between 2001 and the end year of observation. For example, if a home owner was aged 63 years old in 2001 and the home owner's last observation in his/her home was recorded in 2004, the home owner would have spent 50% (or two years) of the period of observation as an elderly person. The table shows that the average house price appreciation rates of home owners decline as the proportion of time aged 65 and over increases. The house price growth rate declines from 42.7% to 36.9% and the annual growth rate declines from 8.4% to 7.2% as the proportion of time aged 65 and over increases from 0% to 100%. The relationship between house price appreciation rates and proportion of time aged 75 and over is similarly negative.

Table 1: Average house price appreciation rates, by proportion of time between 2001 and end year of observation spent as elderly home owner, per cent, 2001-07

Proportion of time spent as elderly home owner	House price growth rate, Y_1 (%)	House price annual growth rate, Y_2 (%)
Proportion of time aged 65 and over (P_{65})		
$P_{65} = 0\%$	42.7	8.4
$0\% < P_{65} \leq 25\%$	47.8	7.6
$25\% < P_{65} \leq 50\%$	46.5	7.4
$50\% < P_{65} \leq 75\%$	49.9	7.7
$75\% < P_{65} < 100\%$	50.2	8.0
$P_{65} \leq 100\%$	36.9	7.2
Total	41.8	8.0
Proportion of time aged 75 and over (P_{75})		
$P_{75} = 0\%$	42.7	8.2
$0\% < P_{75} \leq 25\%$	44.9	7.5
$25\% < P_{75} \leq 50\%$	41.2	7.2
$50\% < P_{75} \leq 75\%$	38.8	6.5
$75\% < P_{75} < 100\%$	46.7	7.2
$P_{75} \leq 100\%$	34.6	7.2
Total	41.8	8.0

Source: Author's own calculations from HILDA Survey waves 1-7

4. Model

To isolate the age effect on house price appreciation rate, ordinary least squares regressions are performed where the house price appreciation rate is a function of the home owner's age and other controls, that is:
$Y = f(Age, n, l, P, X)$ (3)
where Y is Y_1 or Y_2, *Age* represents age variables, n is length of time between 2001 and the end year of observation, l is the length of tenure by 2001, P is a vector of property characteristics and X is a vector of personal characteristics of the home owner. The explanatory variables and their definitions are included in table 2 below.

Two age variables are inserted into the model to represent the home owner age effect. These are the number of years between the start and end year where a home owner is observed to be between 65 and 74 years, and the number of years observed 75 years and over. Hence, for example, for a home owner who was aged 72 years in 2001 and last observed in 2004, the number of years aged 65 to 74 years would be three, and the number of years aged 75 and over would be one. For a younger home owner who was aged under 65 years throughout the period of observation, the number of years variables would be zero. The age variables are measured in years rather than proportion of time as in table 1 so as to facilitate interpretation of the age effects. When a 'years' measure is used, the age coefficient will represent the percentage point impact on house price appreciation rates of an

additional year of being elderly. The correlation between number of years observed as elderly and the period of observation is controlled for by inserting the variable *n* into the model, which controls for the length of period of observation.

The variable *n* can be introduced into the model in two ways. First, it can simply be introduced as the number of years between 2001 and the end year of observation. Second, it can be introduced by including a series of calendar year dummy variables into the regression. For example, if the end year of observation of a home is 2003, the 2003 calendar year dummy variable would be equal to one, and all other calendar year dummies would be equal to zero. If the end year of observation is 2007, the 2007 calendar year dummy would be equal to one while all other calendar year dummies would equal zero.

A length of tenure variable, *l*, is also included, which is defined as the number of years the home owner had lived in his/her home by 2001. For example, if a home owner had lived in his/her home since 1980, the length of tenure would be 21 years by 2001. Kiel and Zabel (1999), an American study, has found that home owners with short tenure overvalue their homes by 8.4% (when compared with the eventual sales price), but home owners with longer tenure overvalue their houses by only 3.3%. As length of tenure is likely to be strongly positively correlated with age, the variable help capture systematic differences in self-reported house values that is a result of older home owners having longer tenures.[2] Tenure length is also likely to be correlated with building age. As the latter is not available from the HILDA Survey, the tenure length variable provides a crude proxy for building age.

