Transition to retirement and beyond: Studies in retirement behaviour in Australia

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Publication Date:
2014

DOI:
https://doi.org/10.26190/unsworks/19710

Transition to retirement and beyond: Studies in retirement behaviour in Australia

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A thesis in fulfilment of the requirements for the degree of
Doctor of Philosophy

School of Economics
UNSW Business School

August 2014

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This paper uses unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA Project was initiated and is funded by the Australian Government Department of Social Services (DSS) and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The findings and views reported in this paper, however, are those of the author and should not be attributed to either DSS or the Melbourne Institute.

Acknowledgements

The synthesis of this thesis has been a very long journey. With the end of the road in sight, I reflect on all those people who have helped me along the way to make this thesis possible.

Firstly and most importantly, I would like to thank my supervisor and mentor for the past six years Professor Hazel Bateman. Without your support and guidance I would not have made it this far. Thank you so much for your infinite patience and wisdom and for believing in me when my own resolve wavered.

Secondly and equally as important, many thanks must go to my joint supervisor Dr Stanley Cho, whose expertise was invaluable. Thank you for your guidance on theoretical modelling, for your patience and support dealing with a programming 'newbie' like me.

To my thesis committee members at UNSW throughout the years, most notably Dr Isabella Dobrescu, Professor Dezil Fiebig, Dr Alberto Motta and Dr Carlos Pimienta, your understanding and advice have helped me to get over the line.

My gratitude also goes to the generous financial support provided to me under the following two Australian Research Council (ARC) grant projects:

- ARC Discovery Grant (DP0877219) - 'Security in retirement: forecasting and managing macro investment risks'
- ARC Linkage Grant (LP11010489) - 'Reconnecting and engaging superannuation fund members'

To my fellow UNSW PhD friends throughout the years including Jimmy Feng, Agne Suziedelyte, Jenny Wong, Lyla Zhang, Sophie Gao, Chunzhou Mu: thank you so much for all the advice and support you have given me in the last six years. Our chats about economics, thesis and anything and everything have been life-saving!

Also thanks must go to all my non-Economics friends who have offered support and advice to keep me sane throughout this journey. Your support is greatly appreciated beyond words.

And last but not least, to my family, who put up with my thesis related neurosis all these years and didn’t give up on me: thank you!

Abstract

The ageing of the population is a global phenomenon which poses a unique set of challenges for policymakers regarding health and age care, labour market dynamics of older workers and devising systems of social protection. The design of the Australian retirement income system based on a public Age Pension supplemented by mandatory and voluntary retirement savings places emphasis on individual decision-making and accountability by individuals to deliver adequate retirement incomes.

The focus of this thesis is to understand the investment and consumption decisions made by Australians who are transitioning to, and in the early years of, retirement. That is, specifically people aged 45 years and over. We start by developing and solving a simple life-cycle optimisation problem for individuals 45 years and over incorporating features of the Australian retirement income system to motivate our empirical research questions and inform our research findings. We find optimal consumption paths to be smooth throughout the individual's lifetime while the optimal portfolio weight for risky asset is higher for working life than for retirement.

We then investigate investment and consumption behaviour of the pre and actual retirees using the Household Income Labour Dynamics of Australia panel dataset for the period 2001 to 2011. We find some evidence of a fall in the proportion of risky assets held for retired single and couple Australian households using a pooled ordinary least squares model, a fixed effects model and a random effects model. We also find a drop in consumption at retirement for older Australian households. However, after employing instrumental variables estimation with subjective retirement expectations as an instrument we find the fall is mainly due to unplanned retirement. There is also a possible delayed effect as the impact of retirement on consumption maybe felt beyond the first year of retirement.

Overall, older Australian households are behaving fairly consistently with the life-cycle portfolio theory of consumption and portfolio choice – they hold less risky assets in

retirement and have smooth consumption unless faced with external shock leading to unplanned retirement.

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Chapter 1: An introduction

1.1 Overview

The Australian population as at 30 June 2012 was 22.7 million people. It is projected to increase to between 36.8 and 48.3 million by 2061 and reaching between 42.4 million and 70.1 million by 2101 (Australian Bureau of Statistics, 2013b). The ageing of the population is characterised by the proportion of younger people declining as the older population increases. This phenomenon is predicted to remain in Australia as the trend to live longer continues, and the fertility and migration increases are not large enough to fill the gap (Australian Bureau of Statistics, 2013b). Australian Bureau of Statistics (ABS) projections show that in 2012, people aged 65 years and over comprise of 14% of the total population. This is projected to increase to 22% in 2061 and 25% in 2101.

This pattern of population ageing is not only confined to Australia. According to the latest projections by the World Bank, the percentage of older adults in developed countries is to increase from 15.3% in 2005 to 26.1% in 2050 (Pallares-Miralles *et al.*, 2012). This worldwide trend places responsibilities on policymakers to ensure the welfare of the elderly and to find solutions to alleviate the financial pressures on the fiscal system. Pension reforms are now at the forefront of policy issues in many countries.

The trend in the ageing of the population has great impact on the retirement income system. Policymakers have to ensure public age pensions and the mandatory retirement pensions are sustainable in the long run and provide adequate provision for the elderly. Furthermore, the ageing population will lead to issues relating to the funding of age and health care and long-term care which has a flow on effect in the labour market.

However, reforms can be controversial and challenging due to the conflicts between short-term implications and long term gains. Often existing retirement income systems are influenced by the institutional, historical and legal designs of a country (Edward, 2007). The World Bank in its 1992 publication, ‘Averting the Old Age Crisis’, had laid the foundations of the key concepts of pension design in the form of the three pillars. This is further refined in the 2005 publication ‘Old Age Income Support in the 21st Century:

An International Perspective on Pension Systems and Reform' to include five pillars which are as follows (Holzmann, 2005):

- Zero pillar - a non-contributory system that provides a minimal level of protection
- First pillar - a contributory system that is linked to earnings
- Second pillar - mandatory individual savings account
- Third pillar - voluntary savings that is discretionary
- Fourth pillar - informal intra-family or intergenerational source of financial or nonfinancial support

Australia has in place a three-pillar retirement income system, which includes a universal but means tested public pension and privately managed mandatory retirement contributions. However, the tax rules, regulations and integration between the public private forms of retirement provision are complex. Given this complex policy design, it is important to investigate the impact it has on retirement behaviour. Consequently, the overall aim of this thesis is to investigate the behaviour of individuals and households transitioning to retirement and beyond. More specifically, the aim is to understand investment and consumption decisions by households in this age group and the impact of these issues on household welfare and for policy design.

1.2 Transition to retirement and beyond: A broad picture

The focus of our study is older Australian households transitioning to retirement and beyond. Individuals aged 45 and over are more likely to consider and plan for retirement. The road of transitioning from work to retirement is not always smooth: there may be a mismatch between what is planned for retirement versus actual reality. Early retirement can occur due to poor health, job loss or other unforeseeable life events. Furthermore, although it is possible to supplement retirement savings by working during retirement, the reality is often difficult due to possible barriers to continue employment such as age discrimination or lack of required skills. The design of the Age Pension also offers a disincentive to continue working.

1.2.1 Retirement and retirement intentions

The Australian Bureau of Statistics undertakes a survey on retirement and retirement intentions for people aged 45 years and over[1]. According to estimates from the 2012-13 survey, of the 8.5 million people aged 45 years and over who had worked two weeks or more at some point, 56% are in the labour force and 39% have retired. The average retirement age is 53.8 years, comprised of 58.5 years for men and 50 years for women[2]. Of those still working, 72% of male workers intend to work until at least age 65 while the corresponding percentage for female workers is lower at 60%.

Of those in the labour force with the intention to retire, the reasons given for the catalyst for retirement include ‘when finances are in order’ for 39% of men and 36% of women; ‘when physical capacity/health declines’ for 23% of men and 23% of women; or ‘when they are eligible for the Age Pension/superannuation’ for 13% of men and 11% of women. We compare these percentages with the actual reasons for retirement given by those retired: ‘reaching the retirement age or eligible for superannuation or pension’ given by 44% of men and 30% of women; ‘own illness, injury or disability’ given by 25% of men and 21% of women; ‘redundancy or unemployment’ for 10% of men and 10% of women. The average retirement age for those who retire due to reaching retirement age/eligible for superannuation/pension is 62.8 years, which is higher than the general average. There seems to be some evidence of a mismatch between retirement plans and reality.

Of the 3.7 million people who intend to retire from the labour force, 49% reported that their main expected source of personal income at retirement is superannuation/annuity/allocated pension and 93% have made contributions to a superannuation scheme at some point in time. 27% of people expect to live on government pension/allowance at retirement. It is also interesting to note that 16% of women who intend to retire cited partner’s income as their main source of income after retirement while for men only 4% would rely on their partner. Of the 3.3 million people already retired, 46% reported government pension or allowance, as the main source of

[1] The statistics are derived from the Multipurpose Household Survey conducted throughout Australia during the 2012-13 financial year.

[2] According to the survey, women who retire before the age of 55 tend to be from the older cohort, own their own homes and retired due to sickness/injury/disability. In contrast, women who retire between 55 to 59 years of age mainly retire due reaching retirement age/eligible for superannuation/pension.

income at retirement and only 17% would rely on superannuation/annuity/allocated pension. This is in direct contrast with the corresponding percentages of those who intend to retire – again a mismatch between plans and reality[3].

1.2.2 Household wealth composition

As families transition from pre-retirement to retirement the dominant household composition also changes from couples with dependents towards a single person household. According to the ABS Household Wealth and Wealth Distribution Survey 2011-12, the household composition with the greatest percentage for those who are 45 to 54 years is a couple family with dependent children, for 55 to 64 years and 65 to 74 years it is couple only households, for 65 to 74 year olds and for those over 74 years of age, lone person makes up the largest percentage of household types.

Figure 1.1 shows the mean values of assets by age groups[4] from 45 years and over in Australia. Owner occupied properties are the largest asset held by households (with many owning their homes outright), while superannuation balances are the largest financial asset held by households.[5] The average amount of superannuation held by 45 to 54 years households is $163,700, 55 to 64 year olds is $242,400, 65 to 74 year olds is $201,400 and for 75 years and over is $56,800. However, in each age group, aggregate financial assets outweigh superannuation accumulations. From Figure 1.2, it can be seen that liabilities associated with owner occupied housing is the largest category of debt. However, the level of debt decreases as households age.

Figure 1.3 shows the mean and median values of superannuation assets using finer age group classification. It shows that the mean and median superannuation balances peak at around 55 to 59 years of age and decreases after that due to individuals entering the decumulation phase. It is also interesting to note that the mean and median superannuation

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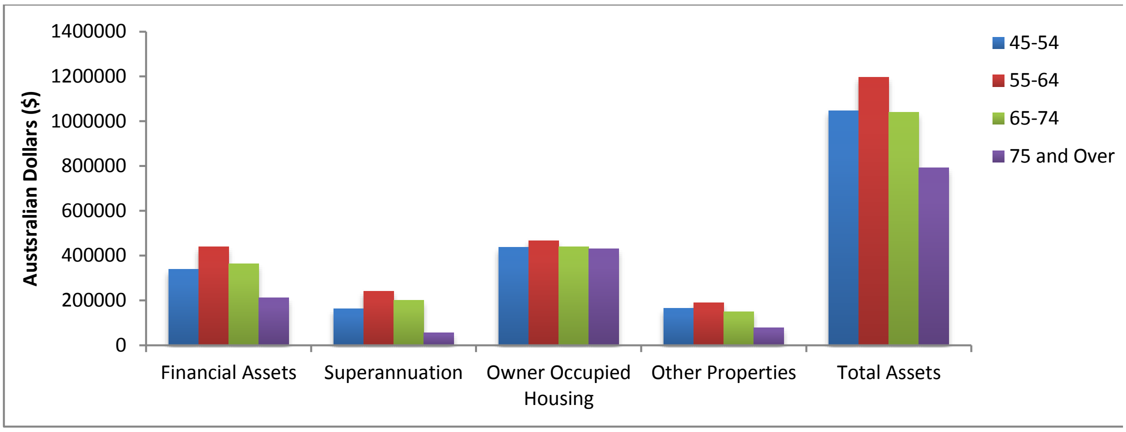
[3] The average age of the retired group is between 65-69 years and of the intended to retire group is between 50-54 years. These are two different cohorts. It is possible that changes in government policies, may affect the cohorts in different ways.

[4] This is the age of the household head.

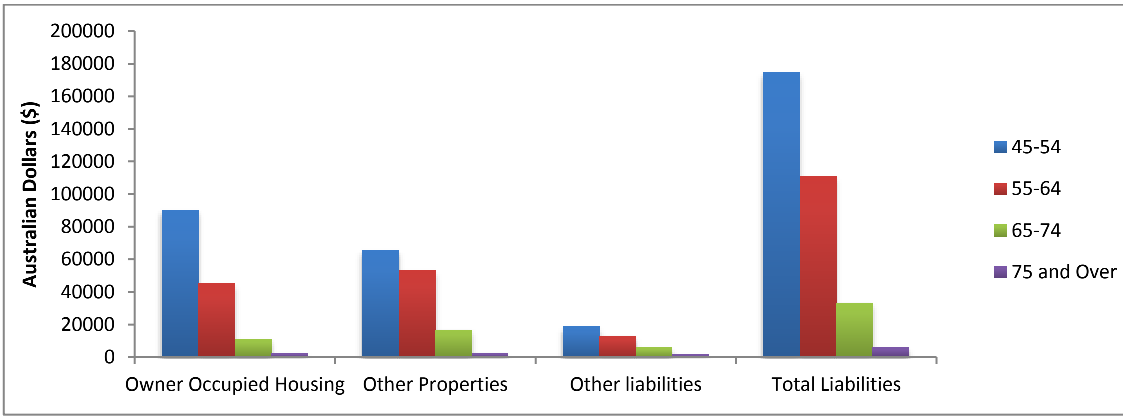
[5] Superannuation is a subset of financial assets and owner occupied housing and other properties are a subset of non-financial assets. They are all components of total assets.

Figure 1.1 Household assets by age groups



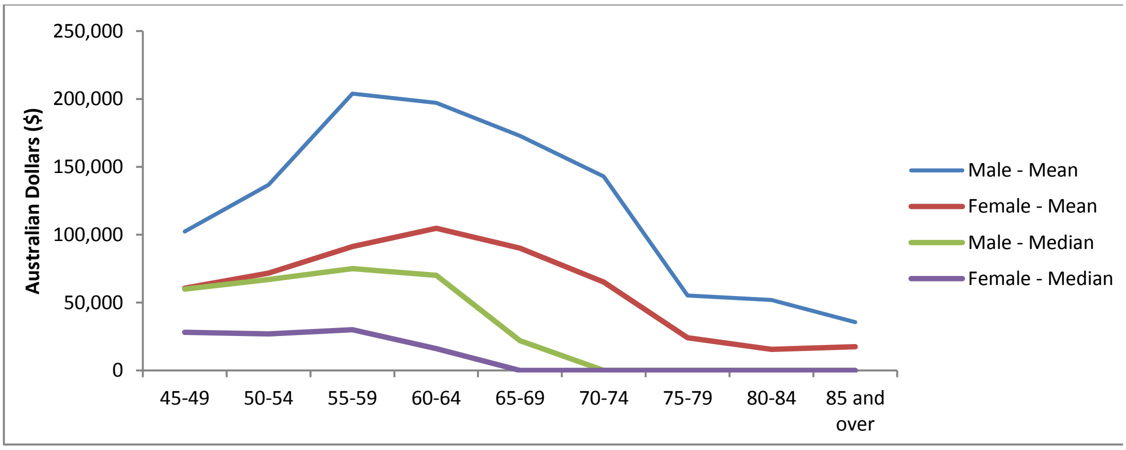
Source: ABS 6554.0 Household Wealth and Wealth Distribution, 2011-12

Figure 1.2 Mean liabilities by age group



Source: ABS 6554.0 Household Wealth and Wealth Distribution, 2011-12

Figure 1.3 Superannuation assets by age group and gender



Source: Association of Superannuation Funds of Australia (ASFA), An Update on the Level and Distribution of Retirement Savings, March 2014 balances are higher for men than women. As at March 2014, the assets of the whole superannuation industry totalled at $1.84 trillion with the March quarter contribution being $22.7 billion (Australian Prudential Regulation Authority, 2014c). Interestingly, as at 30 June 2013, 43.7% of total assets held by superannuation entities were in a default investment strategy where Australian and international shares dominate the portfolio (Australian Prudential Regulation Authority, 2014b).

1.3 Retirement income provisions in Australia

The Australian retirement income system takes the form of a three pillar approach, which has been in place since 1992. The key components are: a means tested Age Pension, compulsory private retirement saving (the Superannuation Guarantee) and voluntary retirement saving including voluntary superannuation and investment in property, equities and bank accounts (Commonwealth of Australia, 2008). The foundations of this system can be traced as far back as 1909 with the introduction of a national means tested Age Pension. Prior to the implementation of the Superannuation Guarantee in 1992, retirement income was reliant on the Age Pension and voluntary retirement saving. The Superannuation Guarantee was introduced both to provide a missing second pillar and to alleviate the burden of the Age Pension on public finances. The three pillars are consistent with the World Bank's recommendations at the time and still comply with the five pillars approach.

1.3.1 The first pillar: Age Pension

The publicly funded Age Pension is designed to serve as a social welfare safety net for people who are unable to fully support themselves in retirement. Payments are subject to both income and assets tests to ensure the fairness and sustainability of the system. To be eligible for the Age Pension the individual has to satisfy both a residency and an age requirement. Currently, men and women's eligibility ages are 65 years[6]. From 1 July 2017, the qualifying ages for both genders will be gradually increased to 67 by 1 July

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[6] As at July 2014. The qualifying age for men born before 1 July 1952 is 65. Women's qualifying age for those born between 1 January 1949 and 30 June 1952 is 65 while for those born before 1 January 1949 is 64 and a half. Figures sourced from http://www.humanservices.gov.au/customer/services/centrelink/age-pension.

2023. In the May 2014 Commonwealth Budget, there was a proposal to increase the retirement age further to 70.

The means test consists of testing either income or assets depending on which yields the lower benefit rate. The income test is designed with lower and upper bound fortnightly income cut-offs. If a single individual's (couples combined) private fortnightly income is under $160 ($284) a fortnight, then she is entitled to a full pension. For amounts exceeding this lower limit (or threshold), the benefits withdraw at a rate of $0.50 (for both) for every dollar of private income. The upper limit is $1,845.60 ($2,825.20)[7] above which pension eligibility is nil.

The assets test limits for full and part pension benefits are different for homeowners and non-homeowners as the individual's home is exempt from the test. The thresholds are higher for non-homeowners. The lower bound assets threshold for single (couples combined) homeowners is $202,000 ($286,500) and $348,000 ($433,000) for non-homeowners[8]. For every $1,000 above the threshold, the withdrawal rate for the pension is $1.50 per fortnight until the upper limit of $764,000 ($1,134,000) for homeowners and $910,500 ($1,280,500) for non-homeowners are reached.

The Age Pension payment amount for single pensioner is $19,916 per year while for each member of a couple it is $15,012.40 per year subject to the means test[9]. These amounts are adjusted twice a year in line with the CPI, the Pensioner and Beneficiary Living Cost Index and Male Total Average Weekly Earnings (MTAWE)[10]. The single Age Pension is tied to 27.7% of Male Total Average Weekly Earnings (MTAWE) to ensure that the single rate does not fall below this minimum, while for couples this benchmark rate is 41.76% of MTAWE (Klapdor, 2014).

[7] These amounts apply as at July 2014. Figures sourced from http://www.humanservices.gov.au/customer/enablers/income-test-pensions.

[8] These amounts apply as at July 2014. Figures sourced from http://www.humanservices.gov.au/customer/enablers/assets/

[9] These amounts apply as at July 2014. Figures sourced from http://www.humanservices.gov.au/customer/services/centrelink/age-pension.

[10] Following changes announced in the May 2014 Budget, from 1 September all pension payments will be indexed by CPI only (Department of Human Services, 2014).

The post-tax replacement rate for an individual solely on Age Pension is 35.2%[11]. This is the percentage of pension benefits relative to average male wages and provides a measure of adequacy. This first pillar is universal and individuals are eligible regardless of their time in the workforce or whether they have access to superannuation (subject to the income and assets tests). Consequently, the Age Pension payments play a supplementary role to other forms of income in retirement such as superannuation or from working part time.

1.3.2 The second pillar: Superannuation Guarantee

The Superannuation Guarantee system mandates employers to contribute a prescribed amount to their employees' nominated superannuation accounts. When the system was first introduced in 1992, the prescribed contribution rate was 4% (or 3% for small employers) and this was progressively increased to 9% over a ten-year period. This is currently at 9.5% and under current government policy will increase by 0.5% each year until it reaches 12% in July 2019 (Australian Taxation Office, 2011). The SG coverage is wide as it is extended to all employees with a few exceptions[12]. A penalty in the form of a Superannuation Guarantee Surcharge is imposed to encourage all employers to make superannuation contributions[13]. The contributions can be made to corporate, industry, public sector, retail or self-managed superannuation funds.

The accrued benefits are preserved and remain in the fund until the individual reaches the statutory preservation age (which ranges from 55-60 depending on the year of birth) when access is then granted (Commonwealth of Australia, 2008). Superannuation was traditionally based on defined benefits, but has largely moved to defined contributions arrangements over the past 25 years. There are still some defined benefit plans (in these plans, an individual is entitled to a pre-specified retirement benefit based on years of

[11] This is calculated using figures from the following sources: ‘full time adult male average weekly ordinary time earnings’ from ABS 6302.0 – Average Weekly Earnings, Australia, Nov 2013; total pension rates for singles as at July 2014; and personal tax rate 2013-14 financial year.

[12] For example, employees earning less than the monthly wage of $450 (Australian Taxation Office).

[13] This surcharge comprises of SG shortfall amounts, nominal interest of 10% pa and administration fee of $20 per employee per quarter. Sourced from https://www.ato.gov.au/Business/Employers-super/What-you-must-do-if-you-haven-t-met-your-obligations/.

contributions and pre-retirement salary) but the majority of individuals belong to defined contribution or accumulation plans. Under the latter, individuals are entitled to the contributions made and any investment earnings resulting from these contributions throughout their years of membership. Once the individual reaches the preservation age, she can withdraw the accumulated funds as a lump sum and/or an account based pension (more commonly known as phased withdrawals) and/or an annuity (including life or term annuities).

1.3.3 The third pillar: Voluntary saving

The third pillar consists of voluntary retirement saving. This takes the form of voluntary (quasi-voluntary) occupational superannuation, personal superannuation or long term saving through other means such as shares, property or bank accounts.

1.4 Individual and economy-wide implications of the retirement income system in Australia

The current Australian retirement income system is not yet mature as the Superannuation Guarantee has only been in place for twenty-two years. As a result many retirees have not had a full working life to accumulate their retirement saving and the amount of superannuation savings may not have reached an adequate level. The system is expected to reach maturity by the late 2030s and hence it is considered a work in progress. In considering the effectiveness of a retirement system, there are two aspects to examine - the individual considerations, such as coverage, adequacy, security and flexibility, as well as economic wide implications, such as intra and intergenerational equity, and labour market and capital market efficiency (Commonwealth of Australia, 2008).

Coverage and adequacy refer to whether the retirement income system provides the majority of the population with acceptable retirement income and whether the amounts will be sufficient compared to the consumption standard they experienced during their working life (Commonwealth of Australia, 2008). When the Australian government first introduced the Superannuation Guarantee, the vision was for superannuation benefits to supplement the Age Pension to allow retirees to have greater retirement income (Commonwealth of Australia, 2010b).

Figures released by the Organisation for Economic Co-operation and Development (OECD) shows the average net pension replacement rate is 48.7% for a person earning average wages. For Australia, this rate is lower at 17.5% for male average workers (Organisation for Economic Co-operation and Development, 2013). This is due to many OECD countries operating contributory earnings related public pension schemes while Australia's Age Pension scheme is fully publicly funded and means tested. The resulting pension benefits are lower compared to many other countries in the OECD, although more likely to be sustainable in the long term. Overall, the net replacement rate for retirement income, including the public, mandatory and voluntary components of the system, is 79.5% and the Australian replacement rate is not too far behind at 67.7% (Organisation for Economic Co-operation and Development, 2013).

Another metric of adequacy is the Retirement Standard measure compiled by the Association of Superannuation Funds of Australia (ASFA). This benchmarks the annual budget needed by Australians to fund either a comfortable or modest standard of living in retirement for single or couple households. Table 1.1 shows the budgets for various households and living standards for the March 2014 quarter. Comparing the current maximum weekly single and couple Age Pension payment rates of $421.40 and $635.30 respectively with the Retirement Standard, we see that they both fall slightly short of the totally weekly budget required for a modest lifestyle. A modest lifestyle is considered to be better than the Age Pension but still only allows basic activities while a comfortable lifestyle enables the retiree to be involved in a broad range of leisure and recreational activities and allow the purchase of household goods, private health insurance, reasonable car, good clothes, electronics and travel (The Association of Superannuation Funds of Australia, 2014).

Table 1.1 ASFA Retirement Standards

($)	Modest lifestyle		Comfortable lifestyle	
	Single	Couple	Single	Couple
Housing – ongoing	63.75	61.19	73.88	85.65
Energy	43.58	57.87	44.22	59.97
Food	75.86	157.15	108.38	195.08
Clothing	17.58	28.54	38.05	57.08
Household goods & services	26.18	35.5	73.65	86.28
Health	39.58	76.39	78.52	138.59
Transport	96.80	99.54	144.25	146.99
Leisure	73.57	109.60	222.94	305.51
Communications	9.63	16.85	26.46	33.67
Total per week	446.52	642.64	810.36	1108.83
Total per year	23283	33509	42254	57817
Annual Age Pension	19,916	30,024.80	19,916	30,024.80

Source: The Association of Superannuation Funds of Australia (2014)

The Australian retirement income system encourages sustainability by advocating private funding of retirement income through mandatory contributions to ease the fiscal burden. The Commonwealth of Australia (2009b) calculates projections using a macroeconomic model developed by the Commonwealth Treasury, which includes all three pillars - Age Pension, Superannuation Guarantee and average salary sacrifice (a form of voluntary saving). The model predicts a total replacement rate of around 75% for an individual on average weekly ordinary time earnings (AWOTE). Furthermore, the inclusion of the third pillar will lead to higher replacement rates for higher income earners, since it is mainly high income earners who take advantage of the opportunity to make additional superannuation contributions (Australian Bureau of Statistics, 2009).

On the security and robustness of the retirement income system structure, the sharing of risk between the public and private sectors is a positive aspect. The inherent design of defined contribution plans means that the individual bears all of the investment and market risk associated with their investments. This is somewhat offset through asset diversification within each plan and the Age Pension also acts as a form of insurance in the event of a large adverse movement in the market. However, the system is not protected against longevity risk and inflation risk as there is no mandatory requirement to purchase a lifetime indexed income stream. As a result, there is the danger that the individual will outlive their savings or that the savings will be eroded by inflation (Bateman *et al.*, 2001).

In terms of the macroeconomic implications of the system, the implementation of compulsory retirement savings can increase intergenerational efficiency by targeting the myopic saving tendencies by individuals and dynamic inconsistencies of preferences (Bateman *et al.*, 2001). It also has a positive effect on intergenerational efficiency - requiring those with lifetime resources to provide for their own retirement, thereby reducing dependence on the Age Pension. This in turn reduces the need for the working population to fund for the retirement of the older generation, especially with the increase in ageing population. Furthermore, the plan to increase Age Pension eligibility age is designed to increase labour market efficiency by encouraging individuals to work for longer and increase the funds for their retirement.

Although the Superannuation Guarantee generally leads to positive macroeconomic implications, the incentives of the scheme ultimately rest on the taxation structure. While there have been improvements made during the past few years, the inherent front-end taxation of super contributions and earnings have a few drawbacks.

1.5 Taxation and superannuation

The taxation of the superannuation scheme has evolved throughout the years. The incentives for voluntary superannuation contributions are mainly embedded in the tax treatment. There are three possible taxation stages for superannuation - contributions, investment earnings and benefits. Major reforms of superannuation taxation started out in the early 1980s. Prior to 1983 neither contributions nor investment earnings were taxed, and only 5% of the lump sum amount was included in taxable income. However, in 1983 lump sum benefit taxes were increased (Australian Prudential Regulation Authority, 2007). Then in 1988, taxes on contributions and investment earnings were introduced and the tax on the benefits was reduced. Therefore, superannuation was taxed at all three possible stages – contributions, investment earnings and benefits. This regime stayed in place until 2007 when the 'Simpler Super' reforms resulted in benefits being tax exempt for those who are 60 years and older[14]. Since 2007, there have been various changes

[14] Tax applies for those under 60 and if tax has not been paid on contributions and earnings.

implemented including changes to the contribution caps and taxes on excess contributions, but the fundamental framework remains the same.

The Australian tax treatment of superannuation is very different from most other OECD countries. The practice of many countries is to tax the retirement benefits at a personal marginal tax rate and leave contributions and investment earnings tax-exempt (Commonwealth of Australia, 2009a). One rationale for this approach is that it overcomes the effects of inflation - superannuation is a form of life-time saving and as such the effective tax rate on the real value of saving increases the longer an asset is held (Commonwealth of Australia, 2009a). Furthermore, superannuation is a type of deferred income. From an income smoothing perspective, it should be taxed at a lower rate as an individual's retirement income is lower than their earnings while working. An implication of front end taxation (as under the Australian tax regime for retirement savings), is that it erodes the amount of savings that goes into the superannuation plan and does not provide the risk sharing properties of an expenditure tax regime.

In 2008, the Australian government commissioned the ‘Australia's Future Tax System Review’ (also known as the Henry Tax Review) to assess the country's tax and transfer system and to formulate improvements. The review highlighted the bias the current Australian system has against long-term savings and advocated an alternative approach which provides a similar tax structure for retirement savings as other OECD countries (Commonwealth of Australia, 2009a). The Review Panel recommended that superannuation contributions be taxed at the individual's marginal tax rate with a capped offset, that the superannuation fund investment earnings be taxed at a very low rate and that retirement benefits be tax free. This differs from the current system in that the proposal allows for the taxation of contributions to be incorporated into the personal income tax system, thereby making it a progressive tax rather than a flat rate tax and facilitating greater equity between low and high income earners. This recommended system would replicate the results of back-end taxation of superannuation currently in place in other OECD countries. However, these recommendations were not supported by the government of the day and no changes were made.

1.6 A Study of retirement behaviour in Australian households

In the context of this evolving and complex retirement incomes framework we examine households transitioning to retirement and beyond. We define this transition to retirement and beyond phase as approximately the final 10 years of working life and the first 10 years of retirement, i.e. the end of the accumulation phase and the beginning of the decumulation phase. It is during this period, that decisions regarding retirement will have the biggest impact on the household welfare. Anecdotal evidence from a 2015 industry survey of Australian workers by the Financial Services Council and superannuation fund ING Direct find that older generation, especially "baby boomers", are more engaged with their superannuation compared to the younger generation as they are closer to retirement (FSC & ING Direct, 2015). This means they are more likely to be aware of their options and make informed decisions regarding retirement.

The age group that best match this definition are those 45 years and over as it is broad enough to capture those in both the accumulation and decumulation phases of their retirement saving and spending. This enables us to better understand their retirement behaviour. More specifically, we investigate the investment and consumption decisions and the implications these have on household welfare, as well as the consequent policy implications. We investigate the following research questions:

- Given the Australian retirement income framework, what are the optimal life-cycle consumption and portfolio choice profiles for individual 45 years old and over?
- Do retired Australian households exhibit behaviour that is consistent with holding a smaller proportion of risky assets compared to working households? Do labour market characteristics affect asset allocation?
- Does the consumption of Australian households fall as they move into retirement? If so, can this fall be explained by subjective retirement expectations?

In Chapter 2, 'A Simple life-cycle model of consumption and portfolio choice for older Australian households', we take a theoretical approach to the research questions by constructing and solving a life-cycle model for individuals 45 years and over using a standard constant relative risk aversion utility framework in order to find the optimal consumption and portfolio choice paths. The model incorporates simple representations of the Age Pension and the Superannuation Guarantee as well as a basic earnings shock and an asset return shock. We use HILDA and previous literature to parameterise the model and simulate the optimal paths for 10,000 individuals. We find that the average optimal consumption path throughout the individual's life-cycle is fairly smooth with no large drop at retirement. The average optimal portfolio share in risky assets is high at the beginning of the life-cycle but drops gradually when approaching retirement. Although it recovers slightly just after retirement, it is substantially lower compared to while the individual is working.

In subsequent chapters, we employ an empirical approach and utilise the longitudinal dataset, the Household Income Labour Dynamics of Australia (HILDA) survey, to investigate the behaviour of older households in relation to investment and consumption. In Chapter 3, 'Retirement and asset allocation of older Australian households', we examine whether retired households 45 years old and over exhibit behaviour that is consistent with holding a smaller proportion of risky assets compared to their working counterparts. We also assess whether labour market characteristics affect asset allocations of households. We utilise the panel data nature of HILDA using wave 2 (2002), wave 6 (2006) and wave 10 (2010) and estimate three models of risky asset holdings for single and couple households - a pooled ordinary least squares (OLS) model, a fixed effects (FE) model and a random effects (RE) model. In each model, we consider the proportion of risky assets held by each household and the relationship with the state of retirement, retirement intentions, labour income characteristics, and individual and household demographics and characteristics. We also utilise a policy change in women's Age Pension eligibility age as an instrumental variable. Overall, we find some evidence of a fall in the proportion of risky assets held by retired single and couple households.

In Chapter 4, 'The retirement-consumption puzzle: An Australian perspective using subjective retirement expectations', we investigate whether older Australian households exhibit a fall in consumption as they move into retirement, and, if so, whether this fall can be explained by subjective retirement expectations. Again, we utilise the panel data nature of HILDA using waves 1 and 3-11 (2001, 2003 to 2011). Subjective retirement expectations are used as an instrument for unanticipated shocks. We estimate both a consumption difference model and a consumption levels model and used three different measures of consumption – expenditure on groceries, expenditure on food eaten at home and expenditure on food eaten outside the home. Overall, our results indicate that the drop in consumption at retirement only exists for household that do not retire as planned, i.e. due to external shocks.

In Chapter 5 'Conclusion', we summarise the results, discuss the implications and identify areas for future research.

Each of the three chapters aims to make a unique further contribution to the existing literature. Chapter 2 offers an Australian perspective on the lifecycle asset allocation model and with the unique retirement system in Australia, the resulting consumption and portfolio choice for older Australian households are of interest. Chapter 3 contributes to the limited Australian literature on retirement and household asset allocation by utilising a unique panel dataset in examining the relationship between the two. Chapter 4 uses a different approach in examining retirement consumption puzzle to existing Australian literature.

Chapter 2: A Simple life-cycle model of consumption and portfolio choice for older Australian households

2.1 Introduction

With the ageing population, countries around the globe are increasingly moving away from government provided public pensions due to the lack of sustainability. They are converging towards private retirement saving arrangements, which involve an increased responsibility for individuals to make their own key decisions regarding their retirement and retirement incomes. Australia is at the forefront of retirement income system reforms with the implementation of a three pillar arrangement comprising private retirement saving and a publicly provided safety net. Key features of the system include a 9.5% compulsory employer contribution to private retirement saving entities – superannuation funds - (with proposals to gradually increase this to 12% by 2020), tax concessions for additional voluntary saving, a universal but means-tested public age pension, the opportunity to choose asset allocation within a superannuation fund (both in accumulation and decumulation stages), and complete freedom of choice of benefit type – including lump sums, phased withdrawal products (account-based pensions) and term and life annuities.

Superannuation assets in Australia total at $1.85 trillion at the end of the June 2014 quarter[15]. With the privately managed retirement income playing such a large role in the Australian economy, it is of interest to policymakers, researchers and the wealth management industry to gain understanding of the behaviour of older Australian households. These older households are either transitioning to retirement or already in retirement. An understanding of saving, investment and expenditure decisions will lead to better-informed policymaking in terms of adequacy, equity and sustainability, and better design of products and strategies which ultimately will increase the likelihood that older Australians have sufficient funds for their retirement.

[15] Figure from the Australian Prudential Regulations Authority's 'Quarterly Superannuation Performance (Interim Edition)':
http://www.apra.gov.au/Super/Publications/Documents/June_2014_Quarterly_Superannuation_Performance.pdf?WT.si_cs=1

Two of the key decisions in the transition to retirement and in retirement involve the allocation of assets between risky and safe assets, and the allocation of income (and wealth) between saving and consumption. The aim of this chapter is to motivate the research questions posed in the subsequent empirical chapters regarding portfolio choice and consumption, by exploring the theoretical implications through solving a life cycle optimisation problem for older households. The main research question being asked in this chapter is: given the Australian retirement income framework, what are the optimal life-cycle consumption and portfolio choice profiles for Australians aged 45 years and over? Of particular interest is at the point of retirement. That is, to investigate whether the optimal consumption and portfolio choice changes as the individual moves from working to retirement.

Existing Australian literature focus on the policy implications of retirement income reforms using overlapping generations (OLG) models to study the macroeconomic effects. While the OLG model generates life-cycle profiles of individuals, our study has a particular focus on older Australian households and we are interested in the optimal life-cycle paths rather than the macroeconomic implications. Subsequently, we develop a simple life-cycle model for households 45 years old and above to better study the consumption and portfolio choice behaviour of the age group of interest.

We use a standard constant relative risk aversion (CRRA) utility framework with uncertain wages and investment returns to solve a dynamic consumption and portfolio selection problem for households 45 years of age and over. The model incorporates a simple representation of the Age Pension and the Superannuation Guarantee along with a basic labour earnings shock and an asset return shock. The model is then calibrated to Australian asset return shock and earnings shock parameters. We solve for the optimal consumption and portfolio choice for 40 periods, from 45 to 85 years of age. We then generate simulated consumption and portfolio choice paths based on the wealth distributions of those who are 45 years of age using data from the Household Income Labour Dynamics of Australia (HILDA) survey. We also explore this question under different assumptions and scenarios as a part of the sensitivity analysis: where superannuation assets are taken as a lump sum at the age of retirement or are taken as an allocated pension at the minimum drawdown rate; when the individual is risk tolerant or time impatient, or when there is no labour income risk.

Using our simplified 'over 45' life-cycle model, we find individual optimal consumption paths to be fairly smooth with no large drop at retirement. The reason for this is individuals anticipate the drop in income after retirement and increase their precautionary savings so that they can maintain the level of consumption after retirement. The optimal portfolio share in risky assets is substantially lower post retirement compared to the share invested while working. Human capital is an implicit safe asset early in the life-cycle as the individual has more earnings potential. As a result, individuals tilt their portfolio towards the risky asset. However, as they age, their human capital depreciates and at retirement they are no longer holding an implicit safe asset. Consequently, she adjusts her portfolio share towards the safe asset.

Comparing the model developed in this chapter with those from the literature, especially from Cocco *et al.* (2005), we have made some simplifications including having simple (iid) income shocks in order to operationalise the model. However, the novel component of our model is we have incorporated features of the Australian retirement income system. This allows us to find the optimal consumption, wealth and portfolio share paths for an Australian-type economy that includes simplified versions of the Age Pension and superannuation. The resulting optimal paths are similar to those obtained in Cocco *et al.* (2005): hump shaped wealth optimal path as the individual accumulate and then decumulate wealth and a flat v-shaped optimal portfolio share path as agents invest in more risky assets earlier in their lifetime and decrease at retirement only to pick up slightly after retirement. However, our optimal portfolio share path differ marginally to that of Chai *et al.* (2011) as in the latter their model also includes annuity in the mix of assets resulting in individuals trading in risky assets for annuities later in life which individuals in our model cannot.

The results we obtain also provide the basis for the hypotheses being tested empirically in Chapter 3 and 4: we expect risky portfolio share being lower in retirement compared to working life; and that consumption path to be smooth through retirement.

The remainder of this chapter is set out as follows. In Section 2.2 we discuss the theoretical and empirical literature on portfolio choice; Section 2.3 sets out the model and the method used in solving the model; Section 2.4 we discuss the parameters used in the model; Section 2.5 explores the results generated from the benchmark model as well as the results of the sensitivity tests; Section 2.6, 2.7 and 2.8 sets out the concluding discussion, the limitations of the study and possible areas of further research.

2.2 Literature review

In order to understand the context of the life cycle portfolio choice literature, we first examine the short-term portfolio choice theory, and then turn to the early seminal works on life-cycle portfolio choice in which short term and long term investment decisions are one and the same. We subsequently discuss the literature surrounding risky labour income and portfolio choice, which provides the specific background to this chapter. Other factors which affect portfolio choice are also briefly discussed. Lastly, we examine the literature on life-cycle portfolio choice in Australia.

2.2.1 Origins of life-cycle portfolio choice

In explaining the origins of life-cycle portfolio choice theory, it is important to begin with a discussion of the short-term portfolio choice theory as two are inextricably linked. Works on optimal asset allocation theories commenced in the early 1950s with Markowitz (1952) where the author postulates the mean-variance analysis. This is where an individual focusing on portfolio returns, and volatility will derive higher expected returns by combining cash with a portfolio of stocks and bonds compared to only combining stocks and bonds alone. The key here is diversification. Following this, Tobin (1958) formulated the mutual fund theory of portfolio choice whereby all investors will hold the same portfolio of risky assets and depending on the risk tolerance level of the investor, the risky portfolio is mixed with more or less cash. However, these theories are based on short-term investment and on constant risk and return. Applying them to long horizon or life-cycle portfolio choice is problematic. Consequently, research on life-cycle portfolio choice commenced in the 1960s with seminal works by Merton (1969), Samuelson (1969) and Mossin (1968).

The aforementioned authors theorise that under a number of restrictive assumptions, the long horizon asset allocation decision is the same as the short horizon one. This branch of the literature focuses on the portfolio decision between a riskless asset and a risky asset and concludes that optimal portfolio shares would remain constant over the life-cycle, and thus be independent of age and wealth. This implies the irrelevance of the time horizon. However, this result rests on several important assumptions as highlighted in Ameriks and Zeldes (2004) including:

- The utility functions of the agents are in the form of constant relative risk aversion (CRRA), which are time-invariant and additively separable over time.
- Agents are assumed to have no labour income or non-tradable assets.
- Asset returns are independently identically distributed over time.
- Markets are frictionless and complete.

This literature has become the basis on which subsequent research is built on. That is, subsequent authors relax these restrictive and often unrealistic assumptions to explore the impact on portfolio allocation. Furthermore, age varying portfolio shares are dependent on relaxing these restrictions.

2.2.2 Risky labour income and portfolio choice

Theoretical models

The unifying theme of this dissertation is the impact of the Australian retirement income provisions on investment and consumption at the individual level. Therefore, a key base assumption we are focussing on is the effect of risky labour income on optimal portfolio choice. The literature in this branch of the portfolio choice theory relaxes the assumption of no labour income given it is highly unrealistic as income risks would likely affect an individual's investment choices and indeed consumption and savings. In this chapter we assume individuals who are not retired earn labour income and those who are retired receive retirement income derived from the Age Pension and the Superannuation Guarantee.

The seminal paper in this branch of the literature is Bodie *et al.* (1992) which uses the lifetime consumption and portfolio choice model of Merton and Samuelson and incorporates flexible labour in order to examine the relationship between labour supply and portfolio choice over the life-cycle. The optimal amount of risky assets the authors derive under wage uncertainty implied that no rebalancing is required if and only if the individual's implicit investment in the risky assets (through human capital) matched her ideal proportion, and that labour flexibility induces the individual to increase her investment in the risky asset. The authors conclude that an individual tends to exhibit more conservative investment behaviour when nearing retirement due to two effects. Firstly, as she moves through her working life, she expends human capital leading to less and less rebalancing of her financial investments. Secondly, the degree of labour flexibility[16] diminishes over the life-cycle which leads to the reduction of the amount of effective human capital which can be drawn on. At any given age in the life-cycle, greater labour flexibility will induce greater risk taking in an individual's financial investments. Furthermore, the riskier the return on an individual's human capital is the lower will be her financial investment in risky assets.

In contrast to Bodie *et al.* (1992), Farhi and Panageas (2007) use a different assumption regarding labour supply. They use a discrete labour choice due to the reality of labour supply being often indivisible in contrast with the continuous choice alternative. This creates an option like characteristic in retirement timing. Farhi and Panageas (2007) find that wealth affects the retirement decision: that is, those with high wealth levels have a higher likelihood of early retirement. The prospect of early retirement encourages savings. Therefore, the choice of when to retire acts as an option for the individual and in turn affects the agent's consumption and portfolio choice decisions. This outlook of early retirement results in the investor's portfolios being more exposed to stock market risk as investment in the stocks will result in higher returns and bring her closer to retirement. Furthermore, in the event of negative market shocks she can always postpone retirement.

Viceira (2001) uses a dynamic optimal consumption and portfolio choice model incorporating retirement and uninsurable labour income risk. He examines the idea that when labour income is imperfectly correlated with stock returns, stocks can act as a hedge for consumption from unexpected drops in labour income. While working, the individual should invest more in risky assets than when retired. The optimal investment fraction of

[16] The authors define labour flexibility as the freedom individuals have in making their labour decisions such as the number of hours to work, how many jobs to take on and when to retire etc.

savings is positively related to expected labour income growth and the retirement horizon when income risk is idiosyncratic, i.e. individuals should invest in stocks when their human capital is large. Furthermore, if there is correlation between labour income shocks and asset return shocks, a rational individual can utilise the resulting hedging properties of the risky asset. An increase in the labour income risk will lead to a fall in the investor's willingness to hold risky asset and instead increase her willingness to save, as labour income resembles a risky asset rather than a riskless asset.

Realistically calibrated models

The theoretical models in the aforementioned papers are not designed to include all realistic aspects of real world retirement systems. Another sub branch of the risky labour income literature is to use a realistically and quantitatively calibrated model to solve for optimal portfolio and savings decisions. This approach allows for the theoretical conclusions to be applied to a wider macroeconomic environment as microeconomic data is used to calibrate the individual labour income process in the models.

Cocco *et al.* (2005) formulate a life-cycle model of consumption and portfolio choice with non-tradable labour income and borrowing constraints in order to examine the rationale for age dependent investment strategies resulting from labour income risks. The labour income and risk characteristics are estimated using the longitudinal U.S. dataset - the Panel Study of Income Dynamics (PSID). The results show that having labour income increases the demand for stocks, in particular early in life. The share invested in equities decreases with age as the labour income profile is downward sloping. However the authors find that to reconcile the empirical predictions of the model with real life data observations would require a disastrous labour income draw.

The aforementioned papers assume labour earnings are exogenous. The broad implication of this is that it offers a bond-life characteristic, as they are not closely correlated with equity returns. Gomes *et al.* (2008b) examine the insurance features of having flexible labour supply: that is, the ability of individuals to work more to hedge against poor equity performance in their investment portfolio. The authors find supporting evidence of younger households holding more equities but the share declines prior to retirement. Adding flexible labour supply increases the optimal equity share significantly prior to retirement. Post retirement, as households draw down their financial assets, the optimal equity share increases with pension benefits becoming a large part of the financial portfolio.

Chai *et al.* (2011) extend the literature further not only using flexible labour supply in realistically calibrated models but also incorporating endogenous retirement date and annuitisation decisions in the mix. They find high equity returns and negative labour market shocks lead younger individuals to work less and buy more annuities and to retire at an earlier date. They also find the optimal behaviour obtained using the model fits well with stylised facts which include a hump-shaped work hours pattern, discontinuities in consumption at retirement and older households having lower annuity take-up.

The labour income specifications of the models in the papers discussed previously are of similar nature. Benzoni *et al.* (2005) make the point that the assumptions may be restrictive and that there is high correlation between returns to human capital and the stock market. The authors investigate co-integration between labour income and market returns in a life-cycle portfolio choice model. A co-integrated relationship implies that past profitability in the economy affects future labour income flows through correlation between returns to labour and physical capital. Therefore, this relationship still exists despite the contemporaneous correlations between market returns and changes in labour income being low. The resulting optimal portfolio choice is hump shaped as younger individuals hold more equities.

2.2.2 Other factors and portfolio choice

The central theme of the aforementioned literature surrounds the presence of labour income risks. However, there are other branches of the portfolio choice literature that focus on the remaining underlying assumptions of the seminal papers by Merton (1969), Samuelson (1969) and Mossin (1968).

Another aspect of labour income that is being addressed in the literature is the role of social security, which alters the optimal portfolio choice, for example Maurer *et al.* (2010), Smetters and Chen (2010) and Li and Smetters (2011). Li and Smetters (2011) find that with a progressive wage indexed social security system (i.e. one in which assumes social security benefits are correlated with stock returns), they are able to closely replicate the key stylised empirical facts in portfolio choice. Maurer *et al.* (2010) examine the effect of labour uncertainty and social security on portfolio choice and savings. The authors find that high labour income risk and low social security lead to an increase in demand for stable income early in life and retirement. Those who are more risk averse save more early in life and hold fewer equities.

Other factors affecting portfolio choice which are examined in the literature through theoretical modelling include alternative utility functions to the CRRA framework (for example, Gomes and Michaelides (2005) and Li and Smetters (2010) use the Epstein-Zin-Weil utility functions and that the resulting optimal portfolio choice matched the empirical data closely); capital gains taxes (for example, Dammon *et al.* (2001) find that the individual's optimal portfolio holdings is dependent on their age, investment portfolio and embedded capital gains on the portfolio); housing (Cocco (2005) concludes that housing has a crowding out effect on equity holdings especially those with low financial-worth); and health (for example, Yogo (2009) incorporates endogenous health into the model as an investment in health).

2.2.3 Portfolio choice, consumption and the Australian evidence

The literature on life-cycle portfolio choice in the Australian context is not extensive. One possible reason for this is that the extensiveness of the U.S. centric literature does not give rise to very different results for the Australian context.

There have been a number of works that use an OLG model or other macroeconomic models to test the macroeconomic effects of policy changes in Australia retirement income system, for example Cho and Sane (2013) examine the relationship between the Age Pension means tests on housing consumption; Guest and McDonald (2002) investigate the effects of the Superannuation Guarantee rates on standards of living; and Creedy and Guest (2008) focus on the savings and labour supply implications of superannuation tax reforms.

More relevant to our study are Kudrna and Woodland (2011b), Kudrna and Woodland (2011a) and Kudrna and Woodland (2013) in which the authors develop an OLG model of the Australian economy incorporating Australian pension, superannuation and taxation policy features in order to test the macroeconomic implications of the Age Pension means tests, the 2009 Age Pension reforms and the 2010 Superannuation Guarantee reforms. Of particular interest, Kudrna and Woodland (2011a) find that when removing the Age Pension means tests, there is less need for individuals to work and save throughout their life-cycle. Furthermore, Kudrna and Woodland (2013) test for a higher Superannuation Guarantee contribution rate from their benchmark model and find that as a result, households alter their saving, labour supply and consumption behaviour in their lifetime in anticipation of increased future superannuation payouts. Consequently, there is less incentive to save and consumption increases.

Connolly and Kohler (2004) formulate an analytical model of household saving based on the OLG model. The authors find that the introduction of a compulsory superannuation scheme can increase saving for liquidity/financially constrained or myopic households.

In a similar vein to our life-cycle model of older households, Hulley *et al.* (2013) focus on life-cycle theory of retired households, i.e. 65 years and above. The authors investigate the impact of the means tested public income transfer on post-retirement decumulation and portfolio choice by solving the dynamic consumption and portfolio allocation problem using Australian data. They find that means tested households should choose more risky portfolios compared to the benchmark households not subjected to the means tests. The proportion of risky assets declines towards the end of life as entitlements decrease. They also show that the Australian data indicates that wealthier households hold riskier portfolios.

There have been a few empirical works that examine portfolio choice in the Australian context. Gerrans *et al.* (2010) use superannuation fund level data to investigate the relationship between age and asset allocation. The authors find a humped relationship between age and equity with the peak occurring at age 34. This is supported by quintile estimations with younger age quintiles having higher equity allocations than older quintiles. Furthermore, allocation to fixed interest investment increases with age suggesting a ‘U-shaped’ age profile for defensive asset class allocations.

Cardak and Wilkins (2009) use the HILDA dataset to find the determinants of household risky asset holdings. The authors find evidence that the coefficients for the ratio of risky assets are stable for individuals between 25 to 54 years of age but are increasing over the 55 to 69 range. Beyond 70 years of age, the coefficient decreases. They attribute this phenomenon to increased financial knowledge and opportunities that are associated with age and experience.

On the consumption empirical literature front, Barrett and Brzozowski (2009), Barrett and Brzozowski (2010) and Barrett and Brzozowski (2012) examine the relationship between retirement and consumption with respect to the existence of the retirement-consumption puzzle. The authors find that there is a drop in consumption at retirement in Australia. However, it can be explained by the distinction between voluntary and involuntary retirement.

Overall, the theoretical literature on portfolio choice shows that with the presence of labour income risks, younger individuals hold more equities as their human capital acts as a safe asset but this 'safe asset' expends as the individual ages. Thus holdings in risky assets decrease with age and upon retirement. Furthermore, incorporating social security into the mix also results in decrease in risky asset holdings later in life.

2.3 The model

The aim of this chapter is to derive a simplified life-cycle model for older Australians that incorporates the key features of the Australian retirement income system. This is in order to motivate the a priori expectations regarding the empirical investigations of portfolio choice and consumption of older Australian households in subsequent chapters. The optimisation problem incorporates structures of the Age Pension and the Superannuation Guarantee. To do this, we solve a discrete time and finite horizon dynamic programming problem for households 45 years old and over. This represents those transitioning to retirement and in retirement. As there are a number of intricacies associated with the Australian retirement income system that are difficult to fully model, we make simplifications.

We consider the consumption stream and portfolio choice for an individual[17] from age 45 to 85. She has a 20-year working life (from the age of 45), during which she earns gross labour income and from which a proportion of mandatory superannuation contributions are made by her employer and held in a superannuation fund. She retires at age 65 and receives an Age Pension payment and her accumulated superannuation assets as a lump sum. From age 66 onwards she receives a constant amount of Age Pension payment. Death is known - the individual lives until 84 and dies at 85.

The main reason for the choice of the life-cycle starting at 45 is that households in this age group are more likely to make decisions relating to retirement. This sample is also used by the Australian Bureau of Statistics (ABS) in the Retirement and Retirement Intentions publication as well as used in HILDA data when surveying participants regarding their retirement intentions. Furthermore, according to the current life tables published by the ABS a female at the age of 45 is expected to live until 85 years of age. Therefore, we set the maximum number of living years to 84 in the theoretical model.

2.3.1 The optimisation problem

The individual's problem is to consume and invest out of wealth, income, Age Pension payments, superannuation assets and investment returns. She invests her savings each period in a risk-free asset and a risky asset and leaves a bequest in the last period[18].

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[17] Here we ignore differences in retirement income/wealth between men and women. We assume that they earn the same amount and the gender of the individual is irrelevant. For more detailed discussion of the limitations of this assumption, please see Section 2.7 Limitations.

[18] There have been a number of debates on the importance of bequests for households. There is some evidence of bequests in the literature but the motivation for leaving one is unclear. Earlier papers such as Kotlikoff & Summers (1981) find 46% of household wealth is comprised of bequests while Modigliani (1988) finds the percentage is lower at 17%. More recently, Kopczuk & Lupton (2007) estimate approximately 75% of a representative sample of elderly single households has the motive to leave a positive net worth bequest and the motivation for such bequest is due to egoistic reasons rather than altruistic or strategic. However, Dynan et al. (2002) find bequest motive disappears in the face of precautionary savings.

The time period is denoted by t and in each successive time period, the agent ages by one year. In this model, we assume the individual's working life starts at 45 years, therefore in timer period 1, $t = 1$, the age of the individual is 45, for example C_1 refers to consumption in period 1 and at age 45 (i.e. $age = t + 44$). T refers to the period in which the agent's dies, i.e. $T = 41$ which is age 85. The remaining wealth she has at 85 is left as a bequest, i.e. W_T refers to wealth/bequest at 85 years.

She is assumed to choose a consumption stream and portfolio to maximise the following:

$$Max\ E_t[\widehat{U}(C_1, C_2, \dots, C_{T-1}, W_T)] = Max\ E_t[\sum_{t=1}^{T-1} U(C_t) + B(W_T)] \tag{2.1}$$

where $U(\cdot)$ is the utility function of consumption and $B(\cdot)$ is the utility of bequest. The individual's preferences are characterised by a concave and time additive utility function for both consumption and bequest:

$$U(C_t) = \beta^t \frac{1}{1-\theta} C_t^{1-\theta} \tag{2.2}$$

$$B(W_T) = \beta^T \frac{1}{1-\theta} W_T^{1-\theta} \tag{2.3}$$

Where $\theta > 0$ is the coefficient of relative risk aversion and β is the discount factor.

In period t, the agent knows her wealth W_t and current income Y_t. In each period, the individual has the following cash on hand to consume:

$$W_t + Y_t \tag{2.4}$$

This income is post superannuation contributions made by the employer. Depending on the retirement status of the individual, there are two different income processes: labour earnings or Age Pension payment (and at the point of retirement, also the lump sum superannuation balance).

Income process

The individual's labour choice is exogenously given with retirement at the age of 65. The amount of labour earnings during her working life is Y_t and includes the 9% compulsory superannuation contribution. The labour income process for her working life is:

$$Y_t = f(t) + \varepsilon_t \tag{2.5}$$

where $f(t)$ is the deterministic component of labour income and is a function of age and represents the second half of the hump shaped profile. ε_t is the random shock associated with earnings and follows a first order autoregressive process:

$$\varepsilon_t = \rho\varepsilon_{t-1} + u_t \tag{2.6}$$

where u_t is independent and identically distributed normal $N(0, \sigma_u^2)$[19].

In each working period, m per cent of her income is invested in a superannuation account, which earns a constant rate of return of $\bar{R}_m$. The superannuation balance, S_t, in each period is:

$$S_t = \sum_{s=1}^{20}(1 + \bar{R}_m)mY_{t-s} \tag{2.7}$$

At the age of 65, she retires and receives the Age Pension payment plus the lump sum superannuation assets accumulated during her working life. From then onwards, she only receives an Age Pension payment in every period until her death. We also test for the alternative scenario where the superannuation asset is received as an allocated pension according to the minimum draw down rates. The Age Pension benefit payment, $\bar{P}$, is based on the maximum amount of Age Pension payment a single person can receive in Australia[20]. This is exogenously given and is constant in each period. Thus at 65, the labour income equation is:

$$Y_{21} = \bar{P} + S_{21} \tag{2.8}$$

In subsequent periods, the individual only receives Age Pension benefits until she dies in period T:

$$Y_t = \bar{P} \tag{2.9}$$

Budget constraint

The individual chooses to consume C_t and invest a proportion, γ_t, of wealth in a risky asset (i.e. equities) while the remaining proportion, $(1 - \gamma_t)$, is invested in the riskless asset. (i.e. bonds). Therefore, Equation (2.4) becomes:

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[19] In order to operationalise our model, we have chosen to incorporate a simple iid shock in the income process. However, in the life-cycle literature, the labour income shocks are often modelled with transitory shock and persistent shock components. The parameters of the shocks are found using variance decomposition methods (see Cocco *et al.* (2005)). As a result of this simplification, the income process is not as realistic. See Section 2.7 Limitations for further discussions.

[20] When modelling the Age Pension component of the retirement income, we ignore the means testing required for the Age Pension due to complexity associated with solving for such a model numerically.

$$W_t + Y_t = \gamma_t(W_t + Y_t - C_t) + (1 - \gamma_t)(W_t + Y_t - C_t) + C_t \quad (2.10)$$

In the next period $t + 1$, the individual's cash on hand amount is:

$$W_{t+1} + Y_{t+1} \quad (2.11)$$

And her wealth W_{t+1} before labour income is given by:

$$W_{t+1} = [\gamma_t R_{t+1} + (1 - \gamma_t)R_f](W_t + Y_t - C_t) \quad (2.12)$$

where R_{t+1} and R_f are the (gross) rate of return on the risky asset and the riskless asset respectively. Equation (2.12) represents the amount of wealth in the next period comprised of the returns from the investment in risky and risk-free assets in the previous period. This is the budget constraint that the individual faces.

Asset process

The rate of return on the risk-free asset, R_f, is constant over time, i.e. $\bar{R}_f$. The rate of return on the risky assets, R_t is independent and identically distributed normal $N(\mu_s, \sigma_s^2)$. This assumption introduces shocks to the return on assets and is reflective of the realities of defined contributions superannuation funds being subjected to market volatilities[21].

2.3.2 Numerical Solution

This problem is solved using numerical methods. We create a discrete grid for the state variable wealth as well as grids for the variables over which choices are made i.e. consumption and γ (the investment portfolio share of risky assets). The shocks to income and assets are discretised using the Tauchen method (Tauchen, 1986). We use backward induction to find the policy functions. In the last period, the agent decides how much to consume and how much to leave as bequest. For the remaining periods, we find the value function values for all combinations of points in the wealth, consumption and risky portfolio share grids. The consumption, wealth and risky portfolio share policy functions are obtained by finding the corresponding maximum values. To do this, we first

[21] For a discussion on the risks faced by retirement savers especially during the 2008-09 global financial crisis, see Bateman (2010). For empirical analysis, Roca & Wong (2008) and Tularam et al. (2009) use Markov regime switching model and EGARCH approach respectively and find a similar conclusion: superannuation funds are sensitive to volatilities in the equity markets.

interpolate to construct an approximation of the value function in the next period and given this approximation we then maximise the value functions for the current period for all combinations of wealth, consumption and proportion of risky assets and so on until period one. We then take the optimal consumption, proportion of risky assets and wealth associated with the maximised value functions in each period to construed the policy functions.

The life-cycle paths are simulated by forward induction. Starting with a specific value of wealth as the initial endowment, the corresponding consumption, portfolio choice and next period's wealth are found using the policy functions. Since next period's wealth does not lie on the original wealth grid, we interpolate linearly and apply the linear weights to the consumption and gamma policy grid points to find the corresponding points. This process is generated for 10,000 individuals with different starting wealth endowments that mimic the actual distribution of net worth in the 2010 HILDA dataset. Each individual has their own unique set of asset and earning shocks during their lifetime. This is then averaged to obtain the optimal life-cycle paths.

2.4 Parameters

The parameters used in the benchmark model are shown in Table 2.1. We use the time, preferences and asset process parameters in the literature. The labour income parameters and wealth levels are derived from HILDA.

Table 2.1 – Benchmark model parameters

Description	Parameter value
Retirement age	65
Discount factor (β)	0.97
Risk aversion (θ)	5
Variance of earnings shock	0.81
Risk free rate of return (R_f)	1.03
Mean return to risky asset	1.0408
Standard deviation of risky asset returns	0.21
Superannuation contribution rate (m)	0.095
Rate of return of superannuation fund (R_m)	1.03

Time parameters and preferences

Individuals start life at age 45. The age of retirement is set to 65 and the individual dies for certain at the age 85. The discount factor β is set to 0.97 and the coefficient of relative risk aversion θ is 5[22]. These parameters are based on those from Chai *et al.* (2011) which are standard values from the life-cycle literature. To test variations to the benchmark case, we also consider individuals who are extremely risk averse with $\gamma = 10$, those who are risk tolerant with $\gamma = 2$, as well as those who are time impatient $\beta = 0.9$.

Labour income process and wealth levels

The HILDA survey is used to derive the labour income levels and shocks used in this model. This dataset is a household based social and economic longitudinal study which commenced in 2001 and is implemented annually (Watson & Wooden, 2001). It collects annual information on income, labour market, demographic and personal characteristics of Australian individuals and households and also collects information on wealth and retirement in less frequent special modules. To date there are 11 waves available for analysis, collected from 2001 to 2012, comprising both standard questions as well as special topic modules which are repeated in cycles. We select 2010 Wave 10 as the cross section from which we derive the wealth levels, as it contains the most recent household wealth module. We also use Waves 1 to 10 to derive the labour income levels and shock.

In order to match the data samples used for the subsequent empirical chapters, we restrict the sample in which we derive the parameters to standard single and couple households, i.e. households which is identified as the following types:

- Lone person
- Single parent with children under 15
- Single parent with dependent student(s)
- Couple only
- Couple with children under 15

[22] In Cocco *et al*. (2005), the coefficient of relative risk aversion is set to 10 which is the upper bound of risk aversion considered reasonable in the literature. We carry out sensitivity tests by varying the coefficient to be 10 in Section 2.5.2.

- Couple with dependent student(s)

The income values used in the model are taken from the individual full time earnings of those in the sample. The average earnings for each age from 45 to 64 are calculated[23]. We then use the earnings data to run an AR(1) process where the derived error variance is used to approximate the earnings shock in our model.

We also use these income values to calculate the superannuation contribution in each period, i.e. the deterministic component of labour income rather than the income after earnings shock. At the point of retirement, the individual would receive her accumulated lump sum payment from her superannuation assets. In order to calculate this using after shock earnings, the state variable at the time of retirement would have to contain all the wage and wage shock information for the last 20 working years. Instead, simplifications are made by using deterministic wage values. This means that all individuals receive the same amount of superannuation lump sum upon retirement. In conducting the simulations, the heterogeneity comes from unique individual asset and earning shocks that each person is exposed to in their lifetime.

We formulate an alternative superannuation accumulation specification where the proportion of superannuation assets to wealth is used to approximate the amount of superannuation balance at the point of retirement. Those with higher wealth would have greater accumulated superannuation assets at retirement. Under this simplification, individuals would receive a different amount of lump sum superannuation depending on their wealth level at the point of retirement.

The distribution of wealth is derived from the equivalised net worth values from the HILDA sample. The wealth values from HILDA are collected on a household basis. An equivalence scale is applied in order to adjust household incomes, accounting for the economics of scale between members of the household (Australian Bureau of Statistics, 2013a). We use the OECD-modified equivalence scale as used by the Australian Bureau

[23] In our model, the individual's working life starts at 45 and ends at 64 before retirement. While the age earnings profile is usually hump shaped (see Blake *et al.* (2007)), the wage associated with 45 is near the peak of the hump and as a result our earnings profile peaks at 51 and then is on a decreasing trajectory until retirement at 64. It is similar to Cocco *et al.* (2005).

of Statistics which gives the value of 1 to the household head, 0.5 to each additional person 15 years or older and 0.3 to each child under 15 years of age (Australian Bureau of Statistics, 2013a). This adjustment allows for more meaningful comparisons between single and couple households. The distribution of the wealth variable is then determined using kernel density. We mimic this distribution by using the associated cumulative density function values.

Other parameters

The real annual risk free rate of return is taken as $R_f = 1.03$. The mean of the rate of return on risky asset is set at 1.0408 and its standard deviation is 0.21 in line with the parameters used in Hulley *et al.* (2013)[24].

2.5 Results

We analyse the results from the model by first using a benchmark case and then testing its sensitivity using alternative assumptions regarding risk aversion and time discounting. We investigate the alternative formulation of the superannuation assets payout as an allocated pension taken at the minimum draw down rates and also explore the superannuation accumulation process as a function wealth rather than deterministic wage.

2.5.1 Life-cycle patterns of consumption, investment and wealth: Benchmark case

In order to analyse the 'post 45 life-cycle' paths for the variables of interest, we consider a benchmark model. In this base case, the individual has moderate risk tolerance ($\theta = 5$), is fairly time patient ($\beta = 0.97$) and when retiring at age 65 receives superannuation balance as a lump sum payout. Using these parameters as well as those listed in Table 2.1, we obtained the optimal consumption, wealth and portfolio choice policy functions for all grid points in the state space. We then generate different draws of earnings and asset shocks for 10,000 individuals and calculate a cross sectional average which is plotted against age.

[24] The authors chose these figures based on the interior solutions of their model.

Figure 2.1 Consumption, wealth and income: Benchmark case

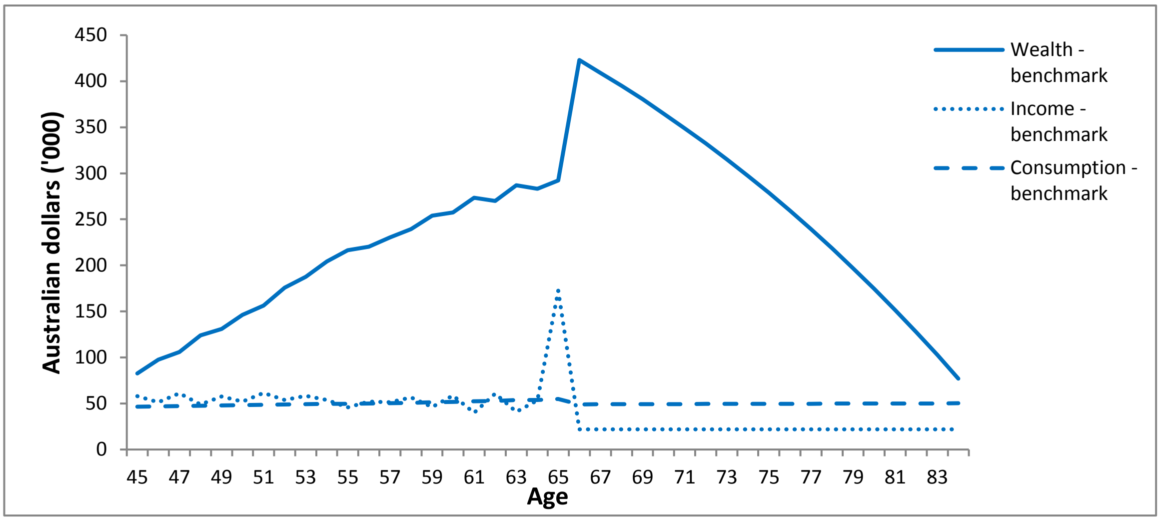


Figure 2.2 Consumption to wealth ratio: Benchmark case

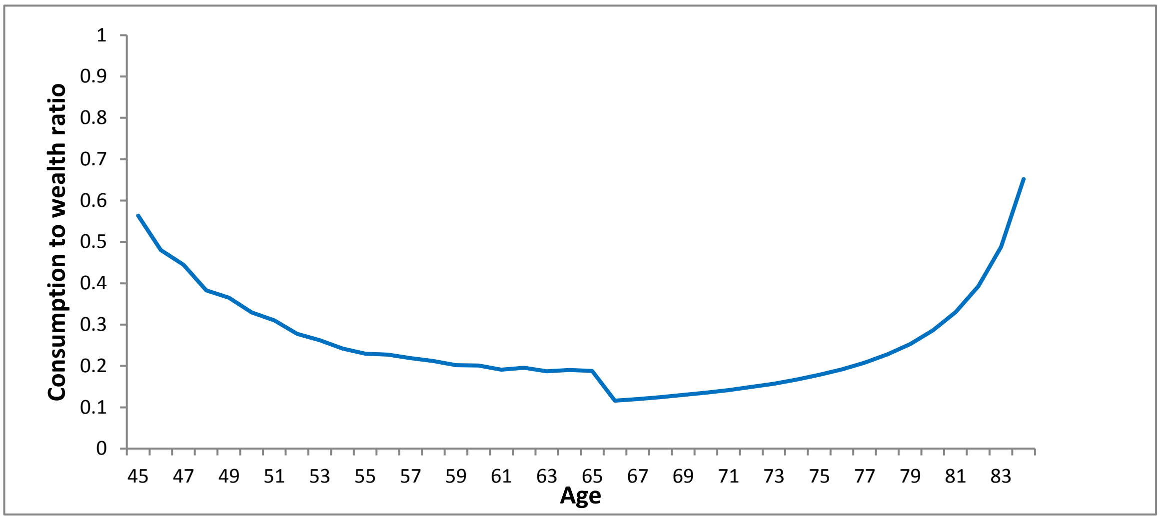


Figure 2.3 Portfolio share in risky asset: Benchmark case

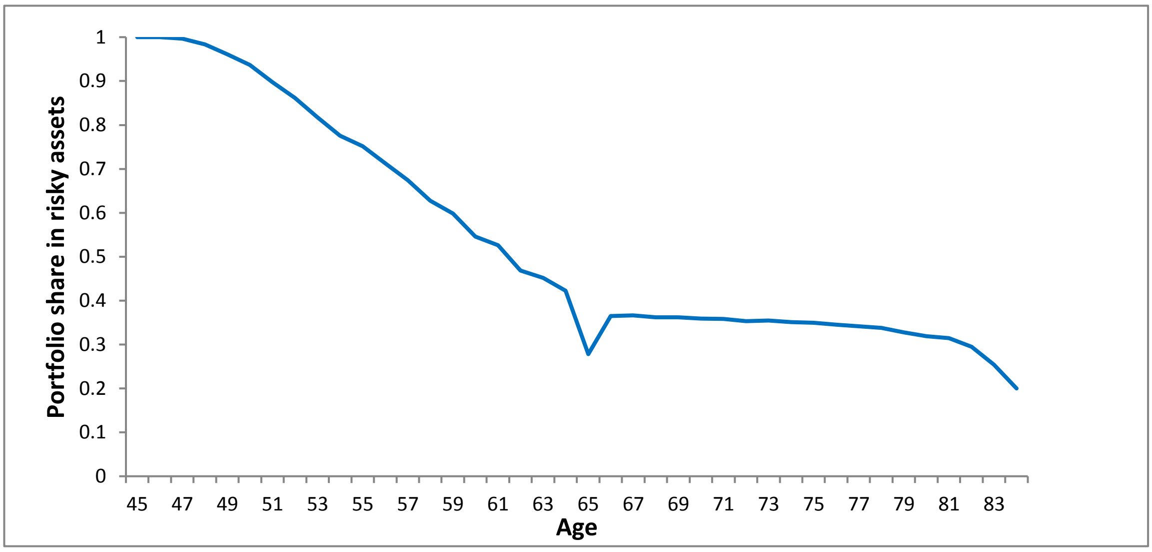


Figure 2.1 shows the average paths of optimal consumption, wealth and labour income for an individual over the 40-year time horizon assuming the risky asset pays its expected return in each year. The small dotted line represents the average labour income and is comprised of two components – the labour income during working life (i.e. between 45 to 64 years of age) and retirement income (i.e. between 65 and 84 years of age). During the working life, the income level fluctuates around the mean values. Then at the point of retirement (age 65), the individual stops working (no longer receiving labour earnings) and receives a lump sum payout of her superannuation asset as well as an Age Pension payment. This leads to a very large spike in the income path at the age of 65. In subsequent periods, income drops as the Age Pension payments come into effect and is constant in each period.