The vector of property characteristics, *P*, includes dwelling type, number of bedrooms and geographical variables. Capital city, rest of state and regional variables capture differences in housing market conditions across locations in Australia. If elderly home owners are disproportionately concentrated in neighbourhoods with low house appreciation rates, the effect of the lower appreciation of these neighbourhoods will be captured in the age coefficient. In order to minimise this bias, neighbourhood characteristics should be included in the model as controls. Neighbourhood variables such as whether noise from traffic, airplanes, trains or industry, and whether occurrences of property damage and burglary or theft are common in the neighbourhood are available from the HILDA Survey. However, these variables are excluded due to two reasons. First, these variables are plagued by a large number of missing values, resulting in a loss of around 12% of the sample when included. Second, they turn out to be insignificant when introduced into the model. Davidoff (2004) used building age and square footage as proxies for neighbourhood characteristics. The study also found generally insignificant effects for these variables. An ethnicity variable is included in this study, which provides a proxy for neighbourhood characteristics. The ethnicity variable is equal to one if the home owner was not born in a main English-speaking country or Australia, and zero otherwise.[3]

For a house owned by a couple, it is assumed that both members of the couple jointly own the home, so the home owner's personal characteristics are the characteristics of the older member of the couple, such as ethnicity, marital status, health and cognitive abilities. An indicator of whether the home owner had cognitive problems helps to control for potential biases in self-reported house values that are due to cognitive problems. The education, employment status of the oldest member of the couple and the income of the income unit are also included to reflect labour market and

[2] The Pearson correlation coefficient between age and length of tenure is 0.455 and is significant at the 1% level.
[3] Main English-speaking countries are classified in the HILDA Survey as New Zealand, United Kingdom, Ireland, Canada, US and South Africa (MIAESR, 2009). Further disaggregation renders the ethnicity variables generally insignificant.

income characteristics that can potentially affect home owners' level of home maintenance expenditures.[4]

Table 2: Model variables and definitions

Variable	Definition[a]
Age	Number of years between start and end year aged 65-74
	Number of years between start and end year aged 75 and over
Length of tenure by 2001	Number of years home owner had resided in his/her home by 2001
Number of years of observation[b]	Continuous number of years variable measuring time difference between 2001 and year of last observation
Calendar year of last observation[b]	2002 (default)
	2003
	2004
	2005
	2006
	2007
Dwelling type	Separate house (default)
	Semi-detached house, row or terrace house, townhouse
	Flat, unit or apartment
Number of bedrooms	Less than three bedrooms
	Three bedrooms (default)
	Four or more bedrooms
Region[c]	Major city (default)
	Inner region
	Outer region, remote or very remote
Capital city or rest of state	Sydney
	Rest of New South Wales (default)
	Melbourne
	Rest of Victoria
	Brisbane
	Rest of Queensland
	Adelaide
	Rest of South Australia
	Perth
	Rest of Western Australia
	Tasmania
	Northern Territory
	Australian Capital Territory
Ethnicity	Born in main English-speaking countries including Australia (default)
	Born outside main English-speaking countries
Marital status	Same partner from start to end year
	Gained partner between start and end year
	Lost partner between start and end year
	No partner from start to end year (default)
Children	Number of children aged 0-4 in start year
	Number of children aged 5-14 in start year
Disability	Whether had disability or long-term health condition between start and end year
Cognition	Whether had cognitive problems due to poor eyesight, hearing or reading abilities between 2001 and end year
Highest educational qualifications	Bachelor degree or higher
	Other post-school qualifications
	No post-school qualifications (default)
Labour market status	Remained employed from start to end year (default)
	Remained out of employment from start to end year
	Gained employment between start and end year
	Lost employment between start and end year
Income	Gross income unit income in start year ($'000)
	Change in gross income unit income between start and end year ($'000)

[4] An income unit is a person or group or persons related by marriage or parent-child relationship who live within the same household and share income (Australian Bureau of Statistics, 1997). A household may comprise several groups of unrelated income units living together.