The dashed line is the optimal consumption path. It tracks income fairly closely before retirement and stays relatively smooth throughout the individual's lifetime. Despite the drop in income after retirement, consumption remains smooth as the individual draws down on savings to maintain their standards of living. The blue solid line represents the individual's wealth level throughout her lifetime. It steadily increases as she accumulates savings pre-retirement. The lump sum superannuation asset received at the age of 65 leads to the peak in wealth at age 66. From that point onwards, wealth is decumulated as the individual draws down on savings for consumption given retirement income in the form of Age Pension payments is less than half of their income during working life. The hump shaped optimal wealth path is consistent with those obtained in Chai *et al.* (2011) and Cocco *et al.* (2005).

Note that the agent in this model starts working at a later point in life. We do not observe the life-cycle consumption behaviour of the lack of savings early in life such as the results found in Campbell *et al.* (2001) and Chai *et al.* (2011) which are based on full life-cycle models. Instead, Campbell *et al.* (2001) find that savings occur outside of retirement accounts after 40 years of age. In our model, the individual starts with a sizeable endowment wealth at age 45 which is a sufficient amount of savings above her income and in subsequent periods she contributes to it further. Figure 2.2 shows the consumption to wealth ratio for the benchmark case. The ratio is downward sloping pre-retirement due to consumption staying fairly constant while wealth accumulates at a faster rate. The kink around retirement is a result of the lump sum superannuation being added to the savings.

During retirement, the ratio is upward sloping as a result of wealth decumulation – the individual spends down on her savings with less income compared to during working life.

The optimal 'post 45' life-cycle path for risky asset portfolio weight is shown in Figure 2.3. The profile shows that the individual is fully invested in stocks until age 47 and from that point on she decreases the amount of risky asset holdings steadily. This can be explained by the risk characteristics of human capital. Although future labour income is subjected to shocks, it can be considered as an implicit holding of a riskless asset. Asset and wage shocks are not correlated in our model therefore income does not resemble equity returns. Thus, in early periods this 'riskless' asset, i.e. future labour income, is large leading to the individual investing a larger proportion of her savings in the risky asset. However, as she accumulates savings and her total wealth increases and her future labour income decreases relatively. Thus, this 'riskless' asset decreases causing the agent to tilt her portfolio towards the safer asset. The model design of setting the retirement explicitly at 65 and using backward induction leads to a sharp dip in the portfolio share just before the retirement age of 65. In reality, individuals can retire earlier or later than 65.

After retirement, the optimal portfolio share increases slightly before becoming fairly constant until the end. The slight increase in the risky asset portfolio ratio at age 66 can be explained by the lump sum of superannuation asset injection at 65 – the large increase in the total amount of wealth offset some of fall in the implicit 'riskless' human capital holdings. However, in subsequent periods, the portfolio share declines very slowly. Although retirement income is a safe asset given the Age Pension payment is not subjected to earnings shocks, asset shocks are still in effect. The amount of safe retirement income is not enough to offset the asset shock as wealth declines rapidly due to the individual drawing down on savings to meet consumption needs. There is a small amount of wealth left at age 84 due to the bequest motive.

The optimal portfolio share path we obtained in our model is similar to that of Cocco *et al.* (2005) where the agents are fully invested in the risky asset earlier in their lives, although in their results, by age 45 the optimal portfolio share is around 90% rather than 100%. The portfolio share decreases until around age 65 before recovering to be on a modestly increasing trajectory during retirement. However, our results differ to the optimal asset allocation path found in Chai *et al.* (2011) in several aspects: agents in our model hold more risky assets at age 45 (100% compared to 80%); while agents in our model start to increase risky asset holdings again at age 66, in their model this occurs at an earlier age (age 58); and in retirement the agents in Chai *et al.* (2011)'s model rapidly decrease the risky asset portfolio share. The reason for these differences is Chai *et al.* (2011) incorporate annuities in their model resulting in individuals trading in risky assets for annuities later in life.

These benchmark results provide the basis on which we form the empirical hypotheses being investigated in the later chapters, in particular, the optimal consumption and portfolio choice around retirement (age 65 in our model). The results indicate a smooth consumption path through retirement and the risky portfolio share is lower in retirement compared to working life. In subsequent chapters, we find there is some empirical evidence showing retired households hold less proportion of risky assets compared to working ones. However, the empirical evidence on consumption and retirement seem to be contrary to the benchmark results. There is a decrease in consumption at retirement which indicates a lack of smooth life-cycle consumption path. We will discuss the implications of these empirical results in Chapter 3 and 4.

2.5.2 Sensitivity analysis

Risk tolerance

Next we consider alternative risk tolerance levels: an individual who is risk averse with a coefficient of relative risk aversion of 10 ($\theta = 10$) and one who is relatively more risk tolerant with a coefficient of relative risk aversion of 2 ($\theta = 2$). We compare the results against the benchmark case where $\theta = 5$.

Figure 2.4 shows the optimal consumption, wealth and income profiles for all three cases. The average income profile is the same for all three cases as the set of random earnings and asset shocks for the 10,000 individuals are kept the same for all model simulations for comparison purposes. We find that those who are risk averse accumulate more wealth before retirement and just after retirement compared to the benchmark and risk tolerant individuals. This is due to people with risk averse preferences having a tendency to not only hold less risky assets but consume less compared to the other two cases. The reason for this is with iso-elastic preferences θ measures both risk aversion and prudence (Campbell *et al.*, 2001). Hence, individuals consume less and increase their precautionary savings. However, upon retirement, they consume more as retirement income has no risk, hence the optimal consumption paths are the same for all risk levels after retirement as seen in Figure 2.5. This is evident when we compare the consumption to wealth ratio for all three cases, as plotted in Figure 2.5. It can be seen that the ratio path for risk averse individuals, the red line, is the lowest while the path for risk tolerant individuals is the highest, and the blue line representing the benchmark case is in the middle as expected. This difference in consumption to wealth ratio paths only applies to the working life, i.e. before age 65, as labour income is exposed to shocks. While after age 65, all three paths converge as retirement income has no risk.

Figure 2.6 shows the portfolio share paths of all three cases. Compared to the benchmark, risk tolerant individuals hold a 100% risky portfolio for longer periods at the start of the life-cycle and overall the portfolio share is much higher than the benchmark and risk averse individuals. However, the opposite applies for those who are risk averse – the individual only holds 70% risky assets at age 45 and this ratio decreases consistently towards retirement and becomes relatively steady after retirement. It is interesting to note that the slight increase in the portfolio share of risky assets just after retirement is much more pronounced for risk tolerant individuals compared to the other two cases, as they are more willing to take on risk.

Figure 2.4 Consumption, wealth and income: Benchmark, risk averse & risk tolerant

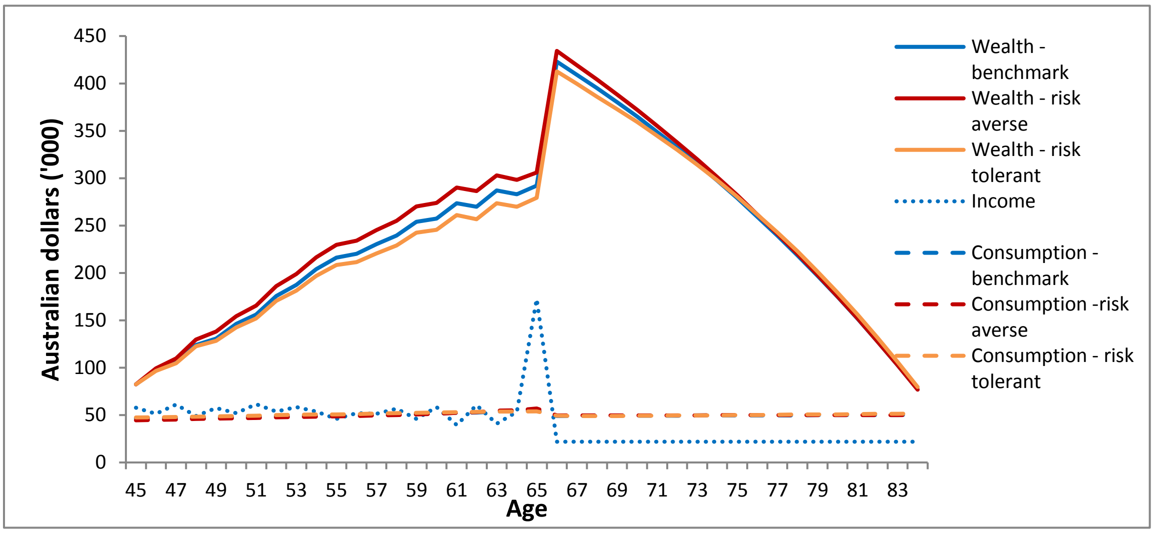


Figure 2.5 Consumption to wealth ratio: Benchmark, risk averse & risk tolerant

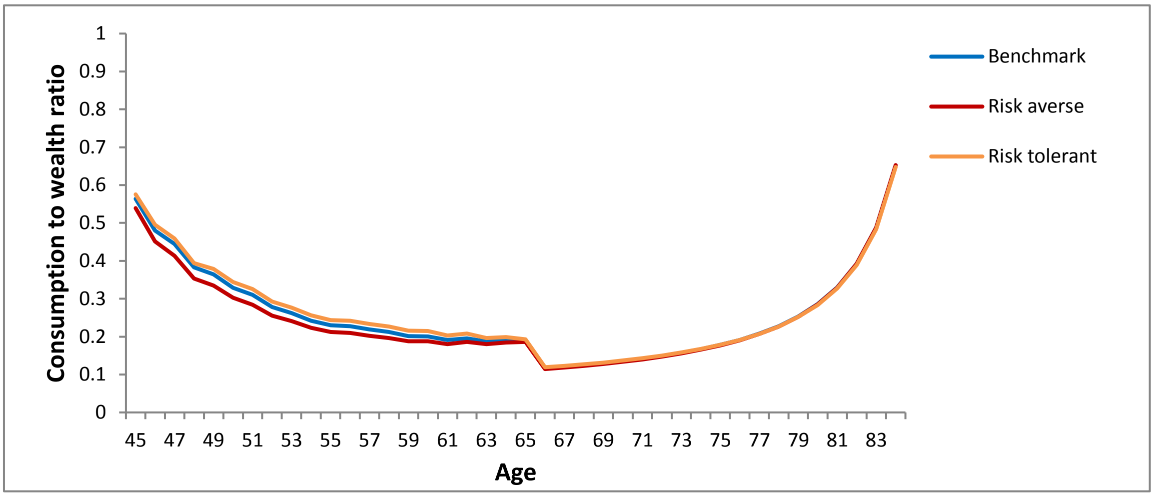
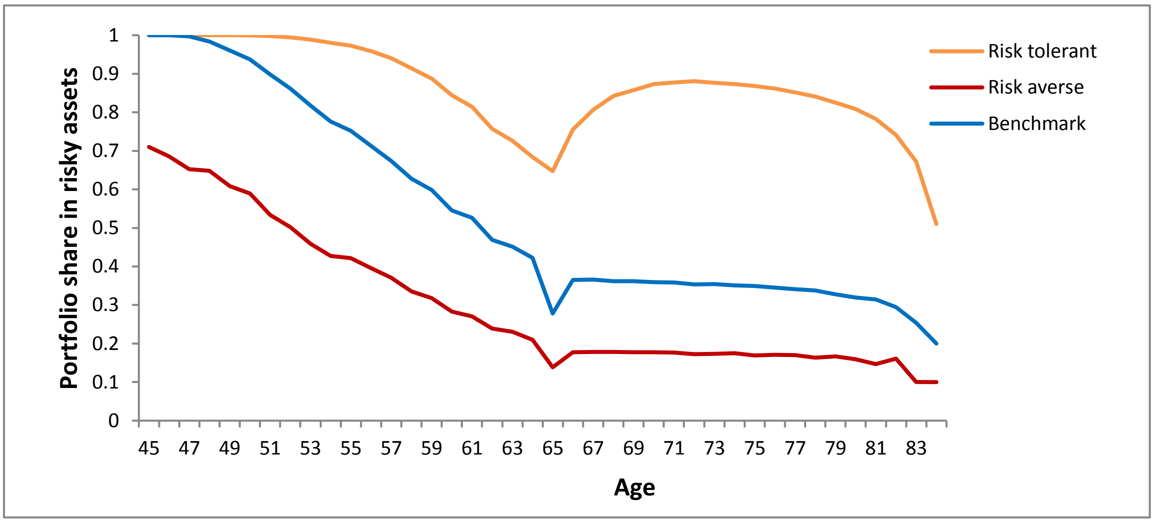


Figure 2.6 Portfolio share in risky assets: Benchmark, risk averse & risk tolerant



Time impatience

The next case we investigate using the model is comparing the benchmark results with individuals who are time impatient, i.e. who have a smaller time discount rate at $\beta = 0.9$ compared to the benchmark of $\beta = 0.97$. This means time impatient individuals value current consumption much more than future consumption. Subsequently they consume more and save less. This is evident in Figure 2.7 which shows the optimal consumption and wealth paths for both benchmark and time impatient individuals. While the income path is kept constant for both cases, we can see that the wealth path for time impatient individuals (the purple solid line) is much lower than the benchmark individuals (the blue solid line). Furthermore, those with time impatience consume more before retirement and save less compared to the benchmark. This is evident as we compare the two consumption paths represented by the dashed lines. Time impatient people end up consuming less post retirement as they have substantially less amount of savings and retirement income is not enough to maintain the consumption level. Figure 2.8 shows the consumption to wealth ratio. We can see that the ratio is higher for time impatient individuals throughout their lifetime compared to the benchmark, which is consistent with the characteristics of time impatience - more importance is placed on consumption today and saving less resulting in a higher consumption to wealth ratio.

The optimal portfolio share path for time impatient individuals is displayed in Figure 2.8 along with the benchmark path. We can observe that overall time impatient individuals hold a higher proportion of risky assets throughout their lifetime compared to the benchmark. The reason for this is that they hold substantially less wealth in general and this translates to holding less in stocks. Therefore, given this small holdings, they are more tolerant to having asset risk exposure.

Labour income risk

We also examine the optimal consumption and portfolio choice for individuals not subject to labour income risk. These individuals receive the deterministic wage.

Figure 2.7 Consumption, wealth and income: Benchmark & time impatience

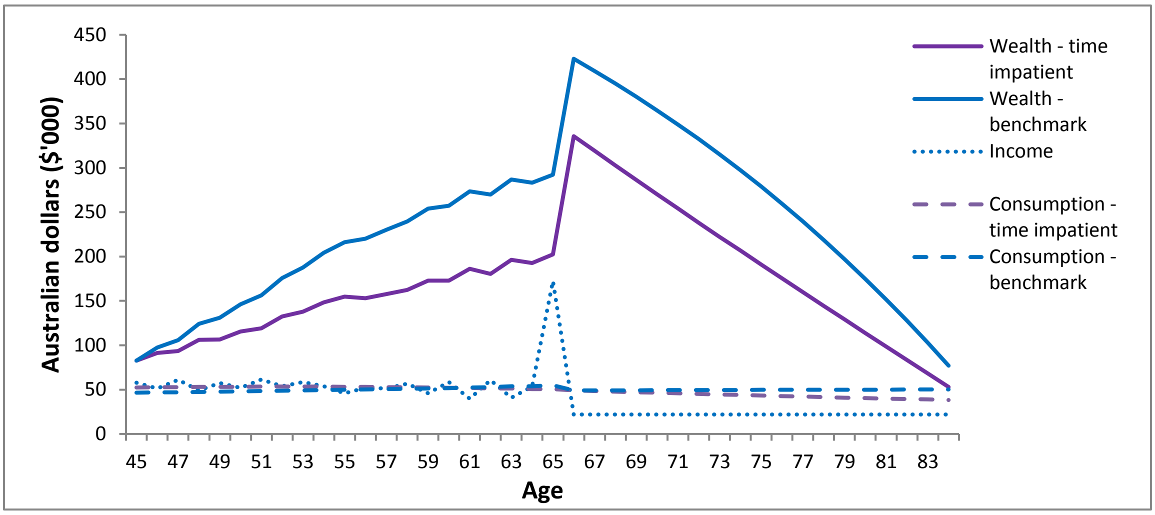


Figure 2.8 Consumption to wealth ratio: Benchmark & time impatience

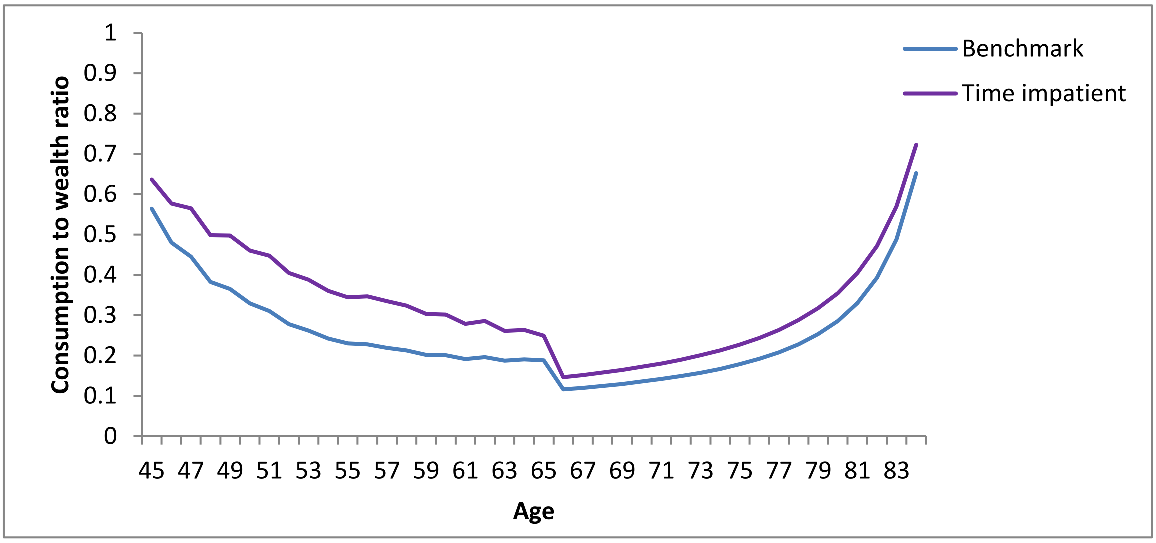


Figure 2.9 Portfolio share in risky assets: Benchmark & time impatience

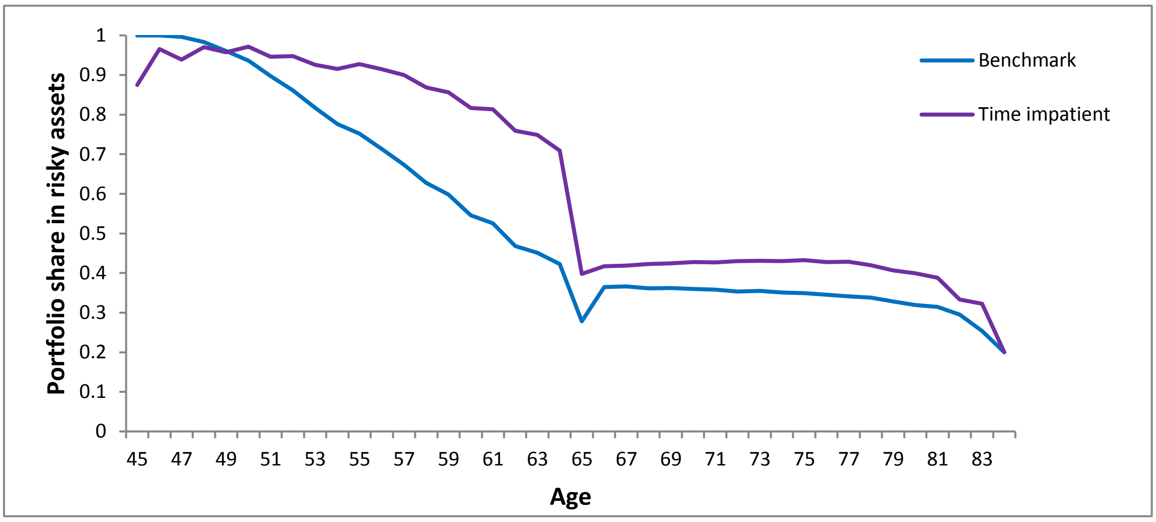


Figure 2.10 Consumption, wealth and income: Benchmark & no income shock

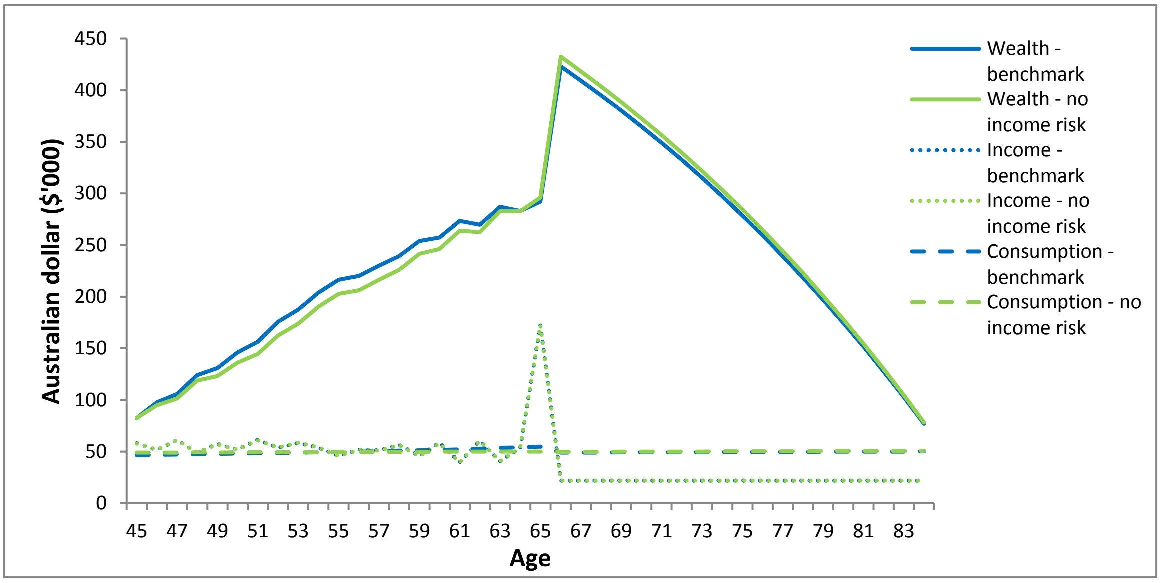


Figure 2.11 Portfolio share in risky assets: Benchmark & no income shock

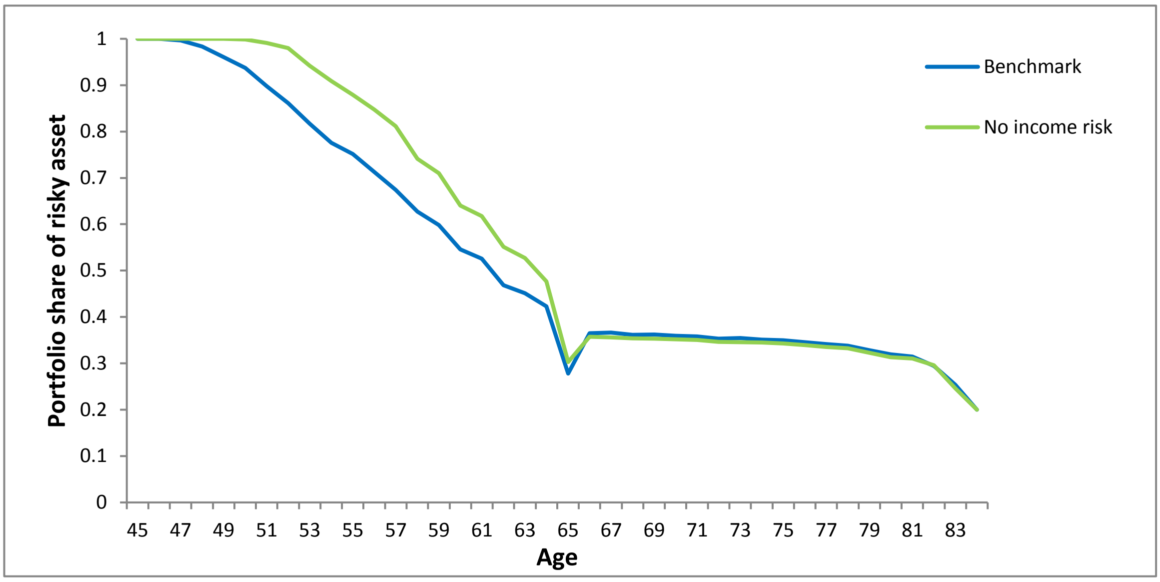


Figure 2.10 shows the optimal consumption, wealth and average income for individuals who do not face income risk compared to the benchmark case. The income paths are similar for both as the benchmark income path is just an average of wage shock realisations. During working life, individuals exposed to labour income risk (i.e. the benchmark) tend to save more. This is in line the findings in Cocco *et al.* (2005) as the absence of labour income risk eliminates the need for precautionary savings.

Furthermore, looking at Figure 2.11 which plots the optimal portfolio share of risky asset for both cases, we can see that individuals not exposed to income risk tend to have a riskier portfolio. They hold almost 100% in stock earlier in life and have more risky assets than the benchmark individuals. This suggests that labour income risk crowds out the asset return risk as in its absence, the fraction of the portfolio allocated to risky labour income is no longer needed and thus the fraction allocated to risky asset increases for a given amount of wealth.

2.5.3 Alternative formulations of superannuation

Superannuation income stream

In the benchmark case, the superannuation balance accumulated by the individual during her working life is taken as a lump sum payout at retirement. In the optimisation problem, this leads to a huge amount of savings at the age of 66. In reality, many Australians elect to take their superannuation balance as an account based income stream instead of as a lump sum payment. Table 2.2 shows the minimum draw down rates which are determined according to age. We use these rates to incorporate superannuation balance as an income stream in our model.

The individual accumulates superannuation during her working life and upon retirement she takes her superannuation asset as an account-based income stream with the withdrawal rates in each period set at the stipulated minimum rates. After the withdrawal in each period, the remaining balance in the account earns the same asset return rate as during her working life (at 3%) and at age 84 she takes the remaining amount as a lump sum before death.

Figure 2.12 plots the optimal consumption and wealth paths for individuals taking their superannuation as a lump sum versus as an income stream. The average income paths, which are also shown in the same chart as dotted lines, indicate relatively different retirement income paths (i.e. the income path after age 64) for individuals taking the income stream compared to those who take the lump sum payout. In the income stream case, individuals experience an income drop at age 65 when they retire due to the combined Age Pension payment and superannuation account based pension not being large enough to offset the lack of labour income. While those receiving their superannuation balance as a lump sum at retirement experience a surge in income.

Consequently, individuals choosing the income stream option tend to have more precautionary savings while working compared to those choosing the lump sum option. The consumption paths between the two options are largely similar in most periods. However, around the time of retirement, i.e. just before and after 65, those who choose a lump sum tend to consume more compared to those who choose an income stream as a result of the large increase in income. However, the differences are not large and consumption paths are fairly smooth for both options.

The minimum drawdown rates, although increasing by age, are not designed to generate an income stream so that only minimum amounts remain as the individual gets older. As a consequence of this, in our model, the individual receives the remaining balance as a lump sum at the age of 84, and only has one year to consume this amount before death. This is evident in the upward spike in the tail of the income path and this leads to a large corresponding consumption in the same period. Thus, those receiving an income stream leave a very small bequest compared to the individuals with lump sum superannuation payout.

We compare the optimal paths for risky asset portfolio shares. Those who choose to receive their superannuation balance as an income stream have a riskier optimal portfolio share as evident in Figure 2.13. The path is higher than the benchmark. This is a result of receiving higher retirement income after age 65 as the superannuation balance is spread out during the retirement and supplements the Age Pension payment in each year. The overall result is the individual tends to hold a riskier portfolio as a result of higher safer assets in retirement.

Table 2.2 Minimum drawdown rates

Age	Minimum percentage withdrawal (%)
Under 65	4
65-74	5
75-79	6
80-84	7
85-89	9
90-94	11
95 or more	14

Source: Australian Taxation Office (2014)[25]

Figure 2.12 Consumption, wealth and income: Lump sum super vs super income stream

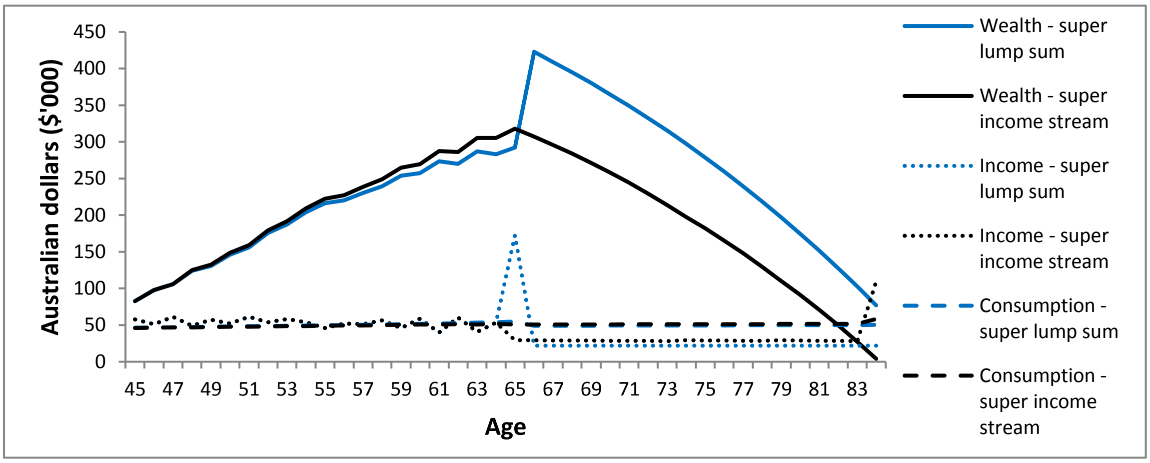
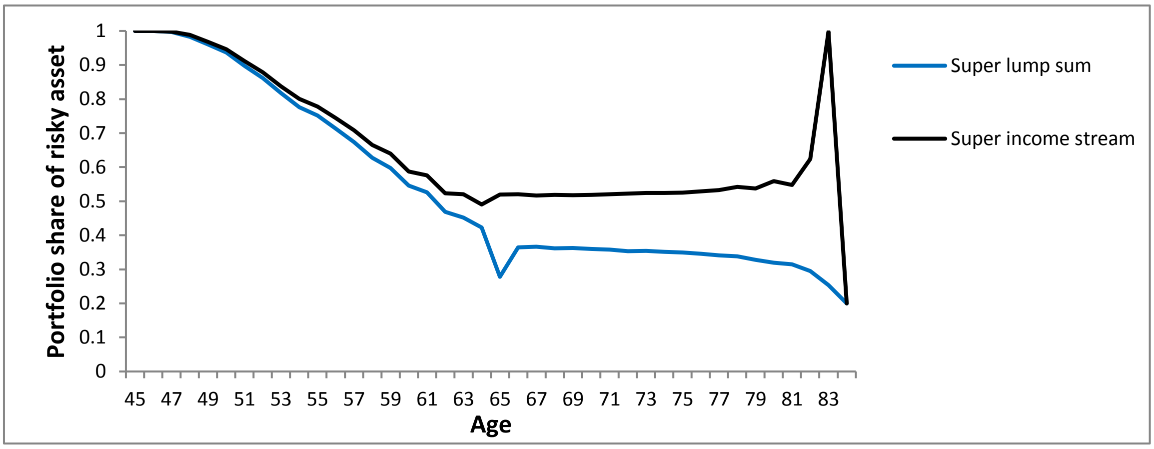


Figure 2.13 Portfolio share in risky assets: Lump sum super vs super income stream



[25] ATO: https://www.ato.gov.au/Rates/Key-superannuation-rates-and-thresholds/?page=11#Minimum_annual_payments_for_super_income_streams

Heterogeneous superannuation balance

Next we consider a heterogeneous superannuation balance. In the benchmark formulation, superannuation is accumulated as 9.5% of deterministic wage invested at 3% asset return. This means that individuals in our model would have the same amount of superannuation balance at age 65. Ideally, the calculation of superannuation balance should be 9.5% of post shock wages. However, this is computationally difficult so we had to make simplifications in the model. An alternative method is to model the superannuation balance at age 65 as a function wealth. The rationale being individuals with higher wealth levels are more likely to have higher superannuation assets.

Subsequently, we use the household wealth module in HILDA Wave 10 to find the average ratio of superannuation balance to net worth at age 65. This ratio is 19.4% which is applied to values of the wealth grid to obtain superannuation balance as a fraction of wealth. Therefore, each individual would have a different superannuation balance depending on their wealth level at age 65. We solve the optimisation problem using the same benchmark parameters and superannuation is taken as a lump sum or as an income stream at the age 65.

Figure 2.14 plots the optimal consumption and wealth paths and the average income paths for the superannuation lump sum case. It is evident that this formulation of superannuation balance results in a smaller superannuation lump sum payout at retirement. Consequently, comparing the optimal wealth paths, those individuals who have a varied superannuation balance have more precautionary savings during their working life as a result of having less retirement income. It is also evident from Figure 2.15, which shows the consumption to wealth ratios, that they also consume less relative to the benchmark. However, the optimal wealth paths for both cases converge after the age 66.

Comparing the optimal portfolio share of risky assets between the two cases (see Figure 2.16), those individuals whose superannuation balance is calculated as a share of wealth holds greater proportion of risky assets before the age of 53. After this age, the portfolio share is less than the benchmark’s and the paths converge after retirement.

Figure 2.14 Consumption, wealth and income: Benchmark vs super varied lump sum

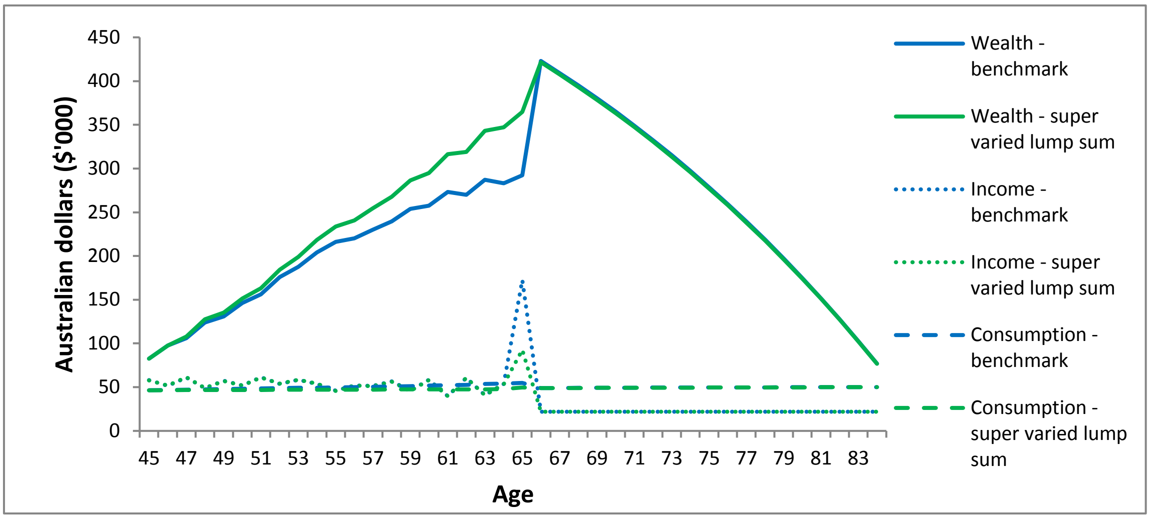


Figure 2.15 Consumption to wealth ratio: Benchmark vs super varied lump sum

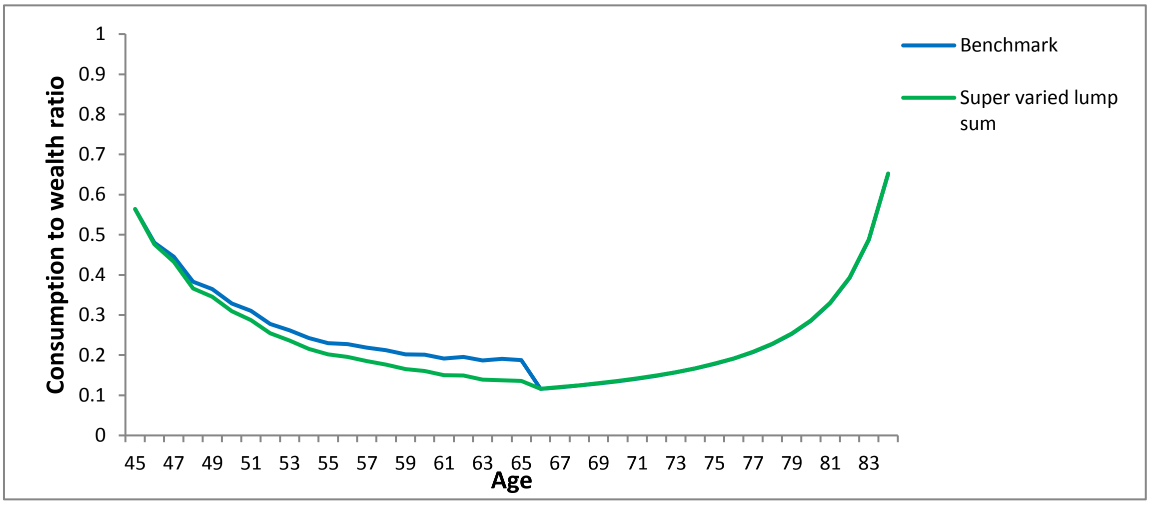


Figure 2.16 Portfolio share in risky assets: Benchmark vs super varied lump sum

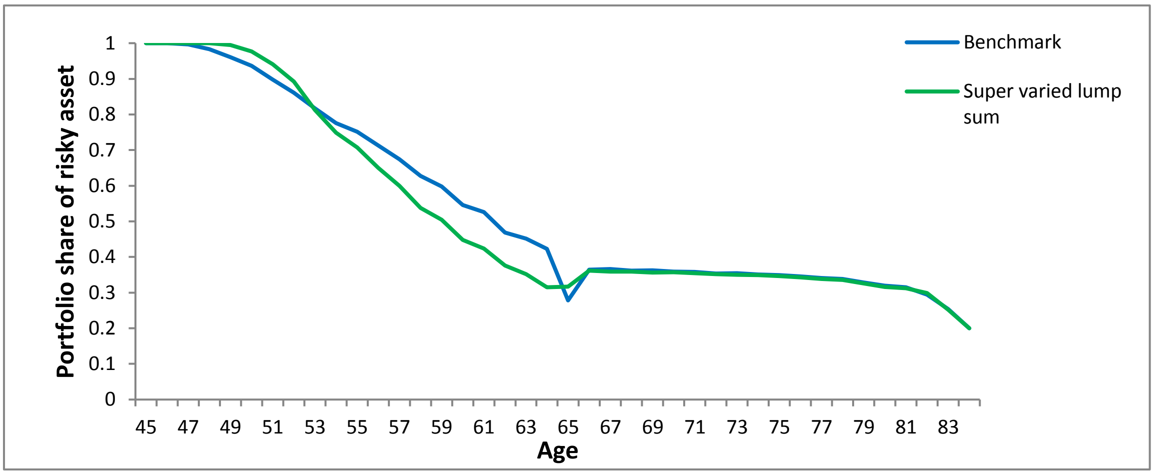


Figure 2.17 Consumption, wealth and income: Benchmark vs super varied income stream

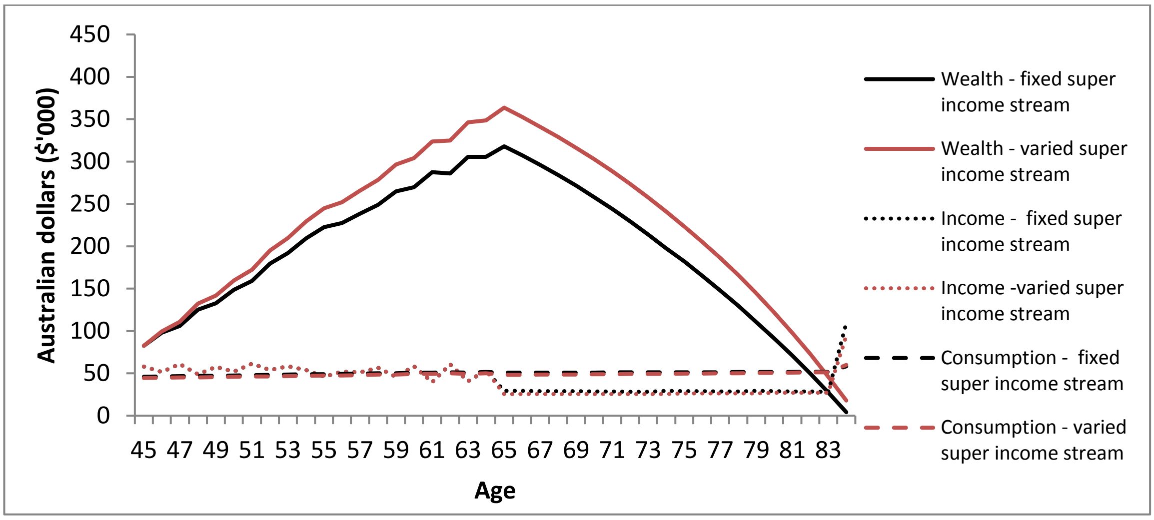
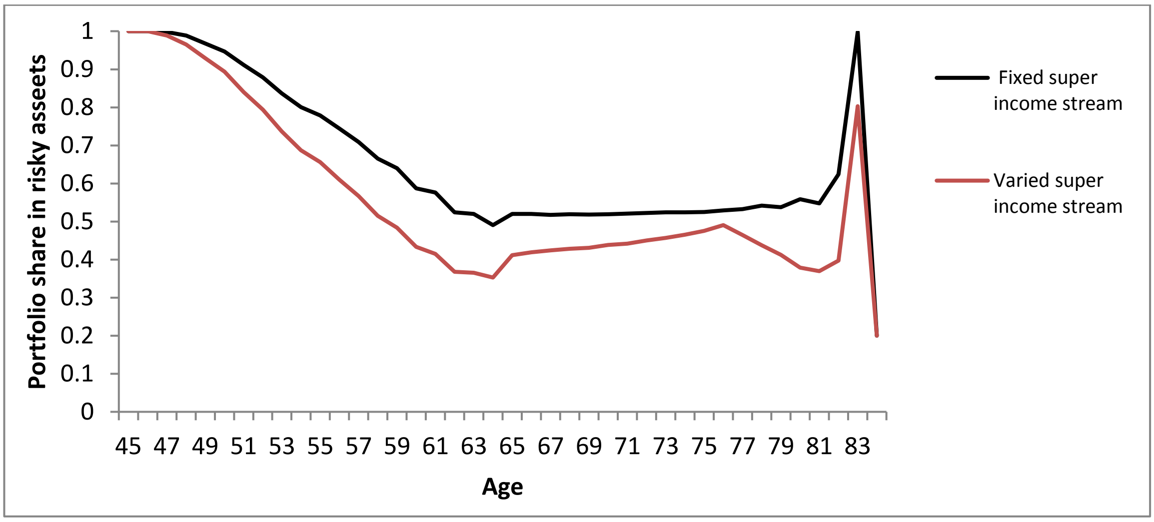


Figure 2.18 Portfolio share in risky assets: Benchmark vs super varied income stream



We then solve the model for superannuation balance taken as an income stream. For this set of results, we compare it to the results obtained using superannuation income stream but with homogeneous superannuation balances (as discussed earlier) for a more meaning comparison. The optimal consumption, wealth and average income paths for both cases are shown in Figure 2.17. Comparing the average income paths (appearing as dotted lines), we note that while the paths are the same during working life, the homogeneous superannuation accumulation method yields higher retirement income compared to when superannuation is a function of wealth. Consequently, consumption is less for those with varied superannuation balance throughout their lifetime. They end up save more in anticipation of this drop in retirement income and when in retirement draw down on their wealth at a slower rate. Hence, the wealth path is higher compared to the fixed balance result. As evident from Figure 2.18, the varied superannuation balance individuals hold a less risky portfolio throughout their lifetime compared to the fixed superannuation balance individuals as a result of receiving lower retirement income.

2.6 Discussion

The aim of this chapter is to provide some theoretical background to motivate the research questions asked in the subsequent empirical chapters relating to consumption and portfolio choice. More specifically, it raises the question, how does the optimal consumption and portfolio choice change as individuals move from working to retirement? We solve a dynamic optimisation problem for individuals age 45 years and over which incorporates features of the Age Pension and the Superannuation Guarantee along with earnings and asset return shocks.

Individuals in the benchmark model have moderate risk tolerance and time preference. Her working life starts at age 45 during which she earns labour income (subject to a random shock). She also contributes 9.5 per cent of her earnings to a superannuation fund. She retires at age 65 and upon retirement she receives her superannuation balance as a lump sum along with the maximum amount of Age Pension payment. From the next period onwards, her retirement income is the same amount of pension payment until her death at 85. The average optimal consumption path is fairly smooth and tracks income before retirement. Despite the drop in income after retirement, the individual is able to draw on their wealth to smooth consumption. The optimal risky asset portfolio weight shows the individual holding more risky assets at the start of the life-cycle but decreasing the share when approaching retirement. The portfolio share increases slightly at the start of retirement but stays fairly constant until the very end of the life-cycle.

We also conduct sensitivity tests by considering the variations in the parameters using the model. We find risk averse individuals tend to have higher precautionary savings before retirement than their benchmark and risk tolerant counterparts as they save more and consume less. But upon retirement they consume more as there is no labour income risk associated with retirement income. Those with time impatience consume more early in the life-cycle compared to later on. They tend to holder a higher share of risky assets than the benchmark. When considering individuals with no labour income risk, we find that the lack of exposure leads to riskier portfolios being held by individuals and less precautionary savings. We also consider the case where the superannuation balance is taken as an income stream upon retirement rather than a once off lump sum payment. Those who choose the income stream tend to save more during their working life but invest in a riskier portfolio. Lastly, we use an alternative formulation of superannuation accumulation where superannuation balance at retirement is a function of wealth rather than a function of deterministic wage resulting in heterogeneous superannuation balance for individuals in the model. This method yields lower retirement income and thus individuals have more precautionary savings and hold less risky assets.

Overall, the consensus is that the optimal consumption path is fairly smooth throughout the individual's life-cycle. This means the pre and post retirement consumption levels are fairly consistent with no large drops at the point of retirement. The optimal portfolio share of risky asset is higher during working life compared to in retirement. This model motivates the empirical work in Chapter 3 and 4 as these chapters investigate whether individuals in retirement actually do hold less risky assets compared to working households and whether consumption is fairly smooth or drops substantially upon retirement. The optimal paths obtained from the model developed in this chapter provide theoretical guidance on how individuals should behave in retirement, while the empirical work assess actual behaviour using Australian data.

2.7 Limitations

The optimisation problem developed in this chapter uses simplifications to model the key characteristics of the Australian retirement income system. We consider the Age Pension payment as exogenous and set at the maximum payment rate for single individuals. The means tests (income and asset) features of the Age Pension are not modelled. However, in reality the means tests are an important part of the design of the pension system. Hulley *et al.* (2013) model the means tests in a simple optimisation problem for retirees and find Age Pension eligible and near eligible households should decumulate faster and choose riskier portfolios early in retirement. However, to model the means tests for the scenarios examined in this thesis would involve considerable complexity.

Our model is based on deterministic income, which is an average of all individuals' income levels. However, these individuals are more likely to follow different income paths. The simplification we make in the model does not take into account that those with higher wealth levels are more likely to have higher income levels. Furthermore, we incorporate only a simple shock for the labour income risk while other papers, such as Campbell *et al.* (2001), which use realistically calibrated models consider earning shocks to have both transient and permanent components. The labour income shocks are also likely to be different by occupation.

We also model retirement as an exogenous choice set at age 65. However, in reality retirement is likely to be endogenous as there is no statutory retirement age in Australia so individuals choose their age of retirement. Furthermore, individuals are more likely to have an uncertain life span in which the time of death is unknown and subject to a probability of survival.

In our model, we ignore the income/wealth inequality between men and women in Australia by assuming both genders receive the same amount of retirement income and wealth. In reality, such inequality exists in the form of pay gaps as men get 17.9% more than women, in retirement savings as men have 46.6% more in superannuation than women and in wealth as men accumulate 22.8% more in assets (Commonwealth of Australia, 2016). Basu & Drew (2009) examine the issue of gender inequality in superannuation using simulations and find that current policy of gender-neutral savings results in lower accumulations for women. They conclude that policy changes are needed to bridge this gap through different default investment options and contribution rates for women.

2.8 Conclusion and Further Research

The aim of this chapter is to find the optimal consumption and portfolio choice paths for older Australian households in order to provide the theoretical motivation for the empirical investigations conducted in subsequent chapters. We solve a simple model of optimal consumption and asset allocation strategies for individuals who start their working life at age 45 and die at age 85. We use the income, wealth and superannuation data from the HILDA survey to calibrate the model. The model is solved using backward induction and grid search where policy functions are obtained. We then simulate the optimal life-cycle paths for 10,000 individuals. We find that the average optimal consumption path is fairly smooth with no large drop at retirement and the average optimal portfolio share in risky asset is lower after retirement compared to working life. This provides an important benchmark for the two empirical chapters: Chapter 3 focuses on the asset allocation of older households in the HILDA survey, while Chapter 4 examines the retirement-consumption puzzle in Australia.

The model in this chapter is basic. It is not designed to fully replicate the intricacies of the Australian retirement income system. An avenue for further research is to make the model richer by modelling income and income shocks in a more realistic fashion incorporating transient and permanent shock components derived from the HILDA dataset. It would also be of interest to incorporate uncertain timing of retirement into the model to reflect the fact that the reality of choosing retirement is often unplanned.
Another extension could be to add means tests to the Age Pension component of the model and add uncertain death using the subjective mortality rates.

Chapter 3: Retirement and asset allocation of older Australian households

3.1 Introduction

The ageing of the population is a global phenomenon, which poses a unique set of challenges to policymakers in terms of dealing with health and aged care, the labour market dynamics of older workers and devising systems of social protection. In Australia, the population is ageing at a faster rate than the fertility rate and coupled with a growing population, it places pressure on the health system, infrastructure and public finances (Commonwealth of Australia, 2010a). In light of these pressures, the government introduced the privately managed retirement income scheme, the Superannuation Guarantee, in 1992 to supplement the public pension system. Given the design of Australia's retirement income provisions there is an increased responsibility on individuals to make key decisions regarding their retirement income and wealth, such as concerning supplementary voluntary contribution rates to superannuation, asset allocation and the timing of retirement. This places emphasis on individual decision-making and accountability in order to deliver adequate retirement incomes and to ease the burden on government spending.

The focus of this chapter is the asset allocation of older Australians. The general consensus amongst financial advisors regarding asset allocation is that the longer the individual's investment time horizon, the greater the exposure to risky assets should be (Ameriks & Zeldes, 2004). Indeed advice regarding asset allocation on websites of investment services such as Merrill and Vanguard stress the importance of time horizon and give examples of those of retirement age reducing the amount of risky assets they hold to protect their investments[26]. Furthermore, there are 'rules of thumb' offered by financial planners[27] such as the proportion of stock held should be 100 less your age

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[26] Merrill Edge article 'Asset Allocation: A Sound Investment Strategy': http://www.merrilledge.com/article/asset-allocation-sound-investment-strategy; Vanguard article 'The power behind Target Retirement Funds': https://retirementplans.vanguard.com/VGApp/pe/pubeducation/bank/targetdate/PowerBehindTRF.jsf?SelectedSegment=BuildingWealth&Article=The+power+behind+Target+Retirement+Funds

[27] For example, CNN Money article 'Ultimate Guide to Retirement - What's the Best Asset Allocation for my Age?': http://money.cnn.com/retirement/guide/investing_basics.moneymag/index7.htm

which reinforces the importance of time horizon in asset allocation decisions. This advice is informed by the implications of the life-cycle theory of consumption, portfolio choice and human capital.

This chapter examines this financial advice in the context of older Australian households (specifically household heads who are age 45 and above). This age group is most likely to be engaged with retirement decision and actively making retirement decisions, therefore their behaviour is of interest to policymakers and researchers. The main empirical question being asked in this chapter is as follows: for older Australian households, do retired households exhibit behaviour that is consistent with holding a smaller proportion of risky assets compared to working households? This question of interest compliments the findings in Chapter 2, where we determined the optimal life-cycle proportion of risky assets to be held by individuals using a simple model of optimal life-cycle consumption and saving incorporating features of Australian retirement income provisions.

We also raise the supplementary question: do labour market characteristics affect asset allocation? We utilise the Household Income Labour Dynamics of Australia (HILDA) survey, a household-based longitudinal study which commenced in 2001, to examine this empirical question along with other determinants of risky asset holdings using four different statistical models. Overall we investigate the relationship between retirement (and retirement intentions) and the proportion of risky assets held by different types of households. We find that there is some evidence that retired households hold a smaller proportion of risky assets. For employed households, those who are self-employed hold less risky assets and those who are further away from their intended retirement age tend to hold more risky assets.

The existing literature on the retirement and asset allocation in Australia is rather limited. The works are focused on determinants of household asset holdings using cross sectional data (Wave 2 of HILDA only). We add to this by using all three available wealth modules of the HILDA dataset and employing panel data estimation techniques in examining the relationship between retirement and asset allocation specifically.

The chapter is set out as follows: in Section 3.2 we discuss the literature underpinning the relationship between age and household asset allocation – both international and Australia-based; Section 3.3 explains the data and variables used in the analysis in this chapter including the features and characteristics; Section 3.4 discusses the methodology and models used in the estimations; Section 3.5 explores the empirical results; Section 3.6 presents an alternative estimation method in the form of an instrumental variable; and Sections 3.7 and 3.8 sets out the concluding discussion, the limitations of the study and possible areas for further research.

3.2 Literature review

3.2.1 Theoretical developments

The financial advice that one should hold a lower proportion of risky assets in retirement derives from extensions to the life cycle theory of consumption and portfolio choice. The seminal works by (Mossin (1968); Merton (1969); Samuelson (1969)) theorise that the long horizon asset allocation decision is the same as the short horizon one. For a portfolio decision between a riskless asset and a risky asset, the optimal portfolio shares are constant over the life-cycle, irrespective of age and wealth. The investor chooses the portfolio that has the best short-term characteristics trading off risk and return. However, this result is based on several restrictive assumptions including no labour income, no non-tradable assets and a utility function in the form of constant relative risk aversion. These early papers suggest that an individual near retirement would hold the same portfolio of risky assets as one that is starting out in her career. This early literature has since been extended as researchers have sought to relax the restrictive assumptions made by the original authors by incorporating: risky labour income (Viceira, 2001; Cocco *et al.*, 2005; Farhi & Panageas, 2007), housing (Cocco, 2005), alternative utility functions (Li & Smetters, 2010) and social security (Maurer *et al.*, 2010; Smetters & Chen, 2010; Li & Smetters, 2011).

A key paper which builds on the seminal works by incorporating labour into the mix is Bodie *et al.* (1992) who explore the relationship between portfolio choice and labour supply by solving the individual's lifetime utility subject to budget constraints. They conclude that the individual will tend to invest more conservatively in financial assets as she nears retirement due to human capital being a safe asset relative to equities and labour flexibility decreasing as she ages. Cocco *et al.* (2005) contribute further to this by using a realistically calibrated life-cycle model of consumption and portfolio choice which has non-tradable labour income. They conclude that the presence of labour income increases the demand for stocks, especially early in life, but the proportion of stock holdings decrease with age as the labour income profile is downward sloping.

3.2.2 Empirical evidence - international

The empirical evidence on age and household asset allocation is largely found in the diverse literature on factors driving household portfolio choice. The results from U.S. based studies which examine the effect of age on asset allocation are mixed. For example, Agnew *et al.* (2003) examine 7000 individual 401(k) plans from 1994 to 1998 and find that investments in equities are higher for males, individuals who are married and those with higher wages and job seniority and lower for those who are older. However, Ameriks and Zeldes (2004) do not find evidence to support this using pooled cross sectional data from the Surveys of Consumer Finances and panel data from the Teachers Insurance and Annuity Association – College Retirement Equities Fund. They conclude that there is no evidence of a gradual reduction in the share in stocks with age but there is some evidence of older individuals not holding shares altogether around the time of annuitisations and withdrawals.

Other papers use international data to examine individual factors influencing asset allocation including individual and labour market characteristics such as income, education and health. Guiso *et al.* (1996) use data from an Italian household survey to estimate risky asset holdings as a two-stage decision process. Their results suggest that individuals facing uninsurable income risk reduce their risky asset holdings. Furthermore, there is some evidence of borrowing constraints leading to individuals choosing more safe and liquid forms of wealth. Iwaisako *et al.* (2004) use Japanese micro data from the year 2000 and find that education and income has a positive effect on equity holdings and, for men, having a working partner has a negative effect on equity holdings. Yamashita (2003) examines the household equity investment decision and its relationship with the ratio of house value to net worth. The author uses data of individual portfolios from the 1989 Survey of Consumer Finances dataset and finds that there is a strong relationship between the ratio of holdings in stocks and the ratio of housing wealth to net worth. The demand for housing crowds out stockholdings, as households with higher leveraged home hold relatively less risky assets.

Heaton and Lucas (2000) investigate the influence that entrepreneurial income risk has on portfolio choice using cross sectional data from the US Survey of Consumer Finances and the Panel of Individual Tax Returns. They conclude that households with high and variable proprietary business income tend to hold less wealth in stocks, and for non-entrepreneurial households who hold stocks in the firm they work in reduces portfolio share in other stocks. Rosen and Wu (2004) examine the relationship between health and household portfolios using data from the Health and Retirement Study and find that there is a strong link between the two. Poor health is associated with holding a smaller share of wealth in risky assets and a larger share in safe assets.

3.2.3 Empirical evidence – Australia

The Australian evidence regarding household asset allocation decisions are scarce due to limited data availability. Gerrans *et al.* (2010) use superannuation fund level data and find a humped relationship between age and equity with the peak at age 34. This is further supported by quintile estimations with younger age quintiles having higher equity allocations than older quintiles. Furthermore, allocation to fixed interest investment increases with age suggesting a 'U-shaped' age profile for defensive asset class allocations.

Superannuation fund level unit record data is difficult to obtain and only includes part of the household financial portfolio. Furthermore, as an administrative dataset, it also has limited information on individual characteristics. An alternative is the HILDA dataset. Both Cardak and Wilkins (2009) and Stravrunova and Yerokhin (2008) use Wave 2 of the dataset to investigate asset allocation behaviour. Cardak and Wilkins (2009) examine the asset allocation decisions of households and the relationship with a range of risks and factors including health, income and liquidity. They find that labour income uncertainty and health risk play important roles along with credit constraints and risky preferences. In particular, homeownership leads to greater risky asset holdings. Stravrunova and Yerokhin (2008) find that higher net worth and level of education have a positive effect on exposure to the stock market while having a non-English speaking background has a negative effect. Their results also suggest a weak negative relationship between expected fraction of wealth in stocks and age, conditional on participation in the stock market. Interestingly, they find that most background risks or alternative investment options have no effect on the share of wealth invested in stocks.

In contrast to these empirical based approaches, which are limited by access to data, Drew et al (2014) utilise simulations to generate wealth outcomes for a hypothetical worker under an array of investment strategies for their SG. The authors find investment strategies with higher proportion of growth assets (i.e. stocks) either with a constant asset mix or changing asset mix during investment horizon, produce better retirement outcome despite higher risks. Kingston & Fisher (2014) suggest a V shaped lifetime path for growth assets in the portfolio – with a fall in the share at the point of retirement. However, post retirement during the drawdown phase, it should rise again. The justification for this increase is due to bequests being used as shock absorbers (Kingston & Fisher, 2004). However, this strategy still advocates for a decrease in risky assets at the point of retirement.

The theoretical literature on household portfolio choice calls for the holding of less risky assets in retirement and there is some empirical evidence to support the theory. Furthermore, other empirically tested factors that also drive the portfolio decision include labour income risks, risk preferences and health. Overall, there is limited empirical literature on the relationship between retirement and asset allocation.

3.3 Data

The HILDA Survey is a household based social and economic longitudinal study which commenced in 2001 and is implemented annually (Watson & Wooden, 2001). It collects annual information on income, labour market, demographic and personal characteristics of Australian individuals and households and also surveys these individuals and households on wealth and retirement in less frequent special modules. It started with a sample of households occupying private dwellings in Australia and was extended to include new household members resulting from changes in household composition.

To date there are 12 waves available for analysis (from 2001 to 2012), comprising of both standard questions as well as special topic modules which are repeated in cycles. This chapter uses data from the wealth module implemented in Wave 2 (2002), Wave 6 (2006) and Wave 10 (2010), as well as responses from the standard questions in those waves. Questions are asked on individual and household levels depending on the specific topics.

3.3.1 Sample construction

This study aims to examine the behaviour of households aged 45 and over. Those in this age group are more likely to consider the implications of retirement and the associated financial issues. The design of the HILDA dataset is such that the information collected in the wealth module is on a household basis, which raises questions regarding the definition of a household for this study. For multi-person households, those living in the same dwelling are considered to be in a household when they make provisions for food and other essentials of living together (Watson & Wooden, 2001). The notion of household in this case should not be confused with family. Those living in the same household can include persons who are related and/or unrelated. As a result of this definition, HILDA includes various types of household composition including share houses. For the purpose of this study we focus on what we call ‘standard households’ which include the following categories:

- Lone person
- Single parent with children under 15
- Single parent with dependent student
- Couple only
- Couple with children under 15
- Couple with dependent student

We exclude the non-standard households (i.e., those not included in the above list), as it is not possible to disentangle the wealth components of non-household/non-family members. We use an unbalanced panel consisting of approximately 700 single households and 2000 couple households, in each of the three waves spanning 8 years. The unbalanced panel nature of the data means that there are individuals who appear only once or twice or all three times across the three waves.

The rationale behind the distinction between single and couple households is that in a couple household, it is assumed that wealth and asset allocation decisions are made by the couple jointly and are therefore affected by the characteristics of both parties. However in a single household, the decisions are made solely by the single individual. In the case of the couple households, the assumption is made that the male is the head of the household unless the couple is in a same sex relationship. In the latter case, one person is arbitrarily selected as the household head. The household heads' respective partners are then matched accordingly. As the retirement decision is likely to affect people above a certain age group, in all households the single person or the household head[28] is at least aged 45 or over in the earliest wave (wave 2).

3.3.2 Dependent variable

In this study we are interested in the portfolio choice behaviour of older Australian households and we investigate whether retired households exhibit behaviour that is consistent with holding a smaller proportion of risky assets compared to working households. The dependent variable used to examine the research question is the proportion of gross risky assets. Two definitions of total assets are considered in this study. The first is a narrow definition which only includes financial assets. That is, equity holdings, cash, trust funds, bank accounts, life insurance and superannuation. The second is a broader definition of total assets which includes the aforementioned assets as well as businesses, properties, cars and other assets[29].

Using the narrow definition of total financial assets - the narrow dependent variable - the proportion of risky financial assets is constructed. The risky financial assets are equity investments and the risky component of the superannuation balance. The data collected does not allow the look through of asset allocation categories of the individual's superannuation accounts. Given the high propensity for an individual's superannuation to be invested in the default option, which is almost always a 'balanced fund', we assume each household's superannuation balance held in a balanced fund. Furthermore, we assume 60%, 65.1% and 62% of the account balance are invested in risky assets in

[28] There are cases of partners to be under the age of 45.

[29] This may include collectibles such as art and antiques, cemetery plots or some other substantial asset.

accordance with the annual average asset allocation of the default fund in Australian superannuation funds published by the Australian Prudential Regulation Authority (APRA) for 2002, 2006 and 2008 respectively which corresponds to Wave 2, 6 and 10 (Australian Prudential Regulation Authority, 2014a). Therefore, the proportion of gross risky financial assets is total gross risky financial assets as a percentage of total gross financial assets.

The alternative dependent variable, the proportion of risky assets, is constructed from the broad definition of total assets. The risky component of total assets not only includes equity investments, the risky component of superannuation (which is treated the same as in the narrow definition) but also includes business and other property investments (excluding own home). Therefore, the proportion of gross risky assets is defined as total gross risky assets as a proportion of total gross assets.

The reason for the distinction between the narrow and broad assets definitions is that property and business investments are rarely traded, and it is difficult to make incremental changes to these asset types. However, in the strict sense, business and property investments are considered risky even though they are of an illiquid nature. Investors cannot readily sell their business and property investments compared to equity investments. Therefore, the narrow definition of financial assets maybe more aligned to the behaviour of individual investors.

3.3.3 Explanatory variables

The research question in this chapter involves the examination of the investment behaviour (i.e. proportion of risky assets held) of older Australian households as related to retirement and retirement intentions. The explanatory variables can be categorised into four groups relating to: retirement, labour income risks, household characteristics and individual characteristics.

Variable of interest – retirement

The variable of interest is 'retirement'. For the purpose of this study, the key characteristic is being in a state of retirement, whereby the individual considers themselves retired and is no longer working or looking for employment. Three variables are used to examine the different aspects of the state of retirement. First is the binary variable measuring whether the individual is retired from the labour force completely (or not). This is derived from the survey question: ‘have you retired completely from the workforce?’ and supplemented by labour force status where the answer to this question is not clear or contradictory (i.e. not asked or do not know). In any of the three waves, if the person is retired, they can elect to return to the work force in subsequent waves. Therefore, it is possible for the retirement variable to change from retired to not retired (and vice versa) for a given individual throughout the waves.

For individuals who are not retired completely from the work force, the variable ‘number of years to intended retirement’ is constructed from questions in the HILDA survey. Individuals are asked ‘at what age do you expect to retire completely from the paid workforce?’. Using the answers to this question, we minus their actual age in each wave to construct the number of years to their intended retirement. This variable measures how far away (in years) the individual is to her planned retirement age. We also define a dummy variable for those who have indicated that they never intend to stop working. We hypothesise that retirement leads to a decrease in risky asset holdings and that the closer to retirement an individual is, the lower the proportion of risky assets the individual will hold – as theorised in lifecycle portfolio choice literature (for example, Bodie *et al.* (1992) as discussed in Chapter 2).

Labour income risks

Consistent with Bodie *et al.* (1992) who identify the effect of wage uncertainty on life-cycle portfolio allocation, we also consider labour income risks. Firstly, the dichotomous variable of whether the individual is self-employed (or not) is used to represent the background risk arising from uncertain future labour income (Stravrunova & Yerokhin, 2008). That is, the self-employed faces higher background risk. Guiso et al (1996) find evidence that uninsurable income leads to individuals reducing the proportion of risky assets held. As a result, casual employment is also used as a proxy for risky income since those with casual employment are not guaranteed regular hours of work nor do they have entitlements such as sick leave and annual leave compared to full time employment. Milevsky (2003) finds that the wages of individuals working in the financial services industry is correlated with investments in risky assets through the channel of investments in the stock market. Subsequently, these individuals have risky wages and should reduce the amount of risky assets in their portfolio. The dummy variable of whether the individual works in the financial services industry (or not) is used as a proxy for risky wages. Although, there may be another channel in which the correlation between working in the financial services industry and risky asset holdings exists. Working in the financial industry may lead to a greater understanding of the availability of investment products or have a better financial literacy.

Household socio-economic characteristics

The decision about the proportion of risky assets to hold is also conditional on the household socio-economic characteristics including: net worth, number of resident children, home equity, business equity and other property equity. Household net worth is the difference between household assets and liabilities. It is expected that those with higher net worth would be in a better position to invest in risky assets.

Having resident children in the household can impose a burden on household expenditure. Therefore the number of resident children is used here to see whether it creates a liquidity constraint. For the age group examined in this study, it is likely that owning one's own home can free up funds for investment in risky assets. Yamashita, (2003) finds that households with large home mortgages have proportionally less risky assets. Given the definition of financial assets in this study, investments in home, business and other properties offer a substitute to investment in financial assets and hence are included as covariates.

Individual socio-economic characteristics

Individual characteristics include age, education (base dummy variable - below high school, high school, diploma/certificate or degree), income, self-assessed health (base dummy variable – poor, fair or good), year of arrival in Australia post 1992 (the year in which the superannuation scheme was established), planning horizon, risk averse or no cash to invest and whether they receive the Age Pension. The rationale behind the inclusion of the variable 'year of arrival in Australia post 1992' is that those who arrive after 1992 would have been in the superannuation scheme for a shorter time than those arriving before and therefore would have accumulated lower superannuation balances as at the time of retirement. As a result, it is likely that they would be looking elsewhere for retirement investments, and perhaps invest more actively outside superannuation.

The variable 'planning horizon' is indication of whether the individual is being forward looking in financial planning to manage their own investments. This is derived from the question 'in planning your saving and spending, which of the following time periods is the most important to you?', with answer choices ranging from 'the next week' to 'more than 10 years ahead'. The base dummy variable is where planning horizon is less than a year, while two dichotomous variables are created to indicate medium and long planning horizons, where medium planning horizon is the next year and long planning horizon is next two years and above. Cardak and Wilkins (2009) find that the length of financial planning horizon has a positive effect on risky asset holdings.

Individuals are also asked their attitude to risk: 'which of the following statements comes closest to describing the amount of financial risk that you are willing to take with your spare cash?'. The statements range from 'I take substantial financial risks expecting to earn substantial returns' to 'I am not willing to take any financial risks' and also includes the option to choose 'I never have any spare cash'. The risk aversion dummy variable is constructed if the individual's response is that they are not willing to take any financial risk[30]. The resulting variable indicates their willingness to take risks. A dichotomous variable is also created for those who do not have any spare cash to invest. Risk aversion is expected to have a negative effect on risky asset holdings: those who are more willing to take risks will hold more risky assets (Stavrunova & Yerokhin, 2008).

Health plays an important factor in household asset allocation composition. Those with worse self-assessed health would be less likely to hold risky assets and possible reasons

[30] This question is based on the Survey of Consumer Finances (SCF) risk-tolerance measure, which has been shown to be correlated with investments in risky assets (Brown & van der Pol (2015)). This HILDA question has been used to construct financial risk preference variable in many studies, see Stavrunova & Yerokhin (2008), Cardak & Wilkins (2008), West & Worthington (2014) and Brown & van der Pol (2015).

for this can be due to risk aversion, planning horizon, bequest motives, health insurance and expectations of future income (Rosen & Wu, 2004). In HILDA, respondents are asked the following question about their health: 'in general, would you say your health is: excellent, very good, good, fair or poor?'. We create the dummy variable 'good health' equals 1 if the response is excellent/very good/good and dummy variable 'fair health' equals 1 if the response is fair and 'poor health' is the base dummy.

Income is expected to have a positive relationship with risky asset holdings (Cardak & Wilkins, 2008). Those with higher income would have more disposable income to invest and this would lead to a positive relationship with proportion of risky assets held. The Age Pension can potentially create a safety net for those who invest heavily on the stock market using their retirement savings to fall back on when the market is down. The use of this variable can test the relationship between Age Pension income and whether the individual invests in any risky assets.

3.3.4 Descriptive statistics

Sample construction was discussed earlier in section 3.3.1. The unbalanced panel consists of 742, 702 and 697 single households and 1,476, 1,194 and 1,104 couple households in 2002, 2006 and 2010 respectively. The descriptive statistics for the panel is displayed in Table 3.1. It can be seen that the average age in the starting year of 2002 is around 60 for both couple and single household heads, while for the partners in couple households the average age is 56 in 2002, as partners are predominately women (and men tend to couple with younger women). Overall, couple household heads have higher levels of education compared to partners and singles. This is consistent with households being predominantly male and single households being approximately 66% female. Around 9% of singles are from non-English speaking backgrounds in all three waves. The percentage is slightly higher for both couple household heads and their partners at around 13%.

In wave 2, 44% of single households consider themselves risk averse and this percentage grows slightly in wave 6 to 51% and to 55% in wave 10. This is likely due to the effect of the cohort ageing, leading to more conservative risk preferences. Also, Wave 10 coincided with the aftermath of the Global Financial crisis. Furthermore, couple household heads are around 10% less risk averse while partners have similar levels of risk aversion as singles. Single households have a smaller percentage of individuals with long planning horizons compared to couples (both household heads and partners), with 26% of singles in wave 10 compared to couple household heads with 38% in the same wave. Overall, the percentage declines as the cohorts age.

For both groups of households, the majority of individuals are in good health, although the percentages (in good health) decrease from wave 2 to wave 10. This is to be expected as individuals age throughout the eight years. A higher percentage of single households receive the Age Pension compared to couple households (both households heads and their partners). For both groups, those receiving the Age Pension increases from wave 2 to wave 10.