Notes:
a. With the exception of the age and number of years of observation variables, all other variables are binary variables which equals one if the characteristics is applicable, and zero otherwise.
b. Number of years of observation and calendar years of last observation cannot be included into the model at the same time.
c. The regional classifications are derived from the Accessibility/Remoteness Index of Australia (ARIA) scores from the 2001 Census. The ARIA index categorises non-contiguous geographical areas within each state or territory into areas that share common remoteness characteristics (Australian Bureau of Statistics, 2001).

5. Findings

House Price Growth Rate between 2001 and End Year of Observation (Y_1)

The age coefficients show that after controlling for other influences, an additional year aged 65-74 lowers house price growth rate by 1 percentage point; similarly an additional year aged 75 or over also lowers house price by 1 percentage point. Home owners in the sample had an average 2001 house price of AUD253,100 and were observed on average for 5.5 years. Hence, holding all other variables constant at the mean, for each additional year that a home owner is aged 65 or over, the elderly home owner's house price will grow by AUD2,531 less than the houses of home owners aged under 65 over a period of 5.5 years. A home owner who is elderly throughout the 5.5 years would suffer from a 5 percentage point discount in house price appreciation rate, or AUD12,655.

The length of tenure variable is significant, lowering house price growth rate by 0.16 percentage points. The number of years of observation has a large positive effect. This is to be expected as the house price growth rate is calculated across the entire period of observation. Hence, the longer the period of observation, the larger the change in house prices.[5]

There is a significant 6.5 percentage point discount in house price growth rate associated with residing in a flat, unit or apartment instead of a separate house. Semi-detached, row or terrace houses and townhouses lowers house price growth rate by 4 percentage points relative to separate houses though this is only mildly significant at the 10% level. Large dwellings as represented by the number of bedrooms and homes in outer regional areas appreciate at lower rates than smaller dwellings and inner regional or city areas respectively. The state and capital city variables are generally highly significant, with housing market conditions appearing to have been stronger in most areas than the default location of rest of New South Wales over the period of observation. Only Sydney and Melbourne have lower house price growth rates, when other influences have been controlled for.

While the age and property variables have proved to be largely significant and with the expected coefficient signs, the effects of the characteristics of home owners are generally insignificant. A home owner who remains out of employment throughout the period of observation is more likely to have had higher house price growth rates than those that were employed. The variable may have captured a wealth effect, that is, some retirees may have higher wealth levels than the non-retired. However, as wealth variables are only available in waves 2 and 6 of the HILDA Survey and not in other waves, wealth variables have not been included in the models.

House Price Annual Growth Rate (Y_2)

In the model predicting house price annual growth rates, an additional year aged 65-74 lowers annual growth rate by 0.13 percentage points and this effect is mildly significant. The negative

[5] Similar results are derived when calendar year dummies are inserted instead of a number of years variable, that is, the coefficients increase as the calendar year of last observation is increased up to 2007.

effect of being aged 75 and over is larger and more significant, at 0.16 percentage points. As expected, length of tenure is significant and negative. When a number of years variable is inserted into the model, it is highly insignificant. Hence, the number of years variable is replaced with a set of calendar year dummies, which yields some interesting results that reflect the strong growth in house prices in 2003 and 2004. In the later years, the calendar year coefficients taper off but still remain positive and highly significant.

Other findings are similar to those generated by the house price growth rate (Y_1) model. There is a strong negative discount in house price annual growth rate associated with residence in a flat, unit or apartment, large dwellings and outer regions. The state and capital city effects also remain largely similar to those in the first model.

Interestingly, being born outside a main English-speaking country has a mild negative effect on house price annual growth rates. The ethnicity variable provides a crude proxy for neighbourhood effects, indicating that the house price annual growth rates in neighbourhoods that are dominated by home owners who from outside main English-speaking countries are 0.7 percentage points lower. Similarly, it would appear that a home owner who has cognitive problems would tend to under-value his/her home by 0.7 percentage points, although again here the effect is only mildly significant.

Overall Findings

Both models are overall significant as indicated by the F-statistic. However, the model of house price growth rate between 2001 and the end year of observation performs better in terms of a higher adjusted R^2. Importantly, findings from both models indicate that there is a significant negative effect on house price appreciation rates that is associated with being elderly.