Table 3.1 Descriptive statistics all samples

	Single households						Couple households					
	2002 (n=742)		2006 (n=702)		2010 (n=697)		2002 (n=1,476)		2006 (n=1,194)		2010 (n=1,104)	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Household head retired	55%		61.3%		67.3%		37.4%		43.8%		50%	
Partner retired							47.4%		51.1%		54.1%	
Household characteristics												
No. of resident children	0.19	0	0.12	0	0.09	0	1	0	1	0	1	0
Net worth	$351,544	$187,225	$480,234	$300,787	$537,780	$365,900	$686,156	$451,993	$1,145,841	$707,193	$1,244,419	$845,805
Business equity	$29,512	0	$24,650	0	$20,026	0	$68,138	0	$73,941	0	$64,959	0
Home equity	$161,631	$110,000	$234,068	$200,000	$284,297	$255,000	$253,223	$200,000	$425,236	$340,500	$503,708	$430,000
Property equity	$30,081	0	$54,043	0	$57,670	0	$64,643	0	$194,460	0	$177,253	0
Individual characteristics – Heads												
Age	61.8	60.5	65.3	64	69.1	68	59.4	58	62.5	61	65.6	64
Male	32.2%		32.8%		33.3%							
Divorced	47.7%		44.4%		45.5%							
Widowed	35.3%		37.5%		37.2%							
Income	$27,530	$17.361	$31,728	$20,187	$34,391	$22,248	$40,406	$28,989	$48,291	$32,951	$51,222	$33,734
High school	6.7%		6.8%		6.7%		7.7%		7%		7.2%	
Diploma/cert.	27.4%		29.5%		28.4%		39.4%		41.7%		41.3%	
Higher degree	15.9%		16.7%		17.8%		21.1%		22%		23%	
NESB	10.4%		8.8%		9%		14.8%		13.1%		12.8%	
Risk averse	43.8%		50.9%		55.2%		35.1%		36.1%		36.7%	
No cash	24.1%		22.8%		17.1%		12.3%		11.1%		9.4%	
Med. plan horizon	19.9%		17.8%		17.6%		20.9%		18.8%		19.1%	
Long plan horizon	33.4%		35.8%		26.1%		44.6%		46.4%		38.1%	
Fair health	20.6%		23.4%		27.7%		18.2%		18%		20.7%	
Good health	70.6%		67%		62.8%		74.5%		73.7%		73.7%	
Age Pension	31.8%		38.2%		46.5%		20.3%		26.5%		33.4%	
Overseas pension	3.8%		4.1%		4%		4.3%		4.2%		4.6%	
Arriving post 1992	0.5%		0.4%		0.6%		2.2%		1.7%		2.1%	

Table 3.1 Descriptive statistics all samples (continued)

	Single households						Couple households					
	2002 (n=742)		2006 (n=702)		2010 (n=697)		2002 (n=742)		2006 (n=702)		2010 (n=697)	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Individual characteristics – partners												
Age							55.8	55	59	59	62.1	62
Income							$22,428.11	$14,079	$27,554.58	$18,343.50	$32,584.92	$19,855
High school							11.7%		11.4%		9.6%	
Diploma/certificate							20.8%		24.3%		25.9%	
Higher degree							17%		18.8%		20%	
NESB							13.7%		13%		12.9%	
Risk averse							45.1%		47.6%		49.9%	
No cash							14.8%		12.3%		10.5%	
Med. plan horizon							22.4%		20.8%		21%	
Long plan horizon							44.5%		46.2%		37.3%	
Fair health							14.9%		15.4%		18.2%	
Good health							80%		76.5%		77.1%	
Age pension							20.5%		23.9%		30.3%	
Overseas pension							3.7%		3.3%		4.1%	
Arriving post 1992							3.3%		3.3%		3.3%	

3.3.5 Assets and liabilities

The focus of this chapter and the central research question surrounds the risky assets holdings of older Australian households. Therefore, we next examine the key features of the HILDA dataset relating to changes in household assets and liabilities. There are two key aspects of interest here – relating to wealth levels of households and the age of the household heads. Consequently, the differences in the composition of asset and liability classes for both types of households are examined by net wealth deciles and age groups over the three relevant waves - wave 2 (2002), wave 6 (2006) and wave 10 (2010).

As categorised by HILDA, the types of assets potentially held by households are cash, equity investments, bank accounts, own home, other properties, businesses, trust funds, vehicles, life insurance, superannuation accounts and other substantial assets such as collectibles and antiques. For households over the age of 45, the main types of assets held are own home, superannuation accounts and bank accounts.

Assets and liabilities by net wealth deciles

Comparing asset class composition by net deciles, The top two panels of Figure 3.1 show the average amount of assets by asset class for each net wealth decile (for both single and couple households) in each of the relevant waves. Own home is by far the largest asset class for all net asset deciles, followed by superannuation accounts and bank account balances. The poorer single households (those in the lower deciles) barely hold any assets with the main (or sometimes only) asset being their own home. By comparison, poorer couple households hold a slightly greater variety of assets and, as expected, more in total compared to single households since their wealth is jointly held. Richer single households (those in the 8th, 9th and 10th deciles), hold a large variety of asset classes with more equity and business holdings compared to all other deciles. Similarly, for couple households, those in the upper deciles have larger mix of asset classes and, furthermore, this mix is greater compared to single households. Overall, total assets have grown across the waves for both types of households.

The types of liabilities held by households in the HILDA dataset are: debts on own home, other properties and business; credit cards; the Higher Education Contribution Scheme (HECS) and other debts which includes personal and investment loans. The HECS debt arises due to dependents being counted in both single and couple household wealth. For the older households considered in the sample, the main types of liabilities held are mortgages on property – both own home or investment properties.

The bottom two panels of Figures 3.1 compare the classes of liabilities held by both single and couple households by net wealth deciles, for the three relevant waves. It can be seen that the largest class of debt for households is mortgage on properties (both own home and for investment). Single households hold significantly less total debt compared to couple households, given the latter represents joint wealth. For single households in the 9th and 10th deciles, the amount of total debt is higher compared to those in lower deciles, and there is more variety in types of debt including other property and businesses, which poorer households, those in the first and second deciles, do not have.

Couples tend to have not only a higher level of debt, but also a greater mixture of debt types, compared to singles, in all deciles. Those households in higher deciles tend to have more ‘other properties’ and business debt. Couple households in higher net wealth deciles have slightly higher total debt, although this effect is not consistent for all richer households. There are very small amounts of HECS debt appearing in the liabilities of these older households. This is due to households with dependents, who may be university students, being counted in the sample.

The overall level of debt does not seem to reduce for all deciles in both single and couple households. However, it tends to fluctuate throughout the waves. This is similar for mortgages associated with own home and other properties.

Figure 3.1 Assets and liabilities by wealth deciles

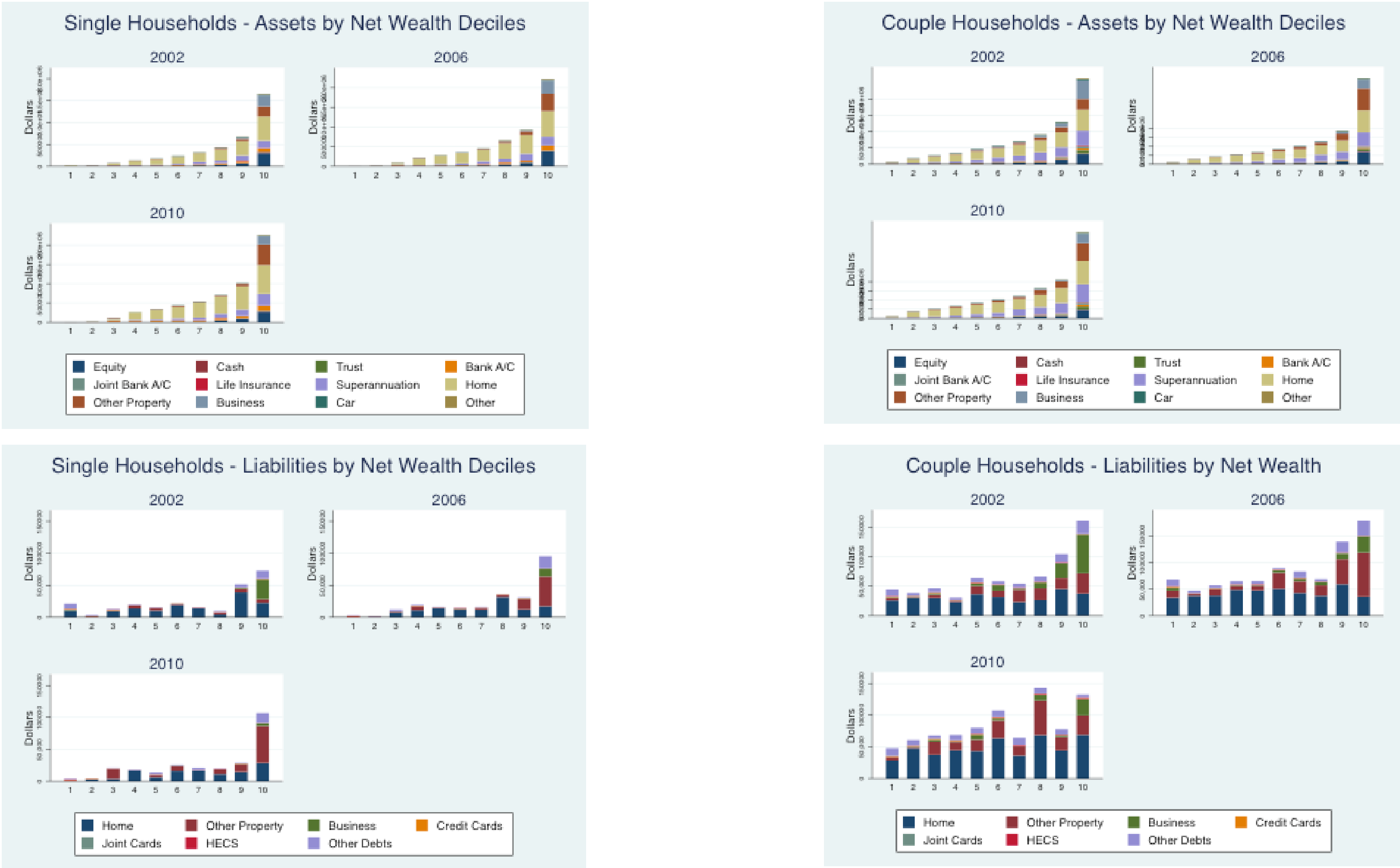

Figure 3.2 Assets and liabilities by age

Assets and liabilities by age groups

The relationship between risky asset holdings and retirement is related to age. Consequently, we examine the composition of the asset and liability classes for both single and couple households by the age of the household head in 2002. The ages are split into five groups: 45 to 54, 55 to 64, 65 to 74, 75 to 84 and greater than 84 years of age. The top two panels of Figure 3.2 show the amount of assets by asset class for single and couple households by net wealth decile, for each of these age groups. For all age groups and in all types of households, own home is the largest asset class. Interestingly, for the younger cohorts of single households - age groups 45 to 54 and 55 to 64 - their superannuation balances increase as the cohorts age. Furthermore, the older age groups do not have large superannuation balances by comparison. This is because the younger households are working for longer and thus accumulating more superannuation under the relatively new Superannuation Guarantee, which was only implemented ten years prior to the first wave of the HILDA data in 2002, compared to the older generations. This also holds true in couple households, with the younger age groups - 45 to 54, 55 to 64 and also 65 to 74 - holding larger superannuation balances than older households.

In all three waves, the younger households tend to have more assets than older households and in particular the age group 55 to 64 has the highest level of assets in all waves for all types of households (except singles in wave 10). The younger households also tend to have a mixture of assets, which include not only own home and superannuation balances but also business assets and other properties (i.e. properties owned by the individual other than their own home). Similarly to assets by net deciles, couple households have more total assets compared to single households. Overall, it can be seen that total assets are increasing as the cohort ages for all households. This is more evident in couple households.

Interestingly, households in all age groups hold some equities with couple households holding more by comparison. For both types of households (single and couple), this amount of equity investment does not seem to decrease as the cohort ages – which does contradict the age-phasing of risky assets. This behaviour is further supported by the observation that those in older age groups - that is, 75 to 84 - still hold a significant proportion of equities. This is more evident in couple households, although it can be partially explained by the fact that the partners of these older household heads can be significantly younger and therefore have some propensity to hold a greater proportion of equities. However, the amount of superannuation balance in both single and couple households decrease with age which is in line with households drawing down on superannuation assets through the decumulation phase to partially fund for retirement.

The bottom two panels of Figure 3.2 show different types of liabilities by age groups for single and couple households in the relevant waves. The largest debt class for both household types is mortgage on own home. However, the amount of debt is significantly less for older age groups, i.e. comparing 45 to 54 year olds to other older groups. Furthermore, for the younger cohorts in both household types, 45 to 54 and 55 to 64 age groups, own home is the biggest liability relative to other liability classes. These households also tend to have a mix of different types of debt including other property debt and other debts.

Couple households also tend to have more mixed debt including business debts compared to single households. Younger age groups of couple households, 45 to 54 and 55 to 64, tend to have more debt than their counterparts in single households, but older couple households, 65 to 74 and 75 to 84, have less debt than single households in the same age groups.

Overall, total liabilities are falling as households age. However, given the relatively small group of households over the age of 84, the observations are rather skewed.

3.4 Methodology

The research question central to this chapter is how the state of 'retirement' affects the proportion of risky assets held by older Australian households. A further complimentary question is how do labour market characteristics impact on risky asset holdings. The HILDA dataset offers a longitudinal dataset incorporating three relevant waves: wave 2 (2002), wave 6 (2006) and wave 10 (2010). The nature of the data allows us to measure the individual's decision to retire from the work force and the impact on risky asset holdings through time. As a result, we employ three different panel data methods. Firstly, we use a pooled cross section ordinary least squares model (pooled OLS) to estimate a relationship between retirement and risky asset holdings. However, due to the dynamic nature of the dataset, such a model is likely to suffer from omitted variable problems. Consequently, we use a fixed effects model (FE model) and a random effects model (RE model) in addressing any shortcomings as a result of the longitudinal nature of the dataset used.

3.4.1 Pooled generalised least squares model

With the three years of relevant data (2002, 2006 and 2010), we use a pooled cross section ordinary least square model to utilise the information contained in all relevant time periods. To measure the effect of retirement on the proportion of risky assets of households, the following pooled regression model is estimated:

$$RA_{it} = \beta_0 + \beta_1 Retired_{it} + \beta_2 x_{it2} + \ ... + \beta_k x_{itk} + \delta_0 Wave6_i$$
$$+\delta_1 Wave10_i + v_{it} \tag{3.1}$$

where RA_{it} is a measure of the percentage of risky assets (narrow definition or broad definition) for each household i at time t, where time t is either wave 2, 6 or 10. $Retired_{it}$ is a dummy variable equalling 1 if the individual belongs to household i at time t is retired, and zero otherwise. $\beta_2 x_{it}$, …, $\beta_k x_{itk}$ are explanatory variables including individual and household characteristics. Dummy variables $Wave6_i$ and $Wave10_i$ are time dummies where $Wave6_i = 1$ when observations are from wave 6 and $Wave10_i = 1$ when observations are from wave 10 (the base is wave 2). β_0, β_1, …, β_k, δ_0 and δ_1 are parameters and v_{it} is an independently and identically distributed error term.

However, it is highly likely that there are time invariant unobserved factors or unobserved effects, a_i, which are not captured in the above model. We can rewrite the error term, v_{it} as a composite error term to take into account the unobserved effects, a_i: $v_{it} = a_i + u_{it}$ (Woolridge, 2003). Therefore, Equation 3.1 can be written as:

$$RA_{it} = \beta_0 + \beta_1 Retired_{it} + \beta_2 x_{it2} + \ ... + \beta_k x_{itk} + \delta_0 Wave6_i$$
$$+\delta_1 Wave10_i + a_i + u_{it} \tag{3.2}$$

An example of possible a_i in this case can be inherent ability, which maybe correlated with education. Not capturing these unobserved effects in the model can lead to inconsistent estimators. In order for OLS to produce consistent estimators, it is assumed that the unobserved effects a_i are uncorrelated with the covariates (Wooldridge, 2000). Otherwise, omitted variable bias occurs and the pooled OLS model is not designed to account for this.

3.4.2 Fixed effects model

To account for the possible omitted variable bias by not capturing the time constant unobserved effect, a_i, a fixed effects model is estimated. In a FE model, the covariates are transformed in order to remove the unobserved effect a_i. Given Equation (3.2), for each i the equation is averaged over time:

$$\overline{RA}_i = \beta_0 + \beta_1 \overline{Retired}_i + \beta_2 \bar{x}_{i2} + \ ... + \beta_k \bar{x}_{ik} + \delta_0 \widetilde{Wave6}_i + \delta_1 \widetilde{Wave10}_i + a_i + \bar{u}_i \tag{3.3}$$

where $\overline{RA}_t = T^{-1} \sum_{t=1}^{T} RA_{it}$ and so on. Then for each period of t, Equation (3.3) is subtracted from Equation (3.2) and given a_i is time invariant it is differenced out (so are the wave dummies) and the model becomes:

$$\widetilde{RA}_{it} = \beta_0 + \beta_1 \widetilde{Retired}_{it} + \beta_2 \tilde{x}_{it2} + \ ... + \beta_k \tilde{x}_{itk} + a_i + \tilde{u}_{it} \tag{3.4}$$

where $\widetilde{RA}_{it} = RA_{it} - \overline{RA}_i$ and so on. Estimating this model, there is no omitted variable bias caused by the unobserved heterogeneity, thus the estimators obtained will be consistent. However, one drawback of this model is that other explanatory variables that are fixed with time, such as gender, will also be differenced out from the model and their effects cannot be measured. Furthermore, for explanatory variables that hardly change over time, the fixed effects will absorb the explanatory powers of these slow changing variables and they will also suffer from the lack of statistical significance (Beck, 2001).

3.4.3 Random effects model

The assumption made by the fixed effects model is that the unobserved effects, a_i, may be correlated with one or more explanatory variables and differencing it out solves the resulting bias. However, the drawback is the model is not able to measure the effects of time invariant explanatory variables. If a_i is uncorrelated with the explanatory variables in all three periods, then using a pooled OLS model (Equation 3.2) will produce consistent estimators. However, with the composite error term $v_{it} = a_i + u_{it}$, a_i is now present in each time period leading to serial correlation (Wooldridge, 2000). Thus, the correlation between the composite errors in two periods is as follow:

$$Corr(v_{it}, v_{is}) = \frac{\sigma_a^2}{(\sigma_a^2 + \sigma_u^2)} \tag{3.5}$$

Where $t \neq s$, σ_a^2 is the variance of a_i and σ_u^2 is the variance of u_{it}. Not accounting for this auto-correlation in the pooled OLS estimations will lead to incorrect test statistics. In order to solve this, we can use Generalised Least Squares transformation to eliminate the serial correlation problem in the OLS, resulting in a random effects (RE) model. Here we define a parameter, λ:

$$\lambda = 1 - \left[\frac{\sigma_a^2}{(\sigma_a^2 + \sigma_u^2)}\right]^{\frac{1}{2}} \tag{3.6}$$

Where λ is between 0 and 1. We can use this parameter to transform Equation 3.2:

$$RA_{it} - \lambda\overline{RA}_i = \beta_0(1-\lambda) + \beta_1(Retired_{it} - \lambda\overline{Retired}_i) + \beta_2(x_{it2} - \lambda\bar{x}_{i2}) + \ldots + \beta_k(x_{itk} - \lambda\bar{x}_{itk}) + (v_i - \lambda\bar{v}_i) \tag{3.7}$$

The overbar denotes time averages the same as in the fixed effects model. The parameter λ cannot be calculated but an estimator, $\hat{\lambda}$, can be obtained by using the residuals from the pooled OLS or FE models:

$$\hat{\lambda} = 1 - \left[\frac{1}{1 + T\left(\frac{\hat{\sigma}_a^2}{\hat{\sigma}_u^2}\right)}\right]^{\frac{1}{2}} \tag{3.8}$$

Where $\hat{\sigma}_a^2$ and $\hat{\sigma}_u^2$ are consistent estimators of σ_a^2 and σ_u^2. Comparing the FE and RE models, the RE estimator takes a fraction, $\hat{\lambda}$, of the time average of the variable and subtracts it from the corresponding variable. Thus, in a pooled OLS model, $\hat{\lambda} = 0$ and in a FE model $\hat{\lambda} = 1$. The RE model allows variables that do not vary across time to be estimated, unlike the FE model.

3.5 Empirical results

The research question we are interested in examining in this chapter is: for older Australian households, do retired households exhibit behaviour that is consistent with holding a lower proportion of risky assets compared to working households? We employ three different types of statistical models to investigate this: a pooled OLS model, a fixed effects model and a random effects model. We also use two different samples: the complete sample consisting of both working and retired individuals over the age of 45, and then the employed households only (in the case of couple households, if the household head is employed). We also estimate the results in the context of two different definitions for the dependent variable – a narrow risky financial asset definition and a broader risky asset definition.

3.5.1 Retirement and risky financial assets holdings

Table 3.2 presents the results of regressing 'retirement' on risky asset holdings and over covariates using the narrow definition of risky financial assets, for both single households and couple households, for all three models – pooled OLS, fixed effects and random effects – as discussed in Section 2.4. For the fixed effects model, time invariant variables such as gender, education (given the older cohort of the sample used), NESB and arriving post 1992 have been omitted. For single households, the results are reported for all, which consists of both male and female households. For couple households both the household head and their partner's characteristics are reported side by side (unless the variables are household characteristics).

Variable of interest – retirement

The relationship central to this exploration is that between 'retirement' and the proportion of gross risky assets held. Retirement is defined as the state when the individual is retired completely from the labour force in a particular wave (although there is the possibility that an individual reverts from being retired to not-retired or working). The OLS results for singles show that single retired households tend to reduce the proportion of risky asset holdings by 14%. This result is in contrast with those from couple households. For those semi-retired couple households, that is if either the household head or their partner are retired but their other half is not, the effect on the proportion of risky assets held are positive. That is, when head of the household is retired, the proportion of risky assets held by the household increases by 2% (although this relationship is not precisely estimated). When the partner is retired, the proportion of risky assets held increases by 4%. However, when the couple household is considered retired, that is if both people in the household are retired, the proportion of risky assets held falls by 5%. It shows that in couple households, financial decisions are likely to be joint – and suggests that as one spouse remains in the labour market, their income offers a safety net for the household to invest in riskier assets compared to those households where both parties are retired. These results are statistically significant.

The fixed effects model tells a similar story. For single households the effect is negative: a 5% increase in the proportion of risky assets when the household is retired. For couple households having either the head of the house or their partner retired will lead to a 3% increase in the proportion of risky assets held by the household. If the household is completely retired, the proportion of risky assets falls by 2%. However, the results obtained from the FE model are not statistically significant.

The observed joint behaviour of couple households is also confirmed by the random effects model estimation where for single households, the fall in the proportion of risky financial assets is 11% for retired households, compared to non-retired ones. Furthermore, the completely retired couple households experience a 4% fall in the proportion of risky asset holdings.

Household characteristics

In conjunction with the variable of interest, other household level and individual level characteristics are also included in the three models. The household characteristics considered include number of resident children, net worth, business equity, home equity and property (other than own home) equity. These are proxies for the financial status of the household.

The number of children living in the household can impose a financial burden on the household budget. For single households, the results from all three models indicate a negative relationship between the number of resident children and the proportion of risky assets held. The pooled OLS model predicts that if the single household increase the number of children by one child, the proportion of risky assets would decrease by 0.3%. Similarly, the fixed effects and the random effects models indicate a 2% and 1% decrease respectively. For the couple households, there is also a negative relationship in all three models. However, the results are not statistically significant for both singles and couples. One possible reason is that for the age group examined, there are not many children still residing in the households.

The coefficient is positive for net worth and negative for net worth squared. Both results are statistically significant. This holds true across all models for both types of households. As predicted, an initial increase in net worth leads to an increase in the proportion of risky financial assets held by both single and couple households. For net worth squared the coefficient is negative. This is in contrast with the results presented in Cardak and Wilkins (2009) where both coefficients on net worth are positive. However, it can be noted that the coefficient values from all three models are of small magnitudes – all less than 1% indicating a very small negative effect as net worth gets larger.

Given the definition of financial risky assets being equity investments and the risky component of superannuation accounts, business investments and property investments (including own home) are considered substitutes to owning risky financial assets. Consequently, business equity, home equity and property equity are also included as covariates in all three models. An increase in home equity or business equity leads to a decrease in the proportion of risky assets held by single households. These results are statistically significant in all models for the single households but for couple households only home equity from the RE model and business equity from the OLS and RE models are statistically significant. For equity associated with property investments other than own home, the coefficients are negative for OLS and RE models but positive for the FE models across both samples. However, the FE results are not statistically significant and the coefficients are of small magnitudes.

Table 3.2 Retirement and risky financial assets: Single households and couple households

Dependent variable	Risky financial assets (narrow definition)								
Independent Variable	Single households			Couple households					
				Household head			Partner		
	Pooled OLS	FE	RE	Pooled OLS	FE	RE	Pooled OLS	FE	RE
	Coefficient (Standard error)			Coefficient (Standard error)			Coefficient (Standard error)		
Retired	-0.1429***	-0.0457	-0.1068***	0.0167	0.0318	0.0119	0.0390***	0.0283	0.0343**
	(0.028)	(0.029)	(0.024)	(0.023)	(0.028)	(0.021)	(0.015)	(0.019)	(0.014)
Both retired				-0.0521**	-0.0222	-0.0392*			
				(0.024)	(0.027)	(0.021)			
Household characteristics									
No. of resident children	-0.0026	-0.0201	-0.0105	-0.0037	-0.0122	-0.0052			
	(0.014)	(0.019)	(0.012)	(0.005)	(0.008)	(0.004)			
Net worth	0.0366***	0.0134**	0.0316***	0.0069***	0.0036**	0.0066***			
	(0.005)	(0.005)	(0.004)	(0.001)	(0.002)	(0.001)			
Net worth squared	-0.0004***	-0.00005	-0.0003***	-0.00004***	-0.00002	-0.00004***			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
Business equity	-0.0161***	-0.0143***	-0.0159***	-0.0070***	-0.0012	-0.0053***			
	(0.005)	(0.005)	(0.004)	(0.001)	(0.001)	(0.001)			
Home equity	-0.0252***	-0.0125**	-0.0203***	-0.0028	-0.002	-0.0028*			
	(0.005)	(0.006)	(0.004)	(0.002)	(0.002)	(0.001)			
Property equity	-0.0207***	0.0001	-0.0128***	-0.0030***	0.0002	-0.0016			
	(0.006)	(0.006)	(0.005)	(0.001)	(0.001)	(0.001)			
Individual characteristics									
Age	0.0051	0.0408**	0.0048	0.012	-0.0088	0.0178**	-0.0082	-0.0058	-0.0089*
	(0.008)	(0.020)	(0.007)	(0.008)	(0.033)	(0.007)	(0.006)	(0.012)	(0.005)
Age squared	-0.0069	-0.0111*	-0.0068	-0.0112*	-0.017	-0.0165***	0.0057	-0.0023	0.0059
	(0.006)	(0.006)	(0.005)	(0.006)	(0.011)	(0.006)	(0.005)	(0.011)	(0.005)
Male	-0.0289		-0.0151						
	(0.018)		(0.018)						
Divorced	0.0182	-0.0523	0.0127						
	(0.023)	(0.039)	(0.023)						
Widowed	-0.0094		0.0046						
	(0.027)		(0.026)						

Table 3.2 Retirement and risky financial assets: Single households and couple households (continued)

Dependent variable	Risky financial assets (narrow definition)								
Independent Variable	Single households			Couple households					
				Household head			Partner		
	Pooled OLS	FE	RE	Pooled OLS	FE	RE	Pooled OLS	FE	RE
	Coefficient (Standard error)			Coefficient (Standard error)			Coefficient (Standard error)		
Income	-0.0007	-0.0297	-0.0024	-0.0068	-0.0397**	-0.0121	0.0454**	0.0472**	0.0459***
	(0.035)	(0.032)	(0.027)	(0.015)	(0.019)	(0.014)	(0.019)	(0.020)	(0.016)
Income squared	-0.0141	-0.0053	-0.0084	-0.0021	0.0050**	-0.0004	-0.0026	0.0050*	-0.0029
	(0.010)	(0.008)	(0.008)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)
NESB	-0.0420*		-0.0459**	-0.0017		-0.0117	-0.0591***		-0.0603***
	(0.023)		(0.023)	(0.018)		(0.018)	(0.019)		(0.018)
High school	0.0454		0.0626*	0.0579***		0.0561***	-0.002		0.0035
	(0.034)		(0.033)	(0.020)		(0.020)	(0.017)		(0.016)
Diploma or certificate	0.0451**		0.0572***	0.0618***		0.0647***	0.0136		0.0104
	(0.019)		(0.019)	(0.013)		(0.013)	(0.013)		(0.012)
Higher degree	0.0611**		0.0839***	0.0742***		0.0862***	-0.0064		0.0006
	(0.026)		(0.025)	(0.015)		(0.015)	(0.016)		(0.015)
Risk averse	-0.0966***	-0.0193	-0.0685***	-0.0784***	-0.0076	-0.0531***	-0.0412***	-0.0121	-0.0313***
	(0.018)	(0.018)	(0.015)	(0.011)	(0.013)	(0.010)	(0.010)	(0.012)	(0.009)
No cash	-0.1534***	-0.035	-0.1084***	-0.0832***	-0.0006	-0.0597***	-0.0353**	-0.0019	-0.0293**
	(0.024)	(0.025)	(0.021)	(0.017)	(0.021)	(0.016)	(0.016)	(0.020)	(0.015)
Medium planning horizon	0.0213	-0.0299*	-0.0058	-0.0097	-0.0143	-0.007	-0.0017	-0.0245*	-0.0096
	(0.017)	(0.016)	(0.014)	(0.012)	(0.013)	(0.011)	(0.012)	(0.013)	(0.011)
Long planning horizon	-0.0124	-0.0455***	-0.0254**	-0.016	-0.0168	-0.0102	0.009	-0.0138	0.0036
	(0.016)	(0.015)	(0.013)	(0.011)	(0.011)	(0.009)	(0.011)	(0.012)	(0.010)
Fair health	0.0624**	0.0328	0.0590***	0.0379	-0.0379	0.0169	0.0208	-0.0042	0.0116
	(0.025)	(0.024)	(0.020)	(0.024)	(0.031)	(0.022)	(0.027)	(0.025)	(0.023)
Good health	0.0918***	0.0221	0.0813***	0.0551**	-0.0431	0.0322	0.0461*	-0.0104	0.0254
	(0.025)	(0.027)	(0.021)	(0.023)	(0.032)	(0.021)	(0.027)	(0.026)	(0.023)
Age Pension	-0.0033	-0.0366	-0.0213	-0.0043	-0.0512*	-0.0302	-0.0122	0.0148	0.0011
	(0.024)	(0.028)	(0.021)	(0.025)	(0.027)	(0.022)	(0.024)	(0.027)	(0.022)
Overseas pension	-0.0305	-0.0411	-0.0349	-0.0467	0.0642*	-0.0158	0.0258	0.0071	0.0183
	(0.027)	(0.035)	(0.026)	(0.038)	(0.035)	(0.030)	(0.045)	(0.047)	(0.038)
Arriving post 1992	-0.0905		-0.0341	-0.0267		-0.0394	-0.0025		-0.0066
	(0.097)		(0.096)	(0.040)		(0.039)	(0.035)		(0.033)

Table 3.2 Retirement and risky financial assets: Single households and couple households (continued)

Dependent variable	Risky financial assets (narrow definition)								
Independent Variable	Single households			Couple households					
				Household head			Partner		
	Pooled OLS	FE	RE	Pooled OLS	FE	RE	Pooled OLS	FE	RE
	Coefficient (Standard error)			Coefficient (Standard error)			Coefficient (Standard error)		
Wave 6	0.0126	-0.1028*	0.0122	0.0388***	0.1569	0.0323***			
	(0.011)	(0.061)	(0.011)	(0.008)	(0.114)	(0.008)			
Wave 10	-0.019	-0.2550**	-0.0197	0.0042	0.2556	0.0002			
	(0.014)	(0.121)	(0.014)	(0.010)	(0.228)	(0.010)			
Retired*Income	0.1980***	-0.0194	0.1069**	0.0841***	-0.0005	0.0583**	-0.0387	-0.0752**	-0.0500*
	(0.066)	(0.053)	(0.054)	(0.031)	(0.032)	(0.027)	(0.031)	(0.034)	(0.029)

Standard errors are reported in parentheses. *** significant at 1% level, ** significant at 5%, * significant at 10%. Cluster robust standard errors are used. Time invariant variables (education, gender and arriving post 1992) are omitted from the FE model.

Individual characteristics

Individual characteristics such as education level, individual preferences such as planning horizons and risk aversion, health status and access to government pensions also play a possible role in risky asset allocation. There is some evidence of age effects, although it is weak. The coefficients for age and age squared are only statistically significant for household heads in the RE model with the coefficient being positive for the former and negative for the latter. This is consistent with a priori expectations as the proportion of risky assets increase as age increases initially. However, when reaching a turning point (54 years for the household head in the RE model), the household decreases risky asset holdings as they age. However, the partner age coefficients are not statistically significant and of the opposite signs. The single household coefficients are also positive in age and negative in age squared, although the age effect is only statistically significant for the FE model.

Gender does not seem to play a role in the proportion of risky assets held as this is tested using the singles sample. The coefficients for being male in both the OLS and RE models are negative. With respect to the indicators for marriage status, divorced and widowed have positive effects on the proportion of risky assets held (only the OLS coefficient for widowed is negative) although none are statistically significant. The positive results are likely due to an increase in assets after divorce or the death of a partner.

Interestingly, income and income squared do not seem to have an effect on the proportion of risky assets held by single households. The coefficients are negative for both covariates and not of statistical significance in any of the three models. For couple households, only the FE model produced statistically significant coefficients of income and income square. The household head's income coefficient is negative while for income square it is positive. For their partner both coefficients are positive. The respective turning points are $397,000 and $472,000. The negative income coefficient for household head is baffling as the a priori expectations are for positive coefficients for both terms (if the turning point is high enough, which is the case here) - as income rises proportion of risky asset holdings should rise and at any positive value of income the partial effect should be positive.

The results from all three models indicate that individuals from a non-English speaking background in both single and couple households decrease th eir risky financial assets holdings. However, the results for education levels are mixed. The coefficients the OLS and RE models are mainly positive and statistically significant for both singles and household heads, indicating that those with higher levels of education tend to increase the amount of risky asset holdings. This is in line with expectations. Those with higher education would have more financial literacy and more confidence to invest in risky financial assets.

Individual preferences in terms of risk aversion and planning horizons have been included in the models. We have taken the approach that risk aversion varies within individuals throughout time.[31] Therefore, the risk averse variable is included in the FE models. As expected, those individuals in both types of households (single and couples) who are risk averse hold less risky financial assets. Furthermore, individuals who indicate that they have no spare cash for investment would decrease the proportion of risky financial asset holdings in both the OLS model and RE model which are both statistically significant. Those individuals with medium and long planning horizons in both types of households tend to decrease the proportion of risky financial asset holdings. This is most evident in the single households and those with long planning horizons who exhibit more conservative behaviour regarding risky financial asset holdings, perhaps due to bequest motives. This is in direct contrast with the finding from Cardak and Wilkins (2009) which found longer planning horizons lead to the individual being more likely to hold risky assets.

Having fair and good health status generally have a positive influence on the proportion of risky financial assets held. This is expected as those with a worse health status are less likely to hold risky assets due to bequest motives or anticipated higher health costs. Whether or not the individual is receiving the Age Pension in Australia or an overseas

[31] Wang & Hanna (1997), using the 1983-1989 panel of the Survey of Consumer Finances, found that risk tolerance increases with age. Guiso *et al.* (2014) tested whether the 2008 financial crisis affected the risk aversion of Italian bank's clients and found that there is an increase in risk aversion after the event and they attributed it to an emotional response triggered by a scary experience.

pension does not seem to have an effect on risky financial asset holdings. This is due to only the coefficients for the couple household head in the FE model being statistically significant. This indicates some evidence of those receiving the Age Pension decreasing the proportion of risky financial assets in the FE model and also those receiving the overseas pension increasing the proportion of risky financial assets held. This observation seems to support the theory that some couple households are using the overseas pension to invest in the stock market which is not so for those receiving Australian pensions. The results also show that those who arrived in Australia after 1992 tend to decrease the proportion of risky financial assets held although none of the coefficients are statistically significant.

3.5.2 Retirement and risky assets holdings: A broad definition

Next we consider the broad definition of risky assets holdings, which incorporates both risky financial assets and other property investments (excluding own home) and business investments. Table 3.3 displays the results from all three models – OLS, FE, RE.

The variable of interest is whether the single individual in the single household case or the household head or his partner in the couple household case is retired. The results from using the broad definition are slightly different to the results from the use of the narrow definition (as discussed earlier) for all three models. For single households, the results are the same – retired households decrease the proportion of risky asset holdings. However, for the couple household sample, the household head being retired also leads to a decrease in risky asset holdings while the opposite results are obtained for the partners. If both the household head and their partner become retired, the proportion of risky assets decreases. This indicates that, given partners are mainly female, they are likely to retire earlier than their partners and as a result if the household head is still working, it is likely that they would hold more risky assets. However, when both are retired, more conservative investment behaviour is exhibited. Note that only the OLS and RE results are statistically significant.

Comparing the results for the household and individual characteristics, the conclusions are largely the same as those drawn from using the narrow definition of risky financial assets. Notably, only non-English speaking background, some levels of higher education, risk aversion, no cash and arriving post 1992 have an effect on the proportion of risky asset holdings. A possible reason for this lack of statistical significance is the definition incorporates business and other property investments which is not as liquid as financial assets and thus cannot readily be decumulated and sold.

Table 3.3 Retirement and risky assets: Single households and couple households

Dependent variable	Risky assets (broad definition)								
Independent variable	Single households			Couple households					
				Household head			Partner		
	Pooled OLS	FE	RE	Pooled OLS	FE	RE	Pooled OLS	FE	RE
	Coefficient (Standard error)			Coefficient (Standard error)			Coefficient (Standard error)		
Retired	-0.0492***	-0.0143	-0.0394**	-0.0345**	-0.0126	-0.0325**	0.0039	0.0163	0.0061
	(0.019)	(0.021)	(0.016)	(0.017)	(0.019)	(0.015)	(0.011)	(0.014)	(0.011)
Both retired				-0.0223	0.0176	-0.0075			
				(0.018)	(0.021)	(0.016)			
<u>Household characteristics</u>									
No. of resident children	-0.0053	0.0025	-0.0072	-0.0034	-0.0106	-0.0047			
	(0.011)	(0.018)	(0.010)	(0.005)	(0.008)	(0.004)			
Net worth	0.0510***	0.0479***	0.0501***	0.0198***	0.0166***	0.0190***			
	(0.004)	(0.005)	(0.004)	(0.001)	(0.002)	(0.001)			
Net worth squared	-0.0006***	-0.0005***	-0.0006***	-0.0001***	-0.0001***	-0.0001***			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
Home equity	-0.0654***	-0.0516***	-0.0601***	-0.0262***	-0.0202***	-0.0245***			
	(0.004)	(0.007)	(0.005)	(0.002)	(0.002)	(0.002)			
<u>Individual characteristics</u>									
Age	-0.0076	-0.0098	-0.0092*	0.0079	0.0724	0.0087	-0.0058	0.0105	-0.0046
	(0.006)	(0.015)	(0.005)	(0.006)	(0.061)	(0.005)	(0.004)	(0.012)	(0.004)
Age squared	0.0044	0.0041	0.0054	-0.0055	-0.0029	-0.0067	0.0041	-0.0066	0.0031
	(0.004)	(0.004)	(0.004)	(0.005)	(0.009)	(0.004)	(0.004)	(0.008)	(0.004)
Male	-0.0109		-0.0039						
	(0.011)		(0.012)						
Divorced	0.0017	-0.0323*	-0.0009						
	(0.016)	(0.019)	(0.016)						
Widowed	-0.01		-0.0049						
	(0.017)		(0.017)						
Income	-0.0269	-0.0408	-0.032	-0.0279**	0.017	0.0268*	0.0574***	0.0375**	0.0268*
	(0.024)	(0.026)	(0.021)	(0.013)	(0.018)	(0.016)	(0.019)	(0.015)	(0.016)
Income squared	0.0045	0.0150**	0.0097	0.0006	-0.0016	-0.0059***	-0.0071***	-0.0072***	-0.0059***
	(0.009)	(0.007)	(0.007)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
NESB	-0.0034		-0.0063	0.0028		-0.0348***		-0.0377***	-0.0348***
	(0.014)		(0.015)	(0.013)		(0.013)		(0.013)	(0.013)

Table 3.3 Retirement and risky assets: Single households and couple households (continued)

Dependent variable	Risky assets (broad definition)								
Independent variable	Single households			Couple households					
				Household head			Partner		
	Pooled OLS	FE	RE	Pooled OLS	FE	RE	Pooled OLS	FE	RE
	Coefficient (Standard error)			Coefficient (Standard error)			Coefficient (Standard error)		
High school	0.0469*		0.0469*	-0.0277**		-0.0255*	0.0176		0.0184
	(0.026)		(0.025)	(0.013)		(0.013)	(0.012)		(0.012)
Diploma/certificate	0.0380***		0.0397***	0.0051		0.0028	0.0203**		0.0209**
	(0.012)		(0.012)	(0.009)		(0.009)	(0.009)		(0.009)
Higher degree	0.0369**		0.0436***	0.0032		0.0039	0.013		0.015
	(0.016)		(0.016)	(0.011)		(0.011)	(0.012)		(0.012)
Risk averse	-0.0222*	0.014	-0.0095	-0.0425***	-0.0082	-0.0335***	-0.0209***	0.0053	-0.0138**
	(0.01	(0.011)	(0.009)	(0.007)	(0.010)	(0.007)	(0.007)	(0.009)	(0.007)
No cash	-0.0626***	-0.0104	-0.0436***	-0.0453***	-0.0216	-0.0402***	-0.0283***	-0.0054	-0.0223**
	(0.015)	(0.017)	(0.013)	(0.012)	(0.016)	(0.011)	(0.011)	(0.014)	(0.010)
Med. plan horizon	0.0144	-0.016	0.0012	0.0056	-0.0017	0.0065	-0.0021	-0.0131	-0.0057
	(0.011)	(0.010)	(0.009)	(0.008)	(0.009)	(0.007)	(0.008)	(0.009)	(0.007)
Long plan horizon	0.001	-0.0045	-0.0007	0.0140*	-0.0125	0.0088	0.0087	-0.0073	0.0033
	(0.011)	(0.010)	(0.009)	(0.007)	(0.009)	(0.007)	(0.008)	(0.009)	(0.007)
Fair health	0.006	-0.0082	0.0051	0.0174	-0.0221	0.01	0.0169	0.0219	0.0196
	(0.018)	(0.017)	(0.015)	(0.014)	(0.019)	(0.013)	(0.017)	(0.016)	(0.014)
Good health	0.0237	-0.0126	0.0166	0.0262*	-0.0213	0.0203	0.0158	0.0128	0.0158
	(0.019)	(0.020)	(0.016)	(0.014)	(0.020)	(0.013)	(0.016)	(0.017)	(0.014)
Age Pension	-0.0191	-0.0039	-0.0122	0.0522**	-0.0192	0.0369*	0.0167	0.0354	0.0217
	(0.015)	(0.019)	(0.013)	(0.023)	(0.024)	(0.020)	(0.023)	(0.025)	(0.021)
Overseas pension	0.0119	0.0176	0.0137	-0.0151	0.006	-0.0156	0.0097	0.0011	0.0075
	(0.024)	(0.029)	(0.022)	(0.021)	(0.022)	(0.019)	(0.023)	(0.030)	(0.022)
Arriving post 1992	0.0127		0.0511	-0.0654***		-0.0681***	0.004		0.0069
	(0.068)		(0.078)	(0.024)		(0.024)	(0.023)		(0.022)
Wave 6	0.008	0.0069	0.0053	0.0069	-0.302	0.0027			
	(0.008)	(0.046)	(0.007)	(0.006)	(0.234)	(0.006)			
Wave 10	-0.0071	-0.0074	-0.0121	-0.0145**	-0.6227	-0.0195***			
	(0.009)	(0.091)	(0.009)	(0.007)	(0.467)	(0.007)			
Retired*Income	0.0691	0.04	0.0650*	0.0427*	0.0108	0.0433**	-0.0054	-0.0466*	-0.0166
	(0.044)	(0.042)	(0.037)	(0.023)	(0.024)	(0.020)	(0.022)	(0.028)	(0.021)

Standard errors are reported in parentheses. *** significant at 1% level, ** significant at 5%, * significant at 10%. Cluster robust standard errors are used.

3.5.3 Retirement Intentions and Risky Assets Holdings

Next we restrict the sample to older Australian households in HILDA that are considered employed in order to examine the impact of retirement intentions and labour income risks on the proportion of risky assets held by the household. The HILDA dataset contains information on the retirement intentions of those over the age of 45 and not retired. Given this information, we consider the effect of retirement intention on risky asset holdings of the still employed single and couple household samples. We construct a variable that indicates how many years the individual is from her intended retirement age. We also use an indicator for those who state that they do not intend to retire. The results are set out in Table 3.4.

The variable of interest is 'years to intended retirement', i.e. the difference between actual age and the intended retirement age. The intuition behind this variable is that the larger the number, the further away the individual is from their intended retirement date. The results from all three models show the coefficient is positive for individuals in single households and household heads in couple households. The coefficient is statistically significant for the fixed effects model for single households and OLS model for couple households. A positive coefficient indicates that a one year increase in the difference between actual age and retirement age, i.e. the individual is retiring later, leads to an increase in the proportion of risky assets held. However, the coefficient on the difference is negative for partners, which is not expected. A possible explanation for this is that since the financial assets are held jointly, the interaction between couples retirement intentions may not be captured. More interestingly, those individuals who indicated that they do not intend to retire tend to hold a smaller proportion of risky financial assets. This may be a result of possible bequest motives or other factors at play.

For this employed household sample, we take into consideration the effects of risky labour income by using proxies. These proxies are whether the individual is self-employed; whether they are in casual employment; or whether they are employed in the financial industry. Whether an individual is self-employed is an indicator for risky labour income as those who are self-employed would have more uncertain income. The results from all three models show that there is a negative relationship between self-employment and the proportion of risky financial assets held by a household (both single and couple). The coefficients are statistically significant in most models and for singles and household heads. Casual work is used as proxy for 'risky' human capital. In this case, the results are mixed. The results are only statistically significant for household heads in the OLS model. The coefficient is negative in this case and as expected since casual employment has an element of risk attached.

Individuals working in the financial industry are used as proxy for risky human capital. For single households there is a negative relationship while for couple households the relationship is generally positive. One possibility that may partially explain the positive relationship is that many working in the financial industry are encouraged to buy shares in their company (and/or receive bonuses in the form of company shares) and may not realise the double exposure. Alternatively, those who work in the financial industry may have a better understanding of financial products and therefore are more willing to hold more risky investments such as shares. Overall, there is little evidence to support a relationship between being in the financial industry and the proportion of risky financial assets held as none of the coefficients are statistically significant.

Comparing the household and individual characteristics' coefficients with those from the full sample, i.e. both retired and employed households are included, the conclusions are similar. The number of resident children and investment substitutes such as investments in business, home or property, have a negative effect on proportion of risky assets held. Those with higher levels of education tend to hold more risky assets. Fair or good health has a positive effect but only for single households and partners in couple households. Those who are risk averse or have no cash reduce risky asset holdings. Singles and household heads receiving Age Pension payments tend to lead to households reducing risky assets holdings. This is an interesting result as one of the policy considerations associated with Age Pension is that it may be used as a safety net to fall back on should ventures into risky assets proven negative. However, this result seems to show that those who are on the Age Pension (full and part) do not seem to increase their risky asset holdings. Singles who arrive in Australia post 1992 tend to hold less risky assets in line with the expectation that they are more likely to be working towards funding their own retirement and less reliant on the Superannuation Guarantee Scheme.

Table 3.4 Retirement intention and risky financial assets: Single households and couple households

Dependent variable	Risky financial assets (narrow definition)								
Independent Variable	Single households			Couple households					
				Household Head			Partner		
	Pooled OLS	FE	RE	Pooled OLS	FE	RE	Pooled OLS	FE	RE
	Coefficient (Standard error)			Coefficient (Standard error)			Coefficient (Standard error)		
Years to intended retirement	0.0001	0.0007**	0.0003	0.0004*	0.0001	0.0002	-0.0003**	-0.0002	-0.0003*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Not retiring	-0.0205	-0.0567*	-0.0306	-0.0177	-0.0077	-0.0187	-0.0227	-0.0233	-0.0177
	(0.036)	(0.034)	(0.031)	(0.019)	(0.025)	(0.018)	(0.021)	(0.026)	(0.020)
Labour income characteristics									
Self employed	-0.0894**	-0.0401	-0.0629*	-0.0723***	-0.0279	-0.0606***	-0.0376**	0.0197	-0.0165
	(0.036)	(0.054)	(0.034)	(0.014)	(0.020)	(0.013)	(0.018)	(0.026)	(0.017)
Casual employment	-0.0069	0.023	0.0038	-0.0355**	0.0308	-0.0077	-0.0064	-0.0047	-0.0078
	(0.025)	(0.024)	(0.021)	(0.015)	(0.020)	(0.014)	(0.011)	(0.015)	(0.011)
Finance industry	-0.0089	-0.114	-0.0295	0.0375	0.041	0.0508	0.0349	0.0013	0.0285
	(0.046)	(0.121)	(0.052)	(0.025)	(0.106)	(0.040)	(0.022)	(0.041)	(0.021)
Household characteristics									
No. of resident children	-0.0279*	-0.0406*	-0.0268*	-0.0066	-0.0096	-0.0070*			
	(0.016)	(0.023)	(0.015)	(0.004)	(0.009)	(0.004)			
Net worth	0.0179***	-0.0031	0.0142***	0.0035***	0	0.0027**			
	(0.006)	(0.008)	(0.005)	(0.001)	(0.002)	(0.001)			
Net worth squared	-0.0002	0.0002	-0.0001	-0.0000**	0	-0.0000*			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
Business equity	-0.0078	-0.0104	-0.0104**	-0.0046***	0.0003	-0.0031**			
	(0.007)	(0.006)	(0.005)	(0.001)	(0.002)	(0.001)			
Home equity	-0.0133**	-0.0068	-0.0107**	-0.0012	-0.0011	-0.0012			
	(0.006)	(0.009)	(0.005)	(0.002)	(0.002)	(0.002)			
Property equity	-0.0112*	0.002	-0.0061	-0.0012	0.0004	-0.0008			
	(0.006)	(0.007)	(0.005)	(0.001)	(0.001)	(0.001)			
Individual Characteristics									
Age	0.0007	-0.0412*	-0.0084	0.0320**	0.0570***	0.0292**	-0.008	-0.0251	-0.0051
	(0.017)	(0.022)	(0.016)	(0.014)	(0.020)	(0.013)	(0.009)	(0.016)	(0.008)
Age squared	-0.0024	0.0377*	0.0051	-0.0284**	-0.0384**	-0.0254**	0.0067	0.0105	0.0032
	(0.015)	(0.020)	(0.014)	(0.013)	(0.017)	(0.012)	(0.009)	(0.014)	(0.008)

Table 3.4 Retirement intention and risky financial assets: Single households and couple households (continued)

Dependent variable	Risky financial assets (narrow definition)								
Independent Variable	Single households			Couple households					
				Household head			Partner		
	Pooled OLS	FE	RE	Pooled OLS	FE	RE	Pooled OLS	FE	RE
	Coefficient (Standard error)			Coefficient (Standard error)			Coefficient (Standard error)		
Male	-0.025		-0.0067						
	(0.023)		(0.024)						
Divorced	0.0708***	0.0195	0.0579**						
	(0.027)	(0.099)	(0.027)						
Widowed	0.0316		0.0257						
	(0.037)		(0.038)						
Income	0.0359	-0.0252	0.0241	-0.0083	-0.0297	-0.0085	0.0458**	0.0239	0.0372**
	(0.038)	(0.030)	(0.029)	(0.013)	(0.018)	(0.013)	(0.019)	(0.023)	(0.016)
Income squared	0.0065	0.001	-0.0043	-0.001	0.0032	-0.0003	-0.0031	0.006	-0.0015
	(0.014)	(0.009)	(0.009)	(0.002)	(0.003)	(0.002)	(0.003)	(0.006)	(0.002)
NESB	-0.0509		-0.0501	-0.0219		-0.0283	-0.0031		-0.0044
	(0.036)		(0.037)	(0.014)		(0.018)	(0.018)		(0.018)
High school	0.0334		0.0453	0.0351**	-0.0294	0.021	-0.0084		0.0037
	(0.039)		(0.038)	(0.016)	(0.131)	(0.020)	(0.016)		(0.016)
Diploma or certificate	0.0327		0.041	0.0410***	0.0111	0.0450***	0.0099		0.0102
	(0.026)		(0.027)	(0.011)	(0.087)	(0.013)	(0.013)		(0.013)
Higher degree	0.0463		0.0636**	0.0550***	-0.0722	0.0597***	-0.0077		0.0019
	(0.029)		(0.029)	(0.013)	(0.192)	(0.016)	(0.015)		(0.014)
Risk averse	-0.0546**	-0.0194	-0.0451**	-0.0463***	-0.0230*	-0.0385***	-0.0230**	0.0024	-0.0143
	(0.021)	(0.025)	(0.019)	(0.010)	(0.014)	(0.010)	(0.010)	(0.013)	(0.009)
No cash	-0.0774**	-0.025	-0.0698**	-0.0360**	0.0278	-0.0197	0.0061	0.0205	0.0055
	(0.033)	(0.047)	(0.035)	(0.016)	(0.022)	(0.016)	(0.015)	(0.021)	(0.015)
Med. planning horizon	0.0299	0.0329	0.0285	0.0046	0.0095	0.0076	-0.0329**	-0.0237	-0.0280**
	(0.025)	(0.028)	(0.024)	(0.012)	(0.015)	(0.012)	(0.013)	(0.014)	(0.012)
Long planning horizon	0.0053	-0.0212	-0.0088	-0.0294***	-0.008	-0.0205**	-0.0188*	-0.0052	-0.0125
	(0.019)	(0.023)	(0.018)	(0.010)	(0.014)	(0.010)	(0.010)	(0.013)	(0.010)
Fair health	0.1483***	-0.0588	0.0858	-0.017	-0.0238	-0.0131	0.0328	0.0587*	0.0437*
	(0.053)	(0.075)	(0.060)	(0.042)	(0.055)	(0.039)	(0.029)	(0.031)	(0.026)
Good health	0.1567***	-0.1223*	0.0726	0.0013	-0.0316	-0.002	0.0398	0.0391	0.0463*
	(0.048)	(0.069)	(0.053)	(0.041)	(0.057)	(0.039)	(0.026)	(0.030)	(0.025)

Table 3.4 Retirement intention and risky financial assets: Single households and couple households (continued)

Dependent variable	Risky financial assets (narrow definition)								
Independent Variable	Single households			Couple households					
				Household Head			Partner		
	Pooled OLS	FE	RE	Pooled OLS	FE	RE	Pooled OLS	FE	RE
	Coefficient (Standard Error)			Coefficient (Standard Error)			Coefficient (Standard Error)		
Age pension	-0.0937	-0.1277*	-0.0968*	-0.0341	-0.0852*	-0.0628*	0.0306	0.0783	0.0524
	(0.059)	(0.077)	(0.056)	(0.034)	(0.047)	(0.033)	(0.044)	(0.050)	(0.037)
Overseas pension	0.0856	-0.0685	0.0262	-0.0108	0.0839	0.0135	0.1275	0.1626*	0.1268
	(0.081)	(0.093)	(0.097)	(0.049)	(0.083)	(0.053)	(0.093)	(0.092)	(0.079)
Arriving post 1992	-0.2081***		-0.1869***	-0.0149		-0.0129	-0.025		-0.0367
	(0.050)		(0.049)	(0.032)		(0.040)	(0.032)		(0.033)
Wave 6	0.0359**	0.0497***	0.0418**	0.0351**	-0.0294	0.021	0.0397***	0.0347***	0.0384***
	(0.018)	(0.012)	(0.017)	(0.016)	(0.131)	(0.020)	(0.010)	(0.008)	(0.010)
Wave 10	-0.0013		0.0026	0.0410***	0.0111	0.0450***	0.0048		0.0049
	(0.025)		(0.025)	(0.011)	(0.087)	(0.013)	(0.012)		(0.012)

Standard errors are reported in parentheses. *** significant at 1% level, ** significant at 5%, * significant at 10%. Cluster robust standard errors are used.

3.6 Instrumental variables method

Two possible issues of endogeneity can arise while estimating the relationship between proportion of risky assets held and retirement. Firstly, retirement maybe correlated with an unobserved variable that also affects the proportion of risky assets held. An individual's retirement decision is likely to be based on inherent unobserved characteristics that may also impact on the household portfolio decision. This is the unobserved heterogeneity problem. We assume that unobserved heterogeneity is time invariant and use fixed effects and random effects methods to account for the omitted variable problem as seen in the previous section. However, if the omitted variables are time variant, the methods will not yield unbiased and consistent estimators. Another possible cause of endogeneity is reverse causality. In this chapter we are interested in the casual relationship of retirement on the proportion of risky assets held. However, there may be a reverse causal relationship in that the proportion of risky assets held may also affect retirement. In order to further address these endogeneity issues, we employ the use of the instrumental variables method.

3.6.1 Instrumental variables estimator: An Age Pension policy change

Section 3.4 Equation (3.1) sets out the following pooled regression model, which we estimated previously:

$$RA_{it} = \beta_0 + \beta_1 Retired_{it} + \beta_2 x_{it2} + \ \dots + \beta_k x_{itk} + \delta_0 Wave6_i$$
$$+\delta_1 Wave10_i + \nu_{it} \tag{3.1}$$

To solve the problem of correlation between the exogenous variables and the error term, ν_{it}, we use an instrumental variable estimator. For an instrumental variable Z_i to be valid, it must satisfy the following two conditions (Blundell and Costa Dias, 2000): the instrument Z_i must be correlated with retirement but uncorrelated with the error termν_{it}.

Table 3.5 Change in women's eligibility age for Age Pension

Date of implementation	Affects women born (inclusive)	Pension eligibility age
	Before 01/07/1935	60 years
01/07/1995	From 01/07/1935 to 31/12/1936	60 years and 6 months
01/07/1997	From 01/01/1937 to 30/06/1938	61 years
01/07/1999	From 01/07/1938 to 31/12/1939	61 years and 6 months
01/07/2001	From 01/01/1940 to 30/06/1941	62 years
01/07/2003	From 01/07/1941 to 31/12/1942	62 years and 6 months
01/07/2005	From 01/01/1943 to 30/06/1944	63 years
01/07/2007	From 01/07/1944 to 31/12/1945	63 years and 6 months
01/07/2009	From 01/01/1946 to 30/06/1947	64 years
01/07/2011	From 01/07/1947 to 31/12/1948	64 years and 6 months
01/07/2013	From 01/01/1949 to 30/06/1952	65 years

Source: Department of Social Services (2014).

The Australian retirement policy framework provides a suitable instrumental variable in addressing the possible endogeneity problem in the form of a policy change in Age Pension eligibility age for women in Australia, which occurred between wave 2 and wave 10, i.e. 2002 and 2010. Traditionally, the pensionable age for women has been 60 years of age compared to 65 for men (Commonwealth of Australia, 1997). Steps have been taken by the government to shift women's pension eligibility age in line with men's in order to cope with the demands on public pension spending. From 1 July 1995, the qualifying age for women increased by 6 months every two years, which affect women born before 1 July 1952 and continues until 1 July 2013 (see Table 3.5). This policy change occurs between wave 2 and wave 10, i.e. between 2002 and 2010.

Looking at Table 3.5, as a result of this policy change, a 62-year-old woman in wave 2 would be eligible for the Age Pension but a 62-year-old woman in wave 6 would not be eligible until she turns 63 years old and a 62-year-old woman in wave 10 would not be eligible until she is 64 years old. Therefore, an instrumental variable is created for those households affected by this change in Age Pension eligibility age.

This is a viable instrumental variable as the change in policy age would affect the household decision to retire or not. However, it is not correlated with the proportion of risky assets held by the household. Therefore, using change in the policy as an instrumental variable can potentially provide consistently estimated parameters, given the unobserved effects.

3.6.2 Instrumental variables estimation results

Given that this change in policy only affects women, we decided to pool the single and couple households and examine whether retirement status of household heads affect the proportion of risky assets held by the household. The instrument we are using here is the change in the Age Pension eligibility for women, which affects both single and couple households. In this pooled dataset, the household head can be male or female, in a couple relationship or single. The variable of interest is redefined for the instrumental variables estimation. Since this policy instrument only affects women, retirement is defined as whether anyone in the household (whether household head or partner) is retired completely from the workforce or not. This new definition is required given the policy only affect women and that household heads by definition are predominantly male. The relationship between the policy instrument and retirement should be stronger with this new definition.

Other covariates are the same as those estimated in the models in Section 3.5.1 and 3.5.2, where the retirement and risky asset holdings (both narrow and broad definitions) are examined. The household characteristics include net worth and other investment substitutes such as investment alternatives. The individual characteristics considered include health status, risk aversion and education level. The pooled sample consists of 5,915 single or couple households.

Firstly we examine the relationship between retirement and risky financial assets. This is the narrow definition where only risky financial assets are considered - that is, equities and the risky component of the superannuation balance. We estimate the relationship for all four models for comparison – pooled OLS, FE, RE and IV (see Table 3.6).

The variable of interest is whether any member of the household is retired. The coefficient for retired is negative in all models except FE. The IV estimate shows a negative but insignificant coefficient. Only the pooled OLS and RE coefficients are statistically significant. When comparing these results with those obtained in Section 3.5.1, care has to be taken as this sample only takes into account the retirement status of any member of the household compared with the estimations presented earlier where we take into consideration both the status of the household head and/or their partner. Overall, the results from the pooled sample indicate a negative relationship between retirement of a household member and proportion of risky assets held. This compares with the earlier results which indicate statistical significance in a negative relationship between retirement and risky asset holdings for the single households but not for couple households unless both couples are retired. Furthermore, the magnitude of the decreases are much smaller for the pooled sample.

Net worth has a positive effect on the proportion of risky financial assets held in all four models. The results also show alternative investment options (business, home and property other than home) have a negative effect. Higher levels of education have a positive effect, with magnitudes getting larger with higher levels of schooling. Furthermore, households which are risk averse or have no cash to invest tend to decrease the proportion of risky financial asset holdings. Interestingly, these results are similar to those obtained in the single and couple separate samples in terms of significance and direction of signs of coefficients.

Next we examine the broad definition of risky assets which include all types of risky assets including equities, the risky proportion of the superannuation balance, business investments and properties other than own home investments. For the variable of interest – whether anyone in the household is retired - the coefficients are negative and significant in the OLS and RE models. However, this is not so for the IV estimation. These results are similar to the narrow definition results discussed earlier. Compared to the broad estimation results in Section 3.5.2, the OLS and RE results are similar but the IV results indicate a lack of statistical relationship. For the remaining covariates, the conclusions are similar to those obtained in the narrow definition estimates.

The IV results fail to show a statistically significant relationship between retirement of the household head and the proportional of risky assets held – either in the form of financial assets or broad risky assets, although the economic relationship is negative. Despite this, the pooled OLS, FE and RE for this pooled sample show some other interesting result. There is a statistically significant negative relationship between Age Pension and retirement which indicates those individuals on Age Pension are not in a position to hold riskier assets. Furthermore, for the risky assets broad definition model, there is a negative relationship between those who arrive after 1992 and it is statistically significant.

We test for the relationship between the policy instrument and the variable of interest, i.e. the endogenous variable, by running a first stage least square estimation where retirement is the dependent variable with the instrument as a covariate along with the remaining covariates in the original risky financial assets and risky assets models estimated (see Section 3.5.1 and 3.5.2). The results are shown in Table 3.6. We can see that the coefficients for retirement in both first stage results are statistically significant at the 5% confidence level for both models. This means the instrument satisfy the instrument relevance rule for IV estimation.

Although this policy change is relevant for the retirement of women, the relationship may be weaker for men. This may explain the large standard errors on retirement in the IV estimation results. We test for whether the instrument is weak by calculating the F-statistic for testing the hypothesis that the instrument does not enter the first stage regression. The robust F-statistic is 3.1 and 2.8 respectively for the two models. Although both F-statistic are significant at 10% of significance, however, Hall *et al.* (1996) show that having an F-statistic at 5% or 10% is not sufficient and in fact Stock *et al.* (2012) suggest that it should exceed 10 for inferences based on the 2SLS to be reliable when there is only one endogenous regressor. In our results, both F-statistic do not exceed 10. It is very likely that the instrument is weak. This will lead to bias estimators and any hypothesis tests associated with the estimators may suffer from size distortion.

Table 3.6 Retirement and risky financial assets: instrumental variables estimations

Dependent variable	Risky financial assets (narrow definition)							
Independent variable			Household head				Partner	
	Pooled OLS	FE	RE	IV	Pooled OLS	FE	RE	IV
			Coefficient (Standard error)				Coefficient (Standard error)	
At least one retired	-0.0290**	0.0013	-0.0184*	-0.019				
	(0.012)	(0.014)	(0.010)	(1.393)				
<u>Household characteristics</u>								
No. of resident children	-0.0051	-0.0142*	-0.0079*	-0.0052				
	(0.005)	(0.007)	(0.004)	(0.005)				
Net worth	0.0101***	0.0050***	0.0092***	0.0101*				
	(0.001)	(0.002)	(0.001)	(0.006)				
Net worth squared	-0.0001***	-0.0000**	-0.0001***	-0.0001***				
	(0.000)	(0.000)	(0.000)	(0.000)				
Business equity	-0.0082***	-0.0030*	-0.0065***	-0.0082***				
	(0.001)	(0.002)	(0.001)	(0.002)				
Home equity	-0.0044***	-0.0031**	-0.0038***	-0.0043				
	(0.002)	(0.002)	(0.001)	(0.005)				
Property equity	-0.0038***	0.0004	-0.0018	-0.0038***				
	(0.001)	(0.001)	(0.001)	(0.001)				
<u>Individual characteristics</u>								
Age	0.0118**	0.0269	0.0114**	0.0119	-0.0089*	0.0049	-0.0064	-0.0089*
	(0.005)	(0.020)	(0.005)	(0.019)	(0.005)	(0.008)	(0.004)	(0.005)
Age squared	-0.0120***	-0.0119**	-0.0120***	-0.0121*	0.0071*	-0.0061	0.0044	0.0071
	(0.004)	(0.005)	(0.004)	(0.006)	(0.004)	(0.007)	(0.004)	(0.005)
Income	0.0174	-0.0308*	0.0102	0.0143	0.0002	0.0222	0.009	0.0037
	(0.014)	(0.016)	(0.012)	(0.424)	(0.022)	(0.019)	(0.016)	(0.496)
Income squared	-0.0069***	0.0038*	-0.0043**	-0.0067	0.0031	0.0027	0.001	0.0027
	(0.002)	(0.002)	(0.002)	(0.035)	(0.003)	(0.004)	(0.002)	(0.048)
NESB	-0.0159		-0.0235	-0.0157	-0.0414**		-0.0451***	-0.0416
	(0.015)		(0.015)	(0.034)	(0.018)		(0.017)	(0.034)
High school	0.0649***		0.0677***	0.0649***	-0.0086		-0.0028	-0.0089
	(0.018)		(0.018)	(0.020)	(0.017)		(0.016)	(0.037)

Table 3.6 Retirement and risky financial assets: instrumental variables estimations (continued)

Dependent variable	Risky financial assets (narrow definition)							
Independent variable	Household head				Partner			
	Pooled OLS	FE	RE	IV	Pooled OLS	FE	RE	IV
	Coefficient (Standard error)				Coefficient (Standard error)			
Diploma or certificate	0.0601***		0.0680***	0.0600***	0.0011		0.0003	0.0016
	(0.011)		(0.011)	(0.013)	(0.013)		(0.012)	(0.066)
Higher degree	0.0828***		0.0980***	0.0826***	-0.0237		-0.0156	-0.0236
	(0.014)		(0.013)	(0.028)	(0.016)		(0.015)	(0.021)
Risk averse	-0.0912***	-0.0107	-0.0598***	-0.0914**	-0.0268***	-0.0114	-0.0211**	-0.0272
	(0.010)	(0.011)	(0.009)	(0.036)	(0.010)	(0.012)	(0.009)	(0.056)
No cash	-0.1340***	-0.0156	-0.0903***	-0.1341***	-0.0031	-0.0009	-0.0106	-0.0032
	(0.014)	(0.016)	(0.012)	(0.023)	(0.016)	(0.020)	(0.015)	(0.026)
Med. planning horizon	0.0079	-0.0195*	-0.0023	0.008	-0.0157	-0.0228*	-0.0163	-0.0159
	(0.010)	(0.010)	(0.009)	(0.014)	(0.012)	(0.013)	(0.011)	(0.027)
Long planning horizon	-0.004	-0.0275***	-0.0098	-0.004	-0.0087	-0.0107	-0.0054	-0.0089
	(0.009)	(0.009)	(0.008)	(0.010)	(0.011)	(0.012)	(0.010)	(0.032)
Fair health	0.0550***	-0.0027	0.0376**	0.0534	0.0146	-0.0025	0.0067	0.0151
	(0.018)	(0.020)	(0.015)	(0.220)	(0.027)	(0.025)	(0.022)	(0.064)
Good health	0.0828***	-0.007	0.0604***	0.0807	0.0329	-0.0141	0.0137	0.0338
	(0.017)	(0.021)	(0.015)	(0.288)	(0.027)	(0.026)	(0.022)	(0.124)
Age pension	-0.0343*	-0.0450**	-0.0451***	-0.0334	0.0129	0.0113	0.0155	0.0139
	(0.018)	(0.019)	(0.015)	(0.128)	(0.023)	(0.025)	(0.020)	(0.142)
Overseas pension	-0.0346	0.0216	-0.0187	-0.0347	0.0153	0.0185	0.0164	0.0148
	(0.024)	(0.026)	(0.021)	(0.024)	(0.040)	(0.049)	(0.036)	(0.080)
Arriving post 1992	-0.0512		-0.0548	-0.0504	0.0176		0.0101	0.0176
	(0.037)		(0.035)	(0.120)	(0.033)		(0.032)	(0.033)
Wave 6	0.0320***	-0.0387	0.0263***	0.0319**				
	(0.007)	(0.066)	(0.006)	(0.016)				
Wave 10	-0.0019	-0.1338	-0.0061	-0.0023				
	(0.008)	(0.131)	(0.008)	(0.061)				
Retired*Income	0.0685***	-0.0117	0.0337*	0.0786				
	(0.023)	(0.016)	(0.017)	(1.404)				
No partner	-0.3287**		-0.2933**	-0.3249				
	(0.133)		(0.121)	(0.546)				

Standard errors are reported in parentheses. *** significant at 1% level, ** significant at 5%, * significant at 10%. Cluster robust standard errors are used. N=5,915.

Table 3.7 Retirement and risky assets: instrumental variables estimations

Dependent variable	Risky assets(broad definition)							
Independent variable	Household head				Partner			
	Pooled OLS	FE	RE	IV	Pooled OLS	FE	RE	IV
	Coefficient (Standard error)				Coefficient (Standard error)			
Retired	-0.0238***	0.0049	-0.0159**	-0.3764				
	(0.008)	(0.010)	(0.008)	(0.312)				
Household characteristics								
No. of resident children	-0.0046	-0.0067	-0.0063	-0.0093				
	(0.004)	(0.008)	(0.004)	(0.007)				
Net worth	0.0228***	0.0190***	0.0217***	0.0243***				
	(0.001)	(0.001)	(0.001)	(0.002)				
Net worth squared	-0.0001***	-0.0001***	-0.0001***	-0.0001***				
	(0.000)	(0.000)	(0.000)	(0.000)				
Home equity	-0.0307***	-0.0230***	-0.0280***	-0.0308***				
	(0.002)	(0.002)	(0.002)	(0.002)				
Individual characteristics								
Age	0.0026	0.0249	0.0003	0.0187	-0.0052	0.0083	-0.0024	-0.0079
	(0.004)	(0.029)	(0.004)	(0.015)	(0.004)	(0.007)	(0.003)	(0.005)
Age squared	-0.0027	0.0008	-0.0014	-0.0115	0.0044	-0.008	0.002	0.0051
	(0.003)	(0.004)	(0.003)	(0.008)	(0.003)	(0.005)	(0.003)	(0.004)
Income	-0.0048	0.0251*	0.0067	-0.0548	0.0055	0.0384**	0.0187	-0.112
	(0.012)	(0.014)	(0.011)	(0.047)	(0.015)	(0.015)	(0.013)	(0.110)
Income squared	-0.0038*	-0.0034*	-0.0040**	-0.001	-0.0036*	-0.0068***	-0.0051***	0.011
	(0.002)	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.002)	(0.014)
NESB	0.0002		-0.0015	0.0027	-0.0313***		-0.0340***	-0.0199
	(0.010)		(0.010)	(0.012)	(0.012)		(0.012)	(0.017)
High school	0.0074		0.0082	-0.0144	0.0137		0.014	0.016
	(0.013)		(0.013)	(0.024)	(0.012)		(0.012)	(0.016)
Diploma or certificate	0.0219***		0.0217***	0.01	0.0107		0.0123	-0.00000886
	(0.007)		(0.007)	(0.013)	(0.008)		(0.008)	(0.014)
Higher degree	0.0245**		0.0270***	0.0059	0.0034		0.004	-0.0052
	(0.010)		(0.010)	(0.020)	(0.012)		(0.012)	(0.016)
Risk averse	-0.0430***	-0.0024	-0.0303***	-0.0437***	-0.0130*	0.0044	-0.0079	-0.0183*
	(0.006)	(0.007)	(0.006)	(0.008)	(0.007)	(0.009)	(0.007)	(0.010)
No cash	-0.0679***	-0.0211*	-0.0537***	-0.0583***	-0.0115	-0.0063	-0.0111	-0.0259
	(0.010)	(0.011)	(0.009)	(0.014)	(0.011)	(0.014)	(0.010)	(0.018)

Table 3.7 Retirement and risky assets: instrumental variables estimations (continued)

Dependent variable	Risky assets (broad definition)							
Independent variable	Household head				Partner			
	Pooled OLS	FE	RE	IV	Pooled OLS	FE	RE	IV
	Coefficient (Standard error)				Coefficient (Standard error)			
Med. planning horizon	0.0129**	-0.0057	0.008	0.0124	-0.0087	-0.0119	-0.0091	-0.0113
	(0.006)	(0.007)	(0.006)	(0.008)	(0.008)	(0.009)	(0.007)	(0.010)
Long planning horizon	0.0166***	-0.0089	0.0096*	0.0154**	0.0006	-0.0091	-0.0026	-0.0011
	(0.006)	(0.007)	(0.005)	(0.008)	(0.008)	(0.009)	(0.007)	(0.009)
Fair health	0.0167	-0.02	0.0071	-0.0122	0.0132	0.0242	0.0179	-0.0149
	(0.012)	(0.014)	(0.010)	(0.029)	(0.017)	(0.016)	(0.014)	(0.031)
Good health	0.0304**	-0.018	0.0206*	-0.008	0.0116	0.0127	0.0128	-0.0326
	(0.012)	(0.015)	(0.011)	(0.037)	(0.016)	(0.017)	(0.013)	(0.043)
Age pension	-0.0433***	-0.008	-0.0328***	-0.0091	0.0154	0.0315*	0.0188	-0.0239
	(0.011)	(0.013)	(0.010)	(0.032)	(0.014)	(0.018)	(0.013)	(0.040)
Overseas pension	0.0044	0.0092	0.0002	-0.0045	-0.0049	-0.0017	-0.0033	0.0013
	(0.017)	(0.019)	(0.015)	(0.018)	(0.022)	(0.029)	(0.020)	(0.023)
Arriving post 1992	-0.0640***		-0.0586**	-0.0641**	0.0127		0.0121	-0.0031
	(0.024)		(0.026)	(0.027)	(0.022)		(0.022)	(0.030)
Wave 6	0.0107**	-0.1162	0.0062	-0.0003				
	(0.005)	(0.104)	(0.005)	(0.012)				
Wave 10	-0.0088	-0.2572	-0.0161***	-0.0325				
	(0.006)	(0.208)	(0.006)	(0.022)				
Retired*Income	0.0118	-0.0133	0.0301	0.4147				
	(0.017)	(0.017)	(0.022)	(0.393)				
No partner	-0.1514		-0.0567	-0.2772				
	(0.113)		(0.107)	(0.182)				

Standard errors are reported in parentheses. *** significant at 1% level, ** significant at 5%, * significant at 10%. Cluster robust standard errors are used. N=5,915.