Table 3: Model of change in house price, 2001-2007 [a]

Explanatory variables	Growth rate between start and end year (Y_1)			Annual growth rate (Y_2)		
	Coefficient		Std. error	Coefficient		Std. error
Constant	4.162		3.156	8.168	***	0.664
Age:						
Number of years between start and end year aged 65-74	-1.024	***	0.318	-0.132	*	0.073
Number of years between start and end year aged 75 and over	-1.012	***	0.355	-0.162	**	0.081
Number of years home owner had resided in his/her home by 2001	-0.156	***	0.042	-0.022	***	0.010
Number of years between 2001 and year of last observation	7.722	***	0.351			
Calendar year of last observation:						
2003				3.770	***	0.482
2004				3.217	***	0.519
2005				1.976	***	0.570
2006				1.828	***	0.560
2007				1.335	***	0.455
Dwelling type:						
Semi-detached, row or terrace house, townhouse	-4.133	*	2.314	-0.806		0.530
Flat, unit or apartment	-6.461	**	2.699	-1.673	***	0.617
Number of bedrooms:						
Less than three bedrooms	-1.146		1.638	-0.157		0.375
Four or more bedrooms	-4.372	***	1.115	-0.701	***	0.255
Region:						
Inner region	0.488		1.826	-0.569		0.418
Outer region, remote or very remote	-7.356	***	2.280	-2.685	***	0.522
Capital city of rest of state:						

Explanatory variables	Growth rate between start and end year (Y_1)			Annual growth rate (Y_2)		
Sydney	-14.121	***	2.178	-2.622	***	0.498
Melbourne	-9.644	***	2.121	-2.219	***	0.485
Rest of Victoria	-3.194		2.122	-0.421		0.485
Brisbane	12.512	***	2.415	2.284	***	0.552
Rest of Queensland	11.690	***	2.002	1.743	***	0.458
Adelaide	8.536	***	2.547	1.056	*	0.583
Rest of South Australia	6.662	**	3.229	1.578	**	0.739
Perth	15.936	***	2.571	1.532	***	0.588
Rest of Western Australia	11.490	***	3.187	1.994	***	0.729
Tasmania	20.567	***	3.245	3.860	***	0.743
Northern Territory	15.838	**	7.244	2.767	*	1.657
Australian Capital Territory	-1.576		4.469	-0.583		1.023
Born outside main English-speaking countries	-1.174		1.570	-0.659	*	0.359
Marital status:						
Same partner from start to end year	1.355		1.209	0.231		0.276
Gained partner	2.384		2.893	0.304		0.662
Lost partner	4.086		2.782	0.631		0.637
Number of children:						
Number of children aged 0-4 in start year	0.101		1.107	0.168		0.253
Number of children aged 5-14 in start year	-0.098		0.655	-0.036		0.150
Whether suffered from disability or long-term health condition between start and end year	0.448		1.490	-0.306		0.389
Whether had cognitive problems between start and end year	-2.778		1.916	-0.720	*	0.438
Highest qualification:						
Bachelor degree or higher	-1.012		1.433	-0.075		0.328
Other post-school qualifications	-1.346		1.140	-0.210		0.261
Labour market status:						
Not employed from start to end year	2.747	*	1.602	0.305		0.368
Gained employment between start and end year	1.878		2.069	0.066		0.473
Lost employment between start and end year	-0.423		1.630	-0.284		0.373
Income:						
Gross income unit income in start year ($'000)	-0.014		0.012	-0.003		0.003
Change in gross income unit income between start and end year ($'000)	0.001		0.009	-0.001		0.002
Regression diagnostics:						
Number of observations	4106			4106		
F-stat	36.898	***		10.076	***	
Adjusted R^2	0.244			0.083		

Source: Author's own calculations from HILDA Survey waves 1-7

Note:

a. Default / reference categories are listed in table 2.

*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level

6. Conclusion

This paper investigates whether the houses of elderly home owners appreciate at the same rate as the average house price appreciation rate in the market. For most elderly home owners, their wellbeing is strongly underpinned by their home ownership status, the value of their homes generally representing their most significant asset in old age. The viability of financial instruments such as reverse mortgages where elderly home owners effectively borrow against their housing equity also depend strongly on house prices appreciating enough to offset the outstanding loan balance at the end of the reverse mortgage tenure. The hypothesis that elderly home owners' houses appreciate at below-average rates has been supported by empirical findings in overseas studies. However, to date no study has examined whether house price appreciation rates among elderly home owners in Australian are systematically lower than those of their younger counterparts.