Table 3.8 Retirement and risky and risky financial assets: instrumental variables estimations first stage results

Dependent variable	At least one retired			
Independent variable	Household head		Partner	
	Risky financial assets	Risky assets	Risky financial assets	Risky assets
	Coefficient (Standard error)		Coefficient (Standard error)	
Policy change	0.0525**	0.0497**		
	(0.025)	(0.025)		
Household characteristics				
No. of resident children	-0.0119**	-0.0128**		
	(0.006)	(0.006)		
Net worth	0.0074***	0.0041***		
	(0.001)	(0.001)		
Net worth squared	-0.0000***	-0.0000***		
	(0.000)	(0.000)		
Business equity	-0.0080***			
	(0.001)			
Home equity	-0.0038**	-0.0003		
	(0.002)	(0.001)		
Property equity	-0.0030***			
	(0.001)			
Individual characteristics				
Age	0.0447***	0.0452***	-0.0092*	-0.0084
	(0.006)	(0.006)	(0.005)	(0.005)
Age squared	-0.0240***	-0.0244***	0.0031	0.0026
	(0.004)	(0.004)	(0.004)	(0.004)
Income	-0.1466***	-0.1415***	-0.3306***	-0.3338***
	(0.017)	(0.017)	(0.025)	(0.025)
Income squared	0.0083***	0.0078***	0.0408***	0.0413***
	(0.003)	(0.003)	(0.004)	(0.004)
NESB	0.007	0.0073	0.0340*	0.0326*
	(0.015)	(0.015)	(0.019)	(0.019)
High school	-0.0626***	-0.0619***	0.0041	0.0061
	(0.017)	(0.017)	(0.018)	(0.018)
Diploma or certificate	-0.0350***	-0.0340***	-0.0312**	-0.0304**
	(0.010)	(0.010)	(0.014)	(0.014)

Table 3.8 Retirement and risky and risky financial assets: instrumental variables estimations first stage results (continued)

Dependent variable	At least one retired			
Independent variable	Household head		Partner	
	Risky financial assets	Risky assets	Risky financial assets	Risky assets
	Coefficient (Standard error)		Coefficient (Standard error)	
Higher degree	-0.0595***	-0.0526***	-0.0281*	-0.0246
	(0.013)	(0.013)	(0.016)	(0.016)
Risk averse	0.0001	-0.0023	-0.0133	-0.0152
	(0.011)	(0.011)	(0.013)	(0.013)
No cash	0.0289*	0.0271*	-0.0380**	-0.0408**
	(0.015)	(0.015)	(0.019)	(0.019)
Med. planning horizon	-0.0002	-0.0012	-0.0055	-0.0073
	(0.012)	(0.012)	(0.015)	(0.015)
Long planning horizon	-0.0042	-0.0033	-0.0044	-0.004
	(0.011)	(0.011)	(0.013)	(0.013)
Fair health	-0.0804***	-0.0817***	-0.0787**	-0.0800**
	(0.020)	(0.020)	(0.032)	(0.032)
Good health	-0.1090***	-0.1088***	-0.1263***	-0.1255***
	(0.019)	(0.019)	(0.030)	(0.030)
Age pension	0.1005***	0.0971***	-0.1030***	-0.1036***
	(0.017)	(0.017)	(0.023)	(0.023)
Overseas pension	-0.0269	-0.0255	0.0206	0.0184
	(0.025)	(0.025)	(0.034)	(0.034)
Arriving post 1992	0.0071	-0.001	-0.0475	-0.0452
	(0.042)	(0.042)	(0.038)	(0.038)
Wave 6	-0.0333***	-0.0326***		
	(0.010)	(0.010)		
Wave 10	-0.0530***	-0.0515***		
	(0.011)	(0.011)		
Retired*Income	0.6715***	0.6942***		
	(0.022)	(0.022)		
No partner	-0.8736***	-0.8457***		
	(0.159)	(0.160)		
Robust F-statistic	3.1408*		2.8037*	

Standard errors are reported in parentheses. *** significant at 1% level, ** significant at 5%, * significant at 10%.

3.7 Discussion

The aim of this chapter is to investigate the empirical question: do retired households exhibit behaviour that is consistent with holding a smaller proportion of risky assets compared to working households? Furthermore, do labour market characteristics affect asset allocation? We use a number of panel data estimation techniques.

Firstly, we consider single and couple households and the relationship between retirement and risky financial asset holdings. We find some evidence of a decrease in the proportion of risky assets held for retired single households. However, for couple households, if only one of the household head or their partner is retired, the relationship (between retirement and risky assets) is positive. If both are retired then the household reduces the proportion of risky financial assets held. These latter two results point to the evidence that the financial decision is made jointly by the household; one party remaining in the job market, provides a safety net for the household to invest in riskier financial assets, compared to those households where the couple is completely retired from the job market.

Next we examine the relationship between retirement intentions and the proportion of risky financial assets held by the household. Here we assume that the individual is forward looking when it comes to investment and retirement, i.e. how far away they are from their planned retirement age plays a role in their investment choices. Taking the sample of single and couple households still employed, we find some weak evidence of retirement intention impacting on the proportion of risky financial assets held. That is, an increase in the difference between the individual actual age and their intended retirement age leads to an increase in the proportion of risky assets held. To clarify, this means the shorter the years between intended retirement age and actual age lowers the proportion of risky assets held. However, this result is not statistically significant for most models except for FE for single households and pooled OLS for couple households. Furthermore, the relationship is negative for partners.

We also test whether there are differences in findings for different definitions of risky assets – that is whether the narrow definition is used, or the broader definition (which also includes property and business investments). We find that for single households the results are largely the same (irrespective of the definition of risk assets), while for couple households the household head tends to reduce the proportion of risky assets held when retired under the broader definition. A likely explanation for this difference is the definition incorporates business and other property investments and individuals tend to exhibit more caution when it comes to buying and selling these investments compared to financial assets such as shares.

Lastly, we also consider the use of an instrumental variable to account for the issue of endogeneity. The endogeneity can arise from unobserved heterogeneity whereby the retirement decision may be based on unobserved characteristics that may also impact on the portfolio decision. Another source of endogeneity may be reverse causality where the retirement decision may be affected by the proportion of risky assets held. As a result, we use instrumental variable estimations. The instrument being used is the change in women's Age Pension eligibility age which is correlated with retirement but not with the risky assets held. The results show a lack of relationship between retirement and the proportion of risky assets held in both the financial definition and the broad definition.

This chapter offers an Australian perspective to the empirical literature on household asset allocation by focusing on the relationship between retirement and asset allocation using the HILDA dataset. The evidence of some weak support for the hypothesis of a decrease in the proportion of risky assets upon retirement is of interest to policymakers as their objective is to ensure the elderly have adequate and secure income for retirement and are not overly reliant on government transfers. Evidence in support of the hypothesis is not overwhelming. This may be partially due to the fact that many Australians of the age 45 and above have few assets outside of their superannuation account and own home, and many have poor financial skills. Policymakers should ensure that older Australians choose (or be directed to) safer asset allocations for their superannuation accounts in order to safeguard their retirement savings. In 2013, the total risky asset allocation of the default investment strategy for Australian superannuation funds was 68% (Australian Prudential Regulation Authority, 2014a), which could be considered risky for those who are retired and have depleted their human capital. Furthermore, 44% of total assets are invested in default strategy[32]. Both policymakers and superannuation funds should consider developing investment strategies specific for individuals approaching retirement and in the post retirement phase. These could include life cycle and target date funds, where the asset allocation in the portfolio emphasizes safe rather than risky as the person ages or approaches specific target dates.

Interestingly, in the realm of retirement policy development in Australia, the Federal Government outlined in their 'Stronger Super' reforms a new simple and cost-effective default superannuation product called MySuper. This product includes one single diversified investment strategy which can be a life-cycle investment option (Commonwealth of Australia, 2011). As at January 2014, there are 116 MySuper products with a few still finalizing the approval process. Of these, 22 are life-cycle products which either involves members switching or cohort funds (Mercer, 2014). Member switching is where members are switched from growth options to a more conservative one as they age. Whereas, cohort funds involves pooling funds of members within the same age groups and manage the investments based on their age. The implementation of the MySuper products is increasing the prevalence of life-cycle funds to the Australia and thus provides more guidance on moving towards safe assets for those approaching or in retirement.

Another important question for policymakers is whether the means tested Age Pension acts as an incentive to engage in risky investment behaviour. From the results presented in this chapter, this does not seem to be the case – for both single and couple households, receiving an Age Pension is associated with a reduction in the holdings of risky assets. This could be due to pensioners not having the financial capacity to invest outside superannuation. The investigation of the impact of part pensions on risky asset holdings is an avenue for further research.

[32] The APRA statistics only takes into account entities with more than 4 members.

3.8 Limitations

The mixed results obtained using the four models (OLS, FE, RE and IV) can be partially attributed to the limitations of the HILDA dataset. One of the most important of these in the context of the analysis discussed in this chapter is the lack of transparency associated the reported superannuation balance which does not provide a breakdown of investment options within the funds. This means that the specific portfolio allocation for each individual is unknown. Instead the industry average is used as a proxy. In doing so, it limits the analysis in this chapter to a fixed asset mix based on the industry average, for all households and individuals of all ages. This may create biases in the results although in which direction it is hard to ascertain. Kingston & Fisher (2014) find that the share between growth assets and safe assets for superannuation portfolio is in reality around 70 to 90 per cent and that the fees charged by fund managers are usually higher for growth assets compared to safe assets, therefore there is a push by the industry for a more aggressive portfolio. Therefore, the industry average (in the default investment option) we used may be on the conservative side and perhaps in reality households hold even more risky assets.

The lack of statistical relationship between retirement and proportional risky assets held could reflect those households holding only risky assets in the form of superannuation and not any other forms. Furthermore, there are households with zero risky assets holdings.

We performed the Hausman test to test whether a RE or a FE model should be used. This tests the null hypothesis that the coefficients estimated by the efficient RE estimator are same as the ones estimated by the consistent FE estimator. If we reject this null, then FE should be used. The tests results show rejection of the null in all models and that FE should be used. However, the lack of statistical significance associated with the coefficients from the FE model is problematic. This is likely due to the lack of variation associated with within individual observations, although we have already eliminated covariates that are not likely to vary with time. Many of the variables such as age pension or risk preferences may change very slowly over time given the household examined is 45 years old and over. The FE model is not designed for such sluggish data. Beck (2001) has suggested if after testing whether FE model is needed, the researcher will need to weigh up the pros and cons of losing the explanatory power of slowly changing or table variables versus the gains from decreased sum of squared errors. In further work, alternative specifications should be investigated. Plumper & Troeger (2007) suggests a three-stage estimation method for time-invariant/rarely changing variables in panel data. This method involves a first stage of running a FE model, the second stage decomposes the unit effects of time-invariance variables and an error term and the third stage re-estimates the first stage by pooled OLS and including the error term from the second stage.[33]

3.9 Conclusion and further research

The central question being examined in this chapter is the relationship between retirement and the proportion of risky assets held. The aim is to test empirically the rule of thumb prescribed by financial planners regarding asset allocation, which is also an implication of the life-cycle model of consumption and saving (as evident from Chapter 2). The coherence and wide scope of the life-cycle framework makes it extremely useful in modelling lifetime choices in many aspects including saving, consumption, human capital and labour supply (Browning & Crossley, 2001). However, there are weaknesses associated with the framework including the lack of empirical corroboration for some of the theoretical implications derived from the model. In the case of asset allocation, the framework suggests that individuals in retirement (i.e. have completely withdrawn from the labour market) should hold less risky assets. Subsequently, we consider the older Australian population, those over the age of 45, as people in this age range would be likely to be making decisions relating to retirement and retirement finances.

We find some evidence of a decrease in the proportion of risky assets held for retired single and couple households. There is also some weak support for the relationship between retirement intention and risky portfolio choice. We also find individuals with risky labour income tend to hold a lower proportion of risky assets. Other factors affecting

[33] However, Greene (2011) disproved the efficiency of the methodology.

risky asset holdings include non-English speaking background, risk preferences and financial planning horizon.

A possible future research avenue can be to estimate a truncated model or a selection model[34]. These models can be used to account for the phenomenon of a number of households holding limited amount of risky assets or zero amounts outside of superannuation balances.

[34] We have conducted previous studies on the same research question using 2002 and 2006 HILDA waves. The results are also weak when using a 2SLS and probit models even after correcting for endogeneity using IV. Similar mixed results are also obtained when using a recursive bivariate probit model where we separated the retirement decision and the phasing down of risky assets decision.

Chapter 4: The retirement-consumption puzzle: An Australian perspective using subjective retirement expectations

4.1 Introduction

For individuals approaching retirement, the main issue of concern is the ability to maintain an acceptable standard of living after retirement. The Association of Superannuation Funds of Australia (ASFA) issues the ASFA Retirement Standard, which contains annual budget benchmarks needed by Australians to fund a comfortable or modest standard of living in retirement. The latest benchmarks, as at the December quarter 2013, show that the annual budget amount for a single person and a couple for a modest lifestyle are $23,175 and $33,358 respectively (The Association of Superannuation Funds of Australia)[35]. This estimated amount is higher than the amount of Australia's Age Pension but only budgets for basic activities.

It is of interest to policymakers and academic researchers alike to examine consumption expenditure at retirement in order to assess whether individuals have saved enough for retirement and whether they have maintained the living standards of their working (pre-retirement) years. One common measure of whether retirees are as well off is to examine retirement incomes by calculating the replacement rate. That is, the income in retirement as a proportion of working income[36]. The rationale is that the retiree's income post retirement should be a reasonable proportion of their income during working life to maintain their standard of living. However, depending on how the replacement rate is calculated, it may not take into consideration those who use non-annuitised wealth to fund consumption. Examining expenditure directly may be a better method to measure the standard of living post retirement (Smith, 2006).

[35] ASFA benchmarks are adjusted for inflation and assumes the retiree(s) own their own home.

[36] The calculation of the 'replacement rate' is not a simple concept as it can be calculated in a number of ways including before or after tax; as a ratio of year before and first year of retirement; or average working life income as a proportion of average expected retirement income.

The life-cycle model framework hypothesises that rational and forward-looking agents choose to smooth the marginal utility of consumption when maximising their expected lifetime utility. As a consequence, the individual undertakes 'consumption smoothing' throughout their entire life-cycle including both during working life and retirement. However, some recent empirical studies investigating how and whether household expenditure changes as households enter retirement find that there is a drop in consumption at retirement (Hamermesh, 1984; Banks *et al.*, 1998; Bernheim *et al.*, 2001). This is known as the 'retirement-consumption puzzle'.

In Australia, the retirement income arrangements consist of a three-pillar system comprising – a universal and means tested Age Pension, compulsory privately managed retirement savings and lifetime voluntary savings. In 1992, the Superannuation Guarantee scheme was introduced as the second pillar. The third pillar of the system includes voluntary superannuation and other forms of saving and investment such as in property, managed funds and equities. The retirement income system is still considered to be immature and even those with full Superannuation Guarantee coverage have only 22 years of coverage. The scheme will become mature in 2037 after reaching what could be considered a full working life of 35 years (Commonwealth of Australia, 2008). A key feature of the reforms to the retirement income system, including the introduction of the Superannuation Guarantee, has been to shift the responsibility to individuals to make their own decisions regarding the amount of voluntary contributions, portfolio allocation of superannuation assets and timing of retirement.

A central focus of policymakers is to determine whether the retirement income policy arrangements lead to adequate incomes (resulting in an adequate standard of living) in retirement. To this end, a drop in expenditure in retirement (relative to pre-retirement expenditure) may be contrary to the life-cycle model's prediction of consumption smoothing and may indicate that retired households have not saved enough (Smith, 2006). However, a drop in expenditure in retirement could also be attributed to a number of other factors such as: the cessation of work-related expenses (Hurd & Rohwedder, 2006), irrational planning prior to retirement (Bernheim *et al.*, 2001), lack of self-control leading to under-saving (Hurd & Rohwedder, 2006), uncertainty associated with the timing of retirement (Smith, 2006), increased leisure time for home production (Aguiar & Hurst, 2005a), poor financial literacy (Lusardi & Mitchell, 2014) or due to hyperbolic discounting (Laibson, 1997).

Empirically, the drop in expenditure in retirement has been observed in a number of countries including the U.S., Spain, Japan, Italy and China (Banks *et al.*, 1998; Bernheim *et al.*, 2001; Hongbin *et al.*, 2003; Miniaci *et al.*, 2003; Wakabayashi, 2008; Luengo-Prado & Sevilla, 2013). In the Australian context, (Barrett and Brzozowski, 2009, 2010 & 2012) have conducted extensive investigation of the consumption-retirement puzzle with the main focus on separating out voluntary and involuntary retirement as a possible explanation for the puzzle.

This chapter continues the overall theme of the thesis of examining the retirement behaviours of the population transitioning to retirement - that is, households over the age of 45. The focus here is on the consumption (and expenditure) aspects of retirement choice using the Household, Income and Labour Dynamics in Australia (HILDA) dataset from 2001 to 2011. The key research questions posed in this chapter are as follows: Do older Australian households exhibit a fall in consumption as they move into retirement? (If so) Can this fall be explained by subjective retirement expectations?

This chapter adds to the existing but limited literature on the retirement-consumption puzzle in Australia (as cited in (Barrett and Brzozowski,,2009, 2010 & 2012) by focusing on subjective retirement expectations to distinguish between expected and unexpected retirement. Furthermore, we utilise more recent data from HILDA than that used in previous research and examine possible delay effects of retirement on consumption.

We build on the methodology of (Haider and Stephens, 2004 & 2007) which employs subjective retirement expectations as an instrument for retirement. However, we differ from the aforementioned papers in the following two aspects: firstly, we use the more extensive set of covariates available in HILDA in the instrumental variables estimations to account for any further omitted variable bias. Secondly, we account for a possible delayed effect of retirement on consumption by estimating a two-year difference in the log consumption equation.

The answers to the research questions offer some empirical evidence in support of the life cycle model as well as empirical corroborations of some of the predicted optimal paths generated by the simple life cycle model in Chapter 2. We find that for households who retire as planned, consumption is not observed to fall. However, there is evidence of the retirement-consumption puzzle in Australia for those households who do not retire as planned. That is, where there are external shocks contributing to unforseen retirement. This suggests that individuals are behaving consistently with the life-cycle portfolio theory of consumption and agents are forward looking and rational.

The subsequent structure of this chapter is as follows: in Section 4.2 we discuss the literature on the retirement-consumption puzzle in Australia and internationally with focus on the explanations of this phenomenon. We then discuss in detail the methodology we use in Section 4.3. Section 4.4 explores features of the data and the construction of estimation samples. Section 4.5 discusses the empirical results and Sections 4.6 and 4.7 conclude the chapter with a discussion of the implications, limitations and further research.

4.2 Literature review

In a life-cycle framework, when the utility function depends on consumption and the marginal utility is continuous and declining in consumption, the maximisation of this utility function would result in the marginal utility of consumption (and consumption) to be smooth (Smith, 2006). However, many studies using data from around the globe find contradictory empirical evidence. For example, Banks *et al.* (1998) find a fall in consumption at around retirement for British households; Bernheim *et al.* (2001) observe this phenomenon in the U.S.; Schwerdt (2005) investigates and finds similar support, using German data; and Battistin *et al.* (2009) documents such evidence for Italy. There are a number of explanations put forward in the literature to account for this drop in consumption at retirement (Bernheim *et al.*, 2001; Hurd & Rohwedder, 2006).

The drop in consumption itself is well documented and is not under contention (Barrett & Brzozowski, 2009). What is controversial is that some of the possible interpretations for this fall are attributed to agents not being rational or forward looking, which is contrary to the spirit of the life-cycle theory.

4.2.1 Cessation of work expenses and home production

The consumption needs of households who are working and those no longer in the labour market may be different. Those not retired may incur extra costs associated with working. However, Banks *et al.* (1998) and Bernheim *et al.* (2001) find that the cessation in work-related expenses is not large enough to fully explain the drop in consumption at retirement.

Another possible explanation arises from the distinction between consumption and expenditure, i.e. the amount of food consumed may not necessarily match the amount of expenditure on the food, as examined in Aguiar and Hurst (2005a). Here the authors use U.S. consumption data from the Continuing Survey of Food Intake of Individuals to examine actual consumption as measured by the nutrition level versus food spending. They find that, despite a drop in food spending at retirement, actual consumption is not adversely affected (measured quantitatively and qualitatively). This gives rise to the explanation that retired households have more leisure time than working households, and thus they have more time for home production and spend more time on food preparation and shopping for cheaper food items.

To find further support for this hypothesis, the aforementioned authors used scanned data records of actual purchases by households and find that the price paid by those over the age of 65 are lower than those in younger age groups (Aguiar & Hurst, 2005b). Brzozowski and Lu (2010) replicate Aguiar and Hurst (2005a) using Canadian data and make the distinction between food consumption and observed food expenditure using the Canadian Food Expenditure Survey and the Canadian Nutrient File. The authors find that, contrary to the US results from Aguiar and Hurst (2005a), there is no fall in expenditure at retirement and, in fact, they observed some positive effect of retirement on food consumption. The authors postulate that this may be attributed to Canada having a wider social safety net for the elderly compared to the U.S.

4.2.2 Irrationality and lack of forward looking behaviour

An alternative explanation put forward in the literature is that individuals do not adequately foresee the decline in income when retired. Bernheim *et al.* (2001) find that differences in relative leisure preferences, home production or work-related expenses cannot fully explain the drop in consumption at retirement, of which the magnitude is negatively correlated with retirement savings and income replacement rates. The authors further conclude that the results can be accounted for outside the life-cycle framework. That is, instead of being forward looking, households use rules of thumb when saving prior to retirement and then re-evaluate and adjust at retirement. This poses a contradiction to the life-cycle framework of forward-looking intertemporal optimisation.

Expectations play an important role in determining consumption and expenditure changes. Intertemporal optimisation requires agents to make rational decisions based on information about future events. Retirement is assumed to be an anticipated event. A possible reason for the drop offered in Bernheim *et al.* (2001) is that individuals are aware of under saving but lack self-control. This also contradicts life-cycle theory as agents are assumed to be making rational and optimal decisions. (Hurd and Rohwedder (2003), 2006)) offer empirical evidence against the theories put forward by Bernheim *et al.* (2001). These authors use data from the Health and Retirement Study (HRS) and the supplementary Consumption Activities Mail Survey (CAMS) and compared expected and actual changes to consumption at retirement. They find that individuals are not surprised by the drop in consumption at retirement with some actually anticipating the drop. Furthermore, wealthier individuals, for whom their consumption is not expected rationally to fall at retirement, still anticipated a decline in consumption. Ameriks *et al.* (2007) find complementary evidence to the results of (Hurd and Rohwedder (2003), 2006)). Using information from TIAA-CREF participants, they conclude that households do expect a decline in consumption when retiring and that the expected decline roughly matches the actual decline at retirement.

4.2.3 Unanticipated shocks

Relating to the role played by expectations, another interpretation of the drop in consumption at retirement is that if the timing of retirement is unknown and uncertain, then it leads to a sudden drop in lifetime resources and hence a corresponding reduction in consumption in retirement (Smith, 2006). Uncertainty can arise in the form of illness or job loss, which is unanticipated[37]. This interpretation is in line with the life-cycle model. Banks *et al.* (1998) find that a large proportion of the fall in consumption around the time of retirement can be attributed to anticipated changes in household demographics and labour market status. However, they postulate that the remaining unexplained drop is due to unanticipated shocks, which change information at retirement rather than lead households to make irrational choices regarding consumption. Smith (2006) and Barrett Brzozowski (2012) consider involuntary retirement as a possible piece of the puzzle. Smith (2006) uses the British Household Panel Survey and makes the distinction between voluntary and involuntary retirement. The latter occurs earlier than anticipated and is associated with negative wealth shocks due to a loss in income. The authors find that a reduction in food spending is only significant when the retirement is involuntary but not when it is voluntary. This is consistent with the explanation provided and shows that with an adverse shock, individuals with lower levels of lifetime wealth cannot cushion against the unexpected fall, resulting in a decrease in consumption.[38]

Noone et al. (2003) find that involuntary retirement is associated with a lack of preparedness for retirement, lower levels of income and satisfaction with life.

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[37] Using the 2011 Census of Population and Housing, the 2008-09 Multipurpose Household Survey and 2011-12 Barriers to Employment for Mature Age Australians Survey, Adair & Lourney (2014) find 51.3% of people between the ages of 50 to 69 retire as a result of retrenchment, dismissal or sickness, injury or disability in Australia.

38 Indeed, Noone et al. (2013) find that involuntary retirement is associated with a lack of preparedness for retirement, lower levels of income and satisfaction with life (including factors such as health, daily activities and family life).

Barrett and Brzozowski (2009, 2010 & 2012) investigate the retirement-consumption puzzle in the Australian context utilising the HILDA dataset Waves 1 to 7. In a similar vein to Smith (2006), the authors examine the relationship between involuntary retirement and consumption. Their results show a drop in consumption at retirement which is evident for those who retire unexpectedly. For those who retire as planned, there are no significant changes in their expenditure at retirement. This is consistent with the UK results reported in Smith (2006). Consumption is used as a measure of well-being in the literature, along with the ability to smooth consumption through the transition to retirement. However, it does not directly translate to household welfare. Therefore the authors investigate alternative measures of well-being, including financial hardship indicators, self-reported financial and life satisfaction, and the relationship with retirement. Consistent with the retirement and consumption results, they find that for a large number of households, where retirement is expected, there is no decline in economic welfare at retirement. However, those households for which retirement is 'forced' experience decline across all indicators of economic well-being.

Haider and Stephens (2004 & 2007) offer a similar approach to Smith (2006) and Barrett and Brzozowski (2009, 2010 & 2012). However, instead of explicitly categorising expected and unexpected retirement, the authors use subjective retirement expectations as an instrumental variable in estimating the relationship between retirement and consumption. The idea is that subjective retirement expectations are a strong indicator of subsequent retirement decisions and thus can be used to test whether consumption drops at expected retirement. The Retirement History Survey (RHS) and Health and Retirement Study (HRS), both U.S. datasets, are employed and subjective retirement expectations are found to be strongly correlated with actual retirement. Despite using these expectations as an instrument, there is still a significant drop in consumption at retirement. The authors also tested alternative explanations of the puzzle such as household bargaining (single versus couple households) (Lundberg *et al.*, 2003) and home production (Hurd & Rohwedder, 2003) and find that there is no evidence to support these hypotheses.

The overall consensus in the literature is that there is evidence of an existence of drops in consumption at retirement. However, the decline is evident in food expenditure (for example Hurst (2003)) and therefore as Hurst (2008) points out, it should be a retirement food expenditure puzzle. Aguiar and Hurst (2008) find that changes in non-food spending are either close to zero or increasing as households transit to retirement. So the primary drivers of the decline in expenditure are work related expenses and food spending. This is confirmed by Fisher *et al.* (2008) who compare retired and non-retired household spending.

The majority of authors are able to account for this drop in food expenditure using models incorporating home production or when taking into account involuntary retirement due to unforeseeable shocks (Hurst, 2008). This chapter continues the work on the retirement food consumption puzzle by adopting an Australian perspective. The question is asked - is the phenomenon in existence in Australia? And if so, can unexpected retirement explain this decline? This chapter adds to the work already undertaken on the retirement consumption Barrett and Brzozowski (2009, 2010 & 2012) by using a more up to date HILDA dataset and utilising a different methodology to approach the research question.

4.3 Methodology

The key research question asked in this chapter is whether the retirement-consumption puzzle exists in Australia and whether it can be addressed when retirement is instrumented by subjective retirement expectations. The HILDA survey offers a longitudinal dataset consisting of 10 relevant waves of information including retirement questions and household expenditure information in waves 1 and 3 to 11. We are able to estimate a pooled cross section ordinary least squares model (pooled OLS) to investigate the relationship between retirement and consumption. Due to the endogeneity of the retirement decision to unobserved heterogeneity, we use subjective retirement expectations as an instrument for retirement and obtain instrumental variables estimation results. In the following section we discuss the theoretical model that lends itself to the estimation model and then turn to the estimation method.

4.3.1 Theoretical model

The life-cycle model provides the starting point for the estimation strategy in examining consumption at retirement. The individual faces the following problem (adapted from

(Bernheim *et al.* (2001); Smith (2006); Haider and Stephens (2007))) in which she chooses consumption by maximising lifetime utility:

$$\max_{C_t}\left\{U(C_t)\psi(X_t)+E_t\left[\sum_{s=t+1}^{T}\left(\frac{1}{1+\delta}\right)^{s-t}U(C_s)\psi(X_s)\right]\right\} \tag{4.1}$$

subject to the following budget constraint:

$$A_{t+1}=(1+r)(A_t+Y_t-C_t)$$

where C_t is consumption, Y_t is income and A_t is total wealth; $U(C_t)$ is the utility function; X_t and X_s are variables that affect utility (acting through $\psi(\cdot)$) which can be a vector of exogenous characteristics such as age and family size; r is the constant interest rate and δ is the individual's subjective discount rate.

Solving for the first order condition results in the following:

$$U'(C_t)\psi(X_t)=\left(\frac{1+r}{1+\delta}\right)E_t[U'(C_{t+1})\psi(X_{t+1})] \tag{4.2}$$

This gives the marginal utility of consumption so that an optimising individual allocates consumption over time periods to equate the marginal utility of consumption today with the discounted expected marginal utility of consumption in the future.

Using a constant relative risk aversion utility function of the form:

$$U(C_t)=\frac{1}{1-\rho}C_t^{1-\rho} \tag{4.3}$$

where ρ is the coefficient of relative risk aversion. We take the derivative, substituting into Equation (4.2) and utilising a first-order Taylor's approximation using log form results in the following approximation:

$$\Delta\ln C_{t+1}=\frac{1}{\rho}(r-\delta)+\frac{1}{\rho}\Delta\ln\psi(X_{t+1})+\nu_{t+1} \tag{4.4}$$

The uncertainty is captured by the expectational error term ν_{t+1}.

4.3.2 Estimation model

In order to estimate the relationship between retirement and consumption, we can utilise Equation (4.4) and formulate the following empirical equivalent:

$$\Delta\ln C_{i,t+1}=\alpha_i+\beta Retire_{i,t+1}+\gamma X_{i,t+1}+\nu_{i,t+1} \tag{4.5}$$

where $i=1,\dots,N$ and $t=1,\dots,T$

$Retire_{i,t+1}$ is a dummy variable for whether or not the head of the household retires between period t and $t+1$; $\Delta\ln C_{i,t+1}$ is the difference between consumption in period t and $t+1$, i.e. consumption growth; and $X_{i,t+1}$ is a vector of time varying demographic characteristics including change in household composition. It must be noted that although i denotes individuals, within the literature, consumption and expenditure are examined on a household level. This is partly due to the data being collected by household rather than on an individual level. A possible reason is that couple households usually share meals and groceries. Subsequently, we use household expenditure data with individuals referring to household heads.

The variable $Retire_{i,t+1}$ is likely to be endogenous, i.e. an individual's retirement decision is likely to be based on inherent unobserved characteristics that may also impact on the consumption decision. As a result $Retire_{i,t+1}$ maybe correlated with the error term $\nu_{i,t+1}$. If this is the case, estimating using Equation (4.5) will yield inconsistent results. A solution to this is to use an instrumental variable strategy where an instrumental variable estimator is used. For an instrumental variable Z_i to be valid, it must satisfy two conditions: Z_i must be correlated with retirement but uncorrelated with the error term $\nu_{i,t+1}$. Then a two-stage least squares model can be estimated.

The common practise in the literature is to use age as an instrument for retirement as seen in Banks *et al.* (1998) and Aguiar and Hurst (2005a)[39]. The reason for this is that age is seen as a strong predictor of retirement as it is closely related to eligibility for government retirement benefits. However, the validity of this instrument is questionable as older households are generally observed to reduce consumption as they age and the relationship between age and actual retirement is not the same as between age and expected retirement (Haider & Stephens, 2004). Both of these issues make age a less than optimal candidate as an instrument. Smith (2006) (in a UK study) and Barrett and Brzozowski (2012) (in an Australian study) propose explicitly taking into account voluntary (expected) and involuntary (unexpected) retirement to address the endogeneity directly. Haider and

[39] Alternative estimation methods also include regression discontinuity approach (see Battistin *et al.* (2009) and Hongbin *et al.* (2003)) and structural modelling (see Laitner and Silverman (2005)).

Stephens (2007) in a later US study suggest to use subjective retirement expectations as an instrument instead of age. In this chapter we are interested in retirement behaviour and have therefore adopted Haider and Stephens' approach in employing subjective retirement expectations.

In the first stage, retirement is regressed on a set of instruments:

$$Retire_{i,t+1} = \alpha_0 + \alpha_1 Z_i + \alpha_3 X_i + \epsilon_i \tag{4.6}$$

Then, predicted retirement, $Predret_{i,t+1}$ is constructed from the first stage estimations and used in place of $Retire_{i,t+1}$ in the estimation equation. Thus, the second stage is:

$$\Delta \ln C_{i,t+1} = \alpha_i + \beta Predret_{i,t+1} + \gamma X_{i,t+1} + \nu_{i,t+1} \tag{4.7}$$

The rational expectations assumption provides a useful instrument in the form of subjective retirement expectations (Haider & Stephens, 2007). To see this, we simplify Equation (4.2) by assuming X_t is constant and $r = \delta$ which becomes:

$$U'(C_t) = U'(C_{t+1}) + \epsilon_{t+1} \tag{4.8}$$

where ϵ_{t+1} is the expectation error. Under the rational expectations assumption, the error term, ϵ_{t+1}, should be uncorrelated with information known to individuals at time t. Therefore, information available at time t and exogenous variables should satisfy the conditions required of instruments.

As discussed previously, we use subjective retirement expectations as an instrument for retirement as was also used in Haider and Stephens (2007). This variable satisfies the criteria for a valid instrument in the following way. Firstly, due to the rational expectations assumption it is not correlated with expectation error between period t and $t + 1$; secondly, it is known to individuals in each period and thus can be a potential instrument for future retirement; and lastly it is a strong predictor of future retirement.

4.4 Data

To answer the question of the existence of the retirement-consumption puzzle in Australia, we use 10 years of the longitudinal dataset HILDA and construct an 'over 45 years' household sample which is undergoing retirement transition for estimation. We focus on household expenditure in the form of spending on groceries and food (as proxies for consumption expenditure) and other household and individual demographics in estimating the relationship of interest.