This study employs the use of a panel dataset, the 2001-07 HILDA Survey, in order to examine the appreciation rates of the houses of elderly home owners compared to younger home owners. The use of a panel dataset is of crucial importance to the present analysis as it allows fixed personal and property-specific characteristics to be controlled for so that changes in house prices are not confounded by compositional changes in the housing market and population of home owners.

House price changes between two points in time can be measured using the house price growth rate over the period that the home owner is observed in the same home, and a related measure, the house price annual growth rate. The age coefficients show that after controlling for other influences, an additional year aged 65-74 lowers house price growth rate by 1 percentage point; similarly an additional year aged 75 or over also lowers house price by 1 percentage point. Home owners in the sample had an average 2001 house price of AUD253,100 and were observed on average for 5.5 years. Hence, holding all other variables constant at the mean, for each additional year that a home owner is aged 65 or over, the elderly home owner's house price will grow by AUD2,531 less than the houses of home owners aged under 65 over a period of 5.5 years. A home owner who is elderly throughout the 5.5 years would suffer from a 5 percentage point discount in house price appreciation rate, or AUD12,655.

In the model predicting house price annual growth rates, an additional year aged 65-74 lowers house price annual growth rate by 0.13 percentage points and this effect is mildly significant. The negative effect of being aged 75 and over is larger and more significant, at 0.16 percentage points. While the age and property variables have proved to be largely significant and with the expected coefficient signs, the effects of the characteristics of home owners are generally insignificant.

The home owner age effect could potentially be confounded by the presence of various sources of bias, including the use of self-reported values, absence of data on building age and fairly aggregated geographical variables. A variable representing the cognitive capabilities of the home owner is inserted into the model to help correct for bias in self-reported values. It has a mildly significant and negative effect in the model predicting house price annual growth rate. Due to data limitations, it is not possible to insert a variable that accurately represents building age into the model. A length of tenure variable is inserted into the model to provide a crude proxy for building age. Variables representing neighbourhood characteristics are also left out. When inserted into the models, they were generally insignificant and resulted in the loss of around 12% of the cases due to missing values. However, an ethnicity variable provides a crude proxy for neighbourhood characteristics.

The findings of this paper has important implications for the viability of housing asset-based retirement funding strategies that have grown in popularity in Australia in recent years, such as reverse mortgages. When compared with empirical findings from overseas studies such as Davidoff (2004) and Rodda and Patrabansh (2007), it would appear that the discount in house price appreciation rates associated with being elderly is smaller in Australia than in the United States. However, it is nevertheless the case that elderly home owners in Australia who assume that their houses will appreciate at the average rate in the housing market may very likely be over-estimating the future values of their homes. Hence, elderly home owners who make decisions to borrow against their home equity on the basis of average house price trends run the risk of being left with little housing equity to draw on for financial emergencies or bequest purposes. Some home owners may find themselves with negative housing equity at the end of the loan tenure if their house prices appreciation rates are lower than the average appreciation rate in the market. Reverse mortgage lenders who provide no-negative equity guarantees to elderly home owners in their contracts will have to absorb the loss associated with house prices not appreciating enough to cover the outstanding loan balance. Due to the lack of regulation in the Australian reverse mortgage market, elderly reverse mortgage borrowers who have lost their no-negative equity guarantee due to trivial contract breaches will have to bear the outstanding debt themselves in their retirement.

Governments and the elderly's children are also at risk should this happen, as they may have to intervene with additional income support during the elderly's remaining years of old age (Ong, 2008).

It now looks as if home owners will face a prolonged period of house price slump. An extended period of weak housing market conditions, coupled with the fact that the elderly's houses appreciate at below-average rates, could see many elderly reverse mortgage borrowers owing larger amounts on their reverse mortgages than expected at the end of their loan tenure. This could become a serious source of concern in the coming years, given that the fall in house prices and below-average house price appreciation rates of the elderly has also been accompanied by a significant decline in the value of their superannuation and shares.

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