4.4.1 HILDA Dataset

HILDA survey a household based social and economic panel study which commenced in 2001. The interviews are conducted annually and the survey collects information on economic and subjective well-being, labour market dynamics and family dynamics of Australian individuals and households, as well as reoccurring special modules on topics such as wealth and retirement. HILDA started (in 2001) with a sample of households occupying private dwellings in Australia, which is tracked over time with new members added resulting from changes in household composition[40]. To date there are 11 waves. This chapter uses expenditure and demographic data from Waves 1, 3 to 11 (Wave 2 did not collect any household expenditure information), that is from year 2001, and then 2003 to 2011, spanning 11 years. Weekly household expenditure questions are asked in Waves 1, 3, 4 and 5. From Wave 6 onwards this is changed to annual household expenditures. Furthermore, only Waves 1, 3, 4 and 5 contain expenditure information on food and drinks inside the home, with this question being omitted in subsequent waves.

4.4.2 Sample construction

This chapter examines the consumption behaviour of households pre- and post-retirement. Subsequently, we use a sample of households aged 45 and over since HILDA asks retirement questions to those in that age group. The expenditure information is collected on a household basis, which brings into question the definition of household types in the survey. Those living in the same dwelling are considered to be a household when they make provision for food and other essentials of living (Summerfield *et al.*, 2012). Consequently, the definition of a household should not be confused with family in this context. In a multi-person household, those living together can include those related and unrelated. HILDA defines a number of different types of household types. Non-standard households are excluded in order to adequately model the relationship between

[40] In Wave 11, new households were included as a top up to the original chosen households.

retirement and consumption. In particular it is difficult to disentangle consumption components amongst members of the same household. Therefore, the standard households used to construct the analysis sample are:

- Lone person
- Single parent with children under 15
- Single parent with dependent student(s)
- Couple only
- Couple with children under 15
- Couple with dependent student(s)

We restrict our analysis to those who were 45 years and over in Wave 1 (2001). Then a 'head of the household' is identified: this can be either a lone person (male or female) or the male member of a couple household. In the case of same sex couple households, one person is randomly assigned as the head of the household. The household heads are then matched to their respective partners (where applicable). The focus of the chapter is retirement expectations and the key question of when an individual expects to retire is only asked of those not retired. Therefore, our sample includes households whose heads are not retired in Wave 1 (2001). These households are then tracked through the 10 waves[41] until they retire. After they become retired, the expectations question is not asked and therefore the subsequent observations of a retired household are not included. It is noted that only the first movement into retirement is considered in the analysis[42]. Any subsequent movements are ignored.

The resulting panel used in the analysis is unbalanced due to households becoming retired and then dropping out of the sample. The decision to construct the sample in this fashion is twofold: firstly, due to the use of the expectation as an instrument which inevitably leads to the truncation of the data; secondly the homogeneity of these households, i.e. they are all transitioning to retirement, makes any discontinuity in expenditure at

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[41] Wave 2 is not included in the analysis due to consumption not recorded in the wave. Consequently only 10 waves are being analysed although in terms of timeline it is 2001 to 2011, i.e. 11 years.

[42] This is in line with methods used in Haider and Stephens (2007) and Barrett and Brzozowski (2012). Not accounting for subsequent re-entering into the work force simplifies the estimation process.

retirement more acute. The problem with using a more heterogeneous full sample would be comparing the expenditure of households which have been already retired with households who are retiring.

4.4.3 Variables

To investigate the retirement-consumption puzzle, we use food expenditure as a proxy for household consumption behaviour. HILDA collects information on a number of proxies for consumption. These are items from the household expenditure components of the survey. Respondents are asked the following series of questions:

- "How much does this household spend on groceries in a normal week?"
- "About how much of the weekly grocery bill goes on food and drink (but not alcohol)?"
- "Approximately, how much would this household usually spend per week on meals outside the home; that is, restaurants, takeaways, bought lunches and snacks? Do not include anything spent on alcohol"

The amounts for these items are amounts averaged across individuals providing responses in the survey for each household. As a result, the key dependent variables used in the analysis in this chapter are 'household expenditure on groceries', 'food purchased for consumption at home' and 'food purchased for consumption outside of the home'.

These expenditures do not include alcoholic beverages and they correspond to the household's weekly spending. The expenditure item 'food purchased for consumption at home' is only collected in Waves 1, 3, 4 and 5, while the other two consumption proxies are collected in all waves except Wave 2, in which expenditure questions were not asked. Furthermore, there were changes in survey design to yearly expenditures recorded rather than weekly values. However, the yearly values are converted into weekly values. Expenditure items are deflated using the Consumer Price Index relating to food and non-alcoholic beverages from the Australian Bureau of Statistics' food and non-alcoholic beverages sub-index, using 2011 as the base year.

Some studies have argued against the use of food expenditures as a measure of household expenditures on the grounds that it is a limited measure of household expenditure. These studies tend to use a broader range of nondurable goods including utilities (Browning *et al.*, 2003), However, Browning *et al.* (2003) find that food categories explain a large part of the variance of total nondurables. This is attributed to the recall method rather than diary use for recording expenditures and, as a result, may be less reliable. The authors also find that 'food at home' expenditure collected via the recall method does as well as the diary method used in Italian and Canadian surveys.

The use of food expenditures to measure household consumption is a commonly adopted approach in the literature (see for example Smith (2006), Haider and Stephens (2007) and Barrett and Brzozowski (2012)). Since food is a nondurable good then any changes in food should be closely linked with changes in household utility (Haider & Stephens, 2007). Furthermore, if households do not smooth expenditure on food, they are less likely to smooth other forms of spending - thus it provides a test for consumption smoothing (Smith, 2006). Consequently, we choose to work with food expenditure in investigating the retirement-consumption puzzle and it also offers comparability with other studies.

The variable of interest in this study is retirement from the workforce. Here we define retirement as being a state in which the individual considers herself to be retired and no longer working or looking for work. The 'retirement' variable is derived from the response to the question, asked of individuals over the age of 45 in HILDA, as to whether they are retired from the labour force. The survey question asked is: 'have you retired completely from the workforce?' In the event that their response is ambiguous, the derived variable 'labour force status' is also used. This is constructed according to the Australian Bureau of Statistics classifications of 'employed', 'unemployed' and 'not in the labour force'.

In a sense, the definition of retirement is a subjective one. Other studies such as Barrett and Brzozowski (2012) use current labour market status and some argue that subjectively defined retirement can differ (Disney & Tanner, 1999). Given we are using subjective retirement expectations to instrument retirement (as discussed later in this chapter), the issue is not substantial provided that when individuals refer to both expectations of retirement and actual realisations of this expectation, they have the same event in mind (Disney & Tanner, 1999).

In choosing the covariates for estimation, we turn to previous literature. Haider and Stephens (2007) use age, changes in household size between two periods, and wave dummies in their estimation, citing the use of these variables is consistent with previous studies in changes in consumption. Indeed this is confirmed in Banks *et al.* (1998) where the authors chose similar sparse covariates in their estimation model. We estimate a simple base model in line with Haider and Stephens (2007) as well as a model with additional variables in line with more recent literature such as Barrett and Brzozowski (2012), Smith (2006) and Bernheim *et al.* (2001) which include health status, marital status and family size as controls in the estimations.

We use a number of household and individual characteristics available from HILDA as controls. Household composition, which is derived from the type of household and the number of resident children living in the household, is hypothesised to influence consumption. The role of demographics in consumption growth models is confirmed in works such as Attanasio and Browning (1993). The dummy variable of whether the household lives in a major city in Australia is included to control for any food price differences between city and regional/remote areas with regional areas having higher food prices. Barrett and Brzozowski (2012) use a similar location variable – state of residence.

The individual characteristics are captured for both the household head and their partner (if they are not single), provided we were able to match household heads and their respective partners for more precise controls. Smith (2006) controls for health status in the estimation model in order to control for the indirect effect of health on spending as ill-health individuals are likely to retire involuntarily. We also control for health status. An individual's health status is constructed from the self-reported health question: 'in general, would you say your health is: excellent, very good, good, fair or poor?'. Two dummy variables are used – 'good health' equals 1 if the response is excellent/very good/good and dummy variable 'fair health' equals one if the response is fair. The base dummy is 'poor health'. Bernheim *et al.* (2001) and Barrett and Brzozowski (2012) include disability as a control. The reasoning behind this is that long term illness and physical disability is likely to affect consumption growth in households. Therefore, a dichotomous variable is also created for whether the individual has a long-term illness or disability.

4.4.4 Descriptive statistics

Table 4.1 shows the descriptive statistics for the starting year and final year of the dataset used, in Wave 1 (2001) and Wave 11 (2011) respectively. We also separate out the sample for ‘not retired’ and ‘retired’ in Wave 11 for comparison. Given the way the sample is constructed, we essentially examine consumption (as defined earlier) and personal characteristics for the years before retirement and then for the first year of retirement. As a result, the panel is unbalanced, with those who retire dropping out of the sample after the first year of retirement. Therefore, the number of observations at the start, i.e. in 2001 (wave 1), is larger with 1052 households and this number halves by 2011 (wave 11) as households become retired and drop out of the sample. Essentially, those remaining in the 2011 sample are those not retired or in the first year of retirement.

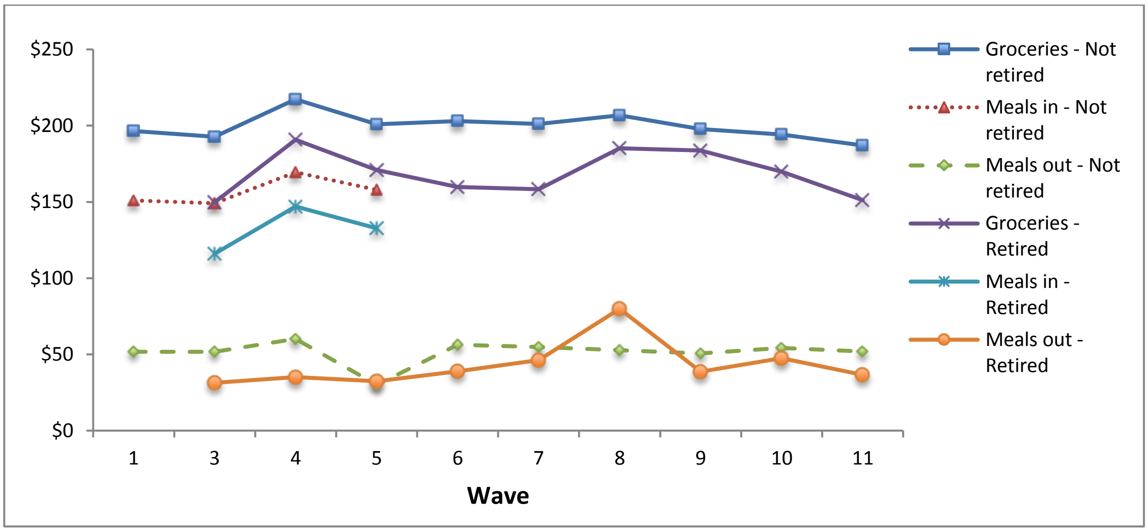
The average age of those in 2001 is 54 years, which is younger compared to the mean age of 61 in 2011 (mean age is 60 for the not retired sample in 2011). Of the 549 households remaining in 2011, 31% are in the first year of retirement. The sample consists of single and couple households and the criteria used to allocate the household member as household head (i.e. male) means that the majority of the household heads are male. Only 20% of household heads are female in 2001 and this percentage does not change significantly by 2011 (even when separating out retired versus unretired).

Around 32% are single households in 2001 and this number falls to 30% in 2011 as the cohort ages. The average household size remains at around two members for both waves. About 58% of the households live in a major Australia city in 2001 and this percentage remains the same in Wave 11. Repeating these comparisons for Wave 11 retired and unretired households, we note that retired households have slightly smaller household sizes, a greater percentage live in a major city and there is a slightly larger proportion of single households.

Table 4.1 Descriptive statistics Wave 1 and Wave 11

	2001	2011	2011 Not retired	2011 Retired
Age	53.59	60.63	60.39	64.58
Retired	0	31%		
Female	19.77%	19.31%	19.31%	19.35%
Single	32.41%	29.69%	29.54%	32.26%
Household size	2.34	2.12	2.13	1.84
Living in a major city	58.17%	57.92%	51.61%	58.30%
Expenditures - groceries	$193.86	$181.84	$183.57	$152.79
Expenditures – food at home	$149.01	$148.31	$149.59	$127.00
Expenditures – food outside home	$50.97	$50.23	$51.03	$37.02
Health - good	85.46%	80.15%	80.31%	77.41%
Health – fair	10.46%	13.66%	13.71%	12.90%
Long term illness/disability	22.62%	28.6%	28.19%	35.48%
Partner’s age	50.28	56.94	56.69	61.33
Partner retired	21.98%	20.67%	12.60%	41.38%
Partner’s health - good	56.92%	54.83%	55.60%	41.94%
Partner’s health – fair	5.8%	8.74%	8.69%	9.68%
Partner’s long term illness/disability	13.59%	18.94%	18.92%	19.35%
Number of observations	1052	549	518	31

Figure 4.1 Average expenditure by year and retirement status



The mean value of weekly expenditure on groceries is $193.86 in 2001 and this figure falls to $181.84 in 2011 (these figures are not adjusted to 2011 CPI). Both spending on food at home and outside home show a similar trend in weekly expenditure - $149.01 to $148.31 and $50.97 to $50.23 respectively. When comparing the average household in 2001, which is essentially not retired, with the average not retired household in 2011 (with the exception of expenditure as measured by spending on groceries), food eaten at home and food eaten outside of home, remain similar. However, the mean value of weekly expenditure on groceries falls by $10. Interestingly, we also compare the expenditures of households who are retired in 2011 with unretired households. We find that the average expenditures are lower by around 20% across all three categories of expenditure types for retired households.

We also plotted the average amount of each of the expenditure measures by wave and retirement status. This is displayed in Figure 4.1. We can see on average, weekly spending on groceries is lower for those who are retired compared to those not retired for all waves. This is similar for the average spending on meals consumed at home. For retired households, expenditure as measured by food eaten outside of home is generally lower than their non-retired counterparts (except for wave 8). It is evident that there are large differences in household expenditure for the retired and non-retired households as measured by food expenditures.

The majority of the household heads report their health to be good at 85% but it decreases slightly in 2011 at 80% as the cohort ages. Those with long term illness and disability increases from 23% to 29% during the 11 years. This is as expected given an increase in average age. Comparing the retired and unretired households in Wave 11, we note that on average a smaller proportion of retired heads of household have good health and fair health compared to their non-retired counterparts. Furthermore, they tend to have a greater proportion of household heads with long term illness/disability.

For partners, the mean age is 50 in 2001 and 57 in 2011 (although the average age is higher for retired households in 2011 at 62 years). Given the definition of household heads, the partners are predominantly female and younger than their partners. Only 22% are retired in the first wave and of those remaining in the sample, 21% are retired in the last wave. For self-reported health, 57% of partners report to be in good health in 2001 and this percentage decreases slightly by 2011. Conversely, the percentage of partners with a long-term illness increases from 14% in the first wave (2001) to 19% in the last wave (2011). Comparing partner's health in Wave 11 according to retirement status of the household head, it can be noted that the proportion of partners in good health is higher for not retired household heads, although the percentages are similar for partners with fair health and with long term illness/disability.

4.4.5 Actual retirement and retirement expectations

When looking at the relationship between retirement and consumption, we need to take into account that the timing of retirement may be correlated with unobserved events such as the consumption decision (Barrett & Brzozowski, 2010). This suggests that it is important to account for expected versus unexpected retirement. To do this we use subjective retirement expectations as an instrument for retirement. In order to assess whether it is a good instrument in predicting subsequent retirement, we examine the relationship between retirement and expected retirement. In each HILDA wave, working individuals are asked the following question: 'At what age do you expect to retire completely from the paid workforce?' In Wave 1, based on the information at hand, the individual would form some expectations about when they would retire. This expectation would be updated as new information arrives.

Firstly, using individuals' responses to the key question from Wave 1, the wave in which they expect to retire is calculated by taking the difference between expected retirement age and actual age. This difference would indicate in which wave they would expect to retire. Figure 4.2 shows the distribution of the expected retirement waves for household heads in the sample used in Wave 1. It can be observed that the percentage of people expecting to retire in waves 3 to 11 is low, under 5%, and similar for all periods. This is due to the starting age of those in the sample being relatively 'young', 45 years old, and far from actual retirement (by wave 11 the youngest individuals would be 56) with the average age of retirement being 62 years of age. Therefore as at Wave 1, 24% of household heads plan to retire beyond Wave 11 with 9% saying they do not intend to retire and 18% indicating they do not know when they will retire.

Figure 4.2 Expected retirement in wave 1

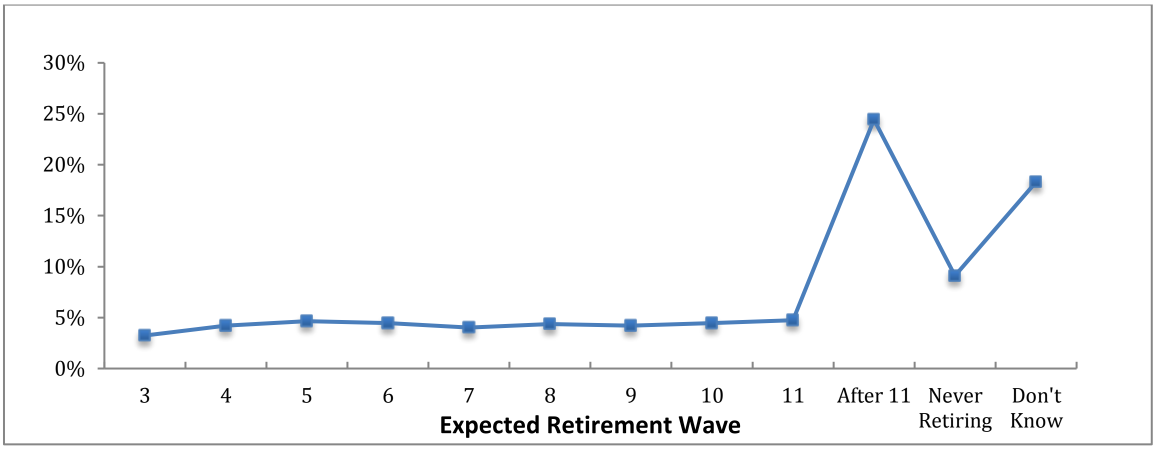


Figure 4.3 Actual retirement vs wave 1 retirement expectations (wave 3-5)

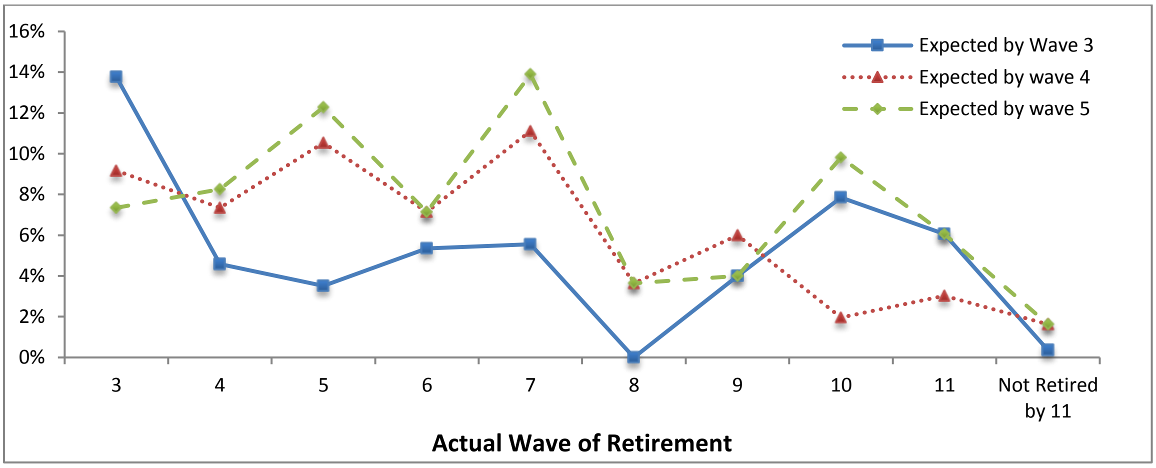


Figure 4.4 Actual retirement vs wave 1 retirement expectations (wave 6-8)

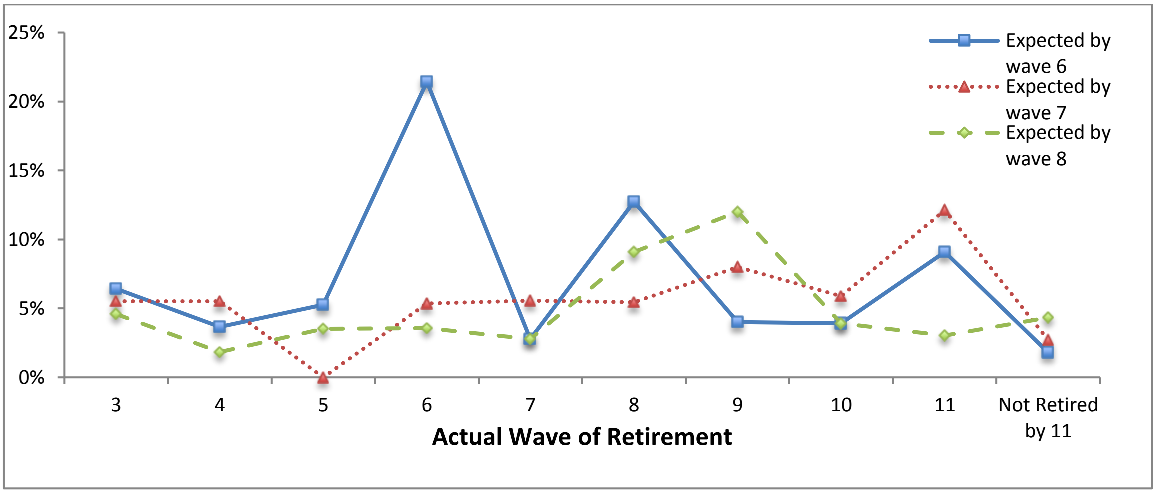


Figure 4.5 Actual retirement vs wave 1 retirement expectations (wave 9-11)

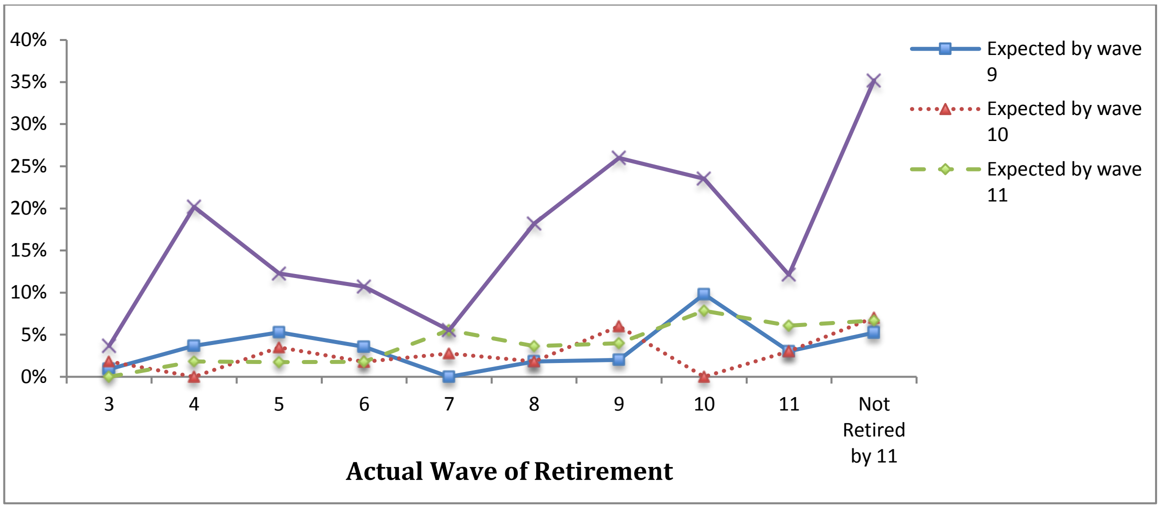
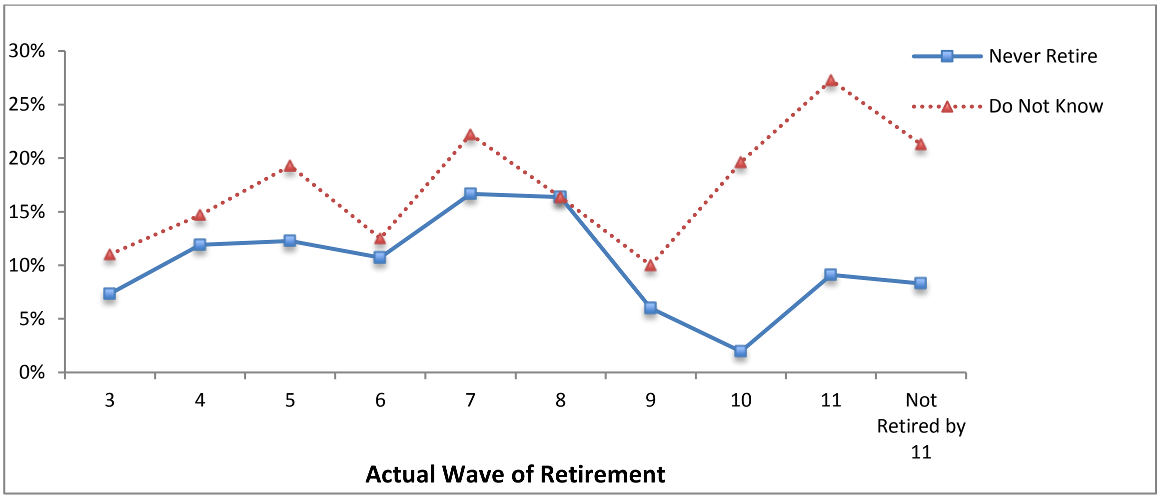


Figure 4.6 Actual retirement vs wave 1 retirement expectations (never retire & do not know)



Figures 4.3 to 4.5 present the relationship between the wave in which the household heads actually retired and Wave 1's retirement expectations, i.e. as at Wave 1, the wave in which they expect to retire. For those who expect to retire in Wave 3 and Wave 6, the modal retirement realisation is in the same wave. For most other waves, the modal wave of realised retirement occurs within two to three years after the expected retirement wave. Disney and Tanner (1999) make an important point regarding expectations being a single measure: for those with uncertainty about their date of retirement, when asked to make a choice on a single age, they will need to condense an underlying probability distribution over a number of different expected retirement ages and this will not necessarily correspond with a mathematical 'expectation'. Bernheim (1987) goes on to assert that individuals are inclined to report the most likely retirement age as opposed to the mean expected retirement age.

Another possible reason for this is that due to the ambiguity of the exact date of birth and date of retirement, expected retirement wave and actual retirement wave may not be exactly the same. For example, a person who is 60 years of age in 2001 and who intends to retire at the age of 65 could plan to leave her job in 2005, 2006 or 2007 depending on the date of birth and retirement date. Bernheim (1987), using the RHS, finds that expectations are highly accurate as long as the retirement intentions are not too long into the future. This can be seen in the HILDA data used here: given that the expectations are formed in Wave 1, predictions in later waves are less accurate (with the exception of expected retirement after Wave 11 as it encompasses a large number of years).

It is also interesting to note that those who provide a response to the expected retirement age question as 'never retire' or 'don't know when they will retire' end up with similar retirement pattern as seen in Figure 4.6. Disney and Tanner (1999) use UK data and find that the response of 'don't know' may reflect a genuine level of uncertainty rather than being uninformed.

To further investigate the strength of the relationship between retirement and expected retirement, the first stage of the 2 stage least squares (2SLS) estimation can be used, i.e. estimating Equation (4.6). This is also to rule out whether the correlation is just due to a strong age-retirement relationship. To do this, we firstly construct a dichotomous variable called ‘expecting to retire’ from individuals’ retirement expectations. The expecting to retire dummy equals 1 if household heads indicate they expect to retire in the year of the survey, one year after the survey or two years after the survey. For all other responses, they are not expecting to retire. Firstly, the responses to Wave 1’s retirement expectations question are used to construct this variable.

Table 4.2 and 4.3 show the results for three different specifications for age and two models. The age specifications considered are linear, quadratic and age category dummies which are used to anticipate different age consumption relationships. The first model, a simple one which includes age, change in household composition and wave dummies, follows the models used in Haider and Stephens (2007). The second model includes other covariates – location, health, disability, partner’s retirement status, partner’s health and partner’s disability (commonly used in the literature). The results on the left panel of Table 4.2 show that, based on expectations formed in Wave 1, those who expect to be retired between two waves are 2% more likely to retire using the linear age and quadratic age formulation in the simple model and 3% more likely to retire when using the age dummies. Under the full covariates model as shown in Table 4.3, which includes the full set of controls, these probabilities are similar to those from the simple model across all age specifications.

The right panels in Table 4.2 and 4.3 also show the relationship between retirement and expected retirement using the most current expectations, i.e. for consumption in period $t+1$ we use retirement expectations from period t. For Wave 3 we use Wave 1’s expectations, for wave 4 we use Wave 3’s expectations and so on. The rationale for this is that under rational expectations, individuals should base their expectations on the most up to date information. Therefore, with the lapse of time, individuals receive new information and should update their retirement expectations accordingly. Hence, the relationship between expected and actual retirement should be stronger if the most current retirement expectations are used instead of those from Wave 1 only. Comparing the results for Wave 1’s and most current expectations, it can be seen across all age specifications and models that the coefficients on retirement expectations are more statistically significant compared to those obtained using Wave 1’s expectations.

Table 4.2 Predicting retirement using retirement expectations: Simple covariates

Dependent variable	Retired					
	Wave 1's expectations			Most current expectations		
	Age	Age, Age^2	Age dummies	Age	Age, Age^2	Age dummies
	Coefficient (standard error)			Coefficient (standard error)		
Retirement expectations	0.0177***	0.0171**	0.0273***	0.0462***	0.0455***	0.0641***
	(0.007)	(0.007)	(0.007)	(0.009)	(0.009)	(0.009)
Age	0.0104***	0.0180***		0.0099***	0.0158**	
	(0.001)	(0.007)		(0.001)	(0.007)	
Age^2		-0.0001			-0.0001	
		(0.000)			(0.000)	
Age (45-54)			-0.0289			-0.0226
			(0.262)			(0.261)
Age (55-64)			0.0343			0.0337
			(0.262)			(0.261)
Age (65-74)			0.1644			0.1622
			(0.262)			(0.262)
Age (75-84)			0.0917			0.086
			(0.264)			(0.263)
Household composition	0.0140*	0.0138*	0.0161**	0.0143*	0.0142*	0.0164**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Wave 3	0.1120***	0.1152***	0.0914***	0.1093***	0.1119***	0.0878***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Wave 4	0.1089***	0.1109***	0.0948***	0.1066***	0.1082***	0.0913***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Wave 5	0.0552***	0.0566***	0.0457***	0.0527***	0.0539***	0.0419***
	(0.014)	(0.015)	(0.015)	(0.014)	(0.015)	(0.015)
Wave 6	0.0511***	0.0521***	0.0457***	0.0488***	0.0497***	0.0420***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Wave 7	0.0233	0.0241	0.0203	0.0226	0.0232	0.0187
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Wave 8	0.0436***	0.0440***	0.0430***	0.0421***	0.0424***	0.0404***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Wave 9	0.0354**	0.0355**	0.0363**	0.0361**	0.0363**	0.0370**
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Wave 10	0.0324**	0.0324**	0.0348**	0.0322**	0.0322**	0.0343**
	(0.015)	(0.015)	(0.016)	(0.015)	(0.015)	(0.015)
R^2	0.0624	0.0625	0.0533	0.0978	0.0979	0.0916
F-stat	41.3938	38.0048	27.4636	43.572	41.1964	34.4214

*** at 1% level of significance, ** at 5% level of significance, * at 10% level of significance. Sample size N=6849

Table 4.3 Predicting retirement using retirement expectations: Full covariates

Dependent variable	Retired					
	Wave 1's expectations			Most current expectations		
	Age	Age, Age^2	Age dummies	Age	Age, Age^2	Age dummies
	Coefficient (standard error)			Coefficient (standard error)		
Retirement expectations	0.0163**	0.0158**	0.0241***	0.0361***	0.0354***	0.0507***
	(0.007)	(0.007)	(0.007)	(0.009)	(0.009)	(0.009)
Age	0.0084***	0.0156**		0.0081***	0.0143**	
	(0.001)	(0.007)		(0.001)	(0.007)	
Age^2		-0.0001			-0.0001	
		(0.000)			(0.000)	
Age (45-54)			0.056			0.0621
			(0.257)			(0.256)
Age (55-64)			0.1045			0.106
			(0.257)			(0.256)
Age (65-74)			0.2119			0.2127
			(0.257)			(0.257)
Age (75-84)			0.1363			0.1338
			(0.258)			(0.258)
Household composition	0.0130*	0.0129*	0.0148**	0.0134*	0.0133*	0.0152**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
City	-0.0046	-0.0048	-0.0058	-0.0044	-0.0046	-0.0054
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Good health	-0.0302***	-0.0304***	-0.0306***	-0.0302***	-0.0304***	-0.0307***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Disability	0.0561***	0.0561***	0.0586***	0.0558***	0.0558***	0.0579***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Partner's retired	0.1207***	0.1205***	0.1263***	0.1185***	0.1183***	0.1228***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Partner's good health	-0.0157**	-0.0159**	-0.0178***	-0.0162**	-0.0163**	-0.0184***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Partner disabled	-0.0243***	-0.0244***	-0.0235***	-0.0265***	-0.0265***	-0.0267***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Wave 3	0.0988***	0.1018***	0.0805***	0.0966***	0.0992***	0.0775***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Wave 4	0.0935***	0.0954***	0.0804***	0.0916***	0.0933***	0.0777***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Wave 5	0.0422***	0.0436***	0.0331**	0.0402***	0.0414***	0.0300**
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Wave 6	0.0418***	0.0427***	0.0362**	0.0398***	0.0407***	0.0332**
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Wave 7	0.02	0.0207	0.0166	0.0193	0.0199	0.0153
	(0.014)	(0.015)	(0.015)	(0.014)	(0.014)	(0.015)
Wave 8	0.0372**	0.0376**	0.0358**	0.0360**	0.0364**	0.0338**
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Wave 9	0.0284*	0.0286*	0.0283*	0.0291**	0.0293**	0.0291*
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Wave 10	0.0266*	0.0267*	0.0281*	0.0265*	0.0266*	0.0279*
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
R^2	0.0965	0.0967	0.0891	0.0978	0.0979	0.0916
F-stat	42.9236	40.6023	33.3941	43.572	41.1964	34.4214

*** at 1% level of significance, ** at 5% level of significance, * at 10% level of significance. Sample size N=6849

Therefore, we utilise the most current expectations in constructing an instrument for retirement in our subsequent estimations.

However, there are some limitations to using 2SLS where the endogenous variable retirement is also binary, i.e. takes the form of zero or one. This means that the model used in the first stage is essentially a linear probability model where the predicted values for $Retire_{i,t+1}$ are not bounded by zero and one, as it can take the form of less than zero or greater than one. However, given the second stage estimation is linear, with change in log consumption being the dependent variable, it is difficult to avoid using the linear probability model. We cannot simply estimate a non-linear first stage (such as a probit model) and use the predicted values obtained in the second stage as only the OLS estimates of the first stage is guaranteed to produce first stage residuals that are uncorrelated with the fitted values and covariates (Angrist & Pischke, 2009). Therefore, we use the linear probability model in the first stage consistent with other studies in the literature (for example, Haider & Stephens, 2007)[43].

4.5 Empirical results

The empirical question we are interested in investigating in this chapter is: for older Australian households, do they exhibit a fall in consumption as they move into retirement? Furthermore, if so, can this fall be explained by subjective retirement expectations? To this end, we employ subjective retirement expectations as an instrumental variable for retirement. Firstly, we estimate pooled OLS and IV models of the first difference of log of consumption with simple covariates. Then we estimate the models again using more comprehensive covariates. We use the first difference formulation as it is most commonly used in the literature (see Haider & Stephens, 2007). We then re-estimate the models using the consumption levels which enables the findings to be compared to Barrett and Brzozowski (2009, 2010 & 2012) as the authors use the

[43] We investigate this issue by generating the predicted values from the models in Table 4.2 and 4.3. We find that values outside of 0 and 1 are around 6-7% for the simple models and around 15 to 17% for the full models.

HILDA dataset as well. We consider the delayed effects of retirement by using second difference of log consumption as the dependent variables as well as estimating the consumption levels again by including second year retirement data.

4.5.1 Baseline model

To investigate the retirement-consumption puzzle, we estimate equation (4.7) using a simple baseline model in line with Haider and Stephens (2007). The dependent variable is the first difference of log of consumption in period t and $t+1$, $\Delta\ln C_{i,t+1}$, for each household in the sample in each wave. The first difference of log consumption gives the percentage change in consumption, an approximation:

$$\ln C_{t+1} - \ln C_t \approx \frac{C_{t+1} - C_t}{C_t} \tag{4.9}$$

The model is estimated using all 10 waves of data as a pooled OLS regression. The first difference in consumption is then regressed on $Retire_{i,t+1}$, whether the household becomes retired between year t and $t+1$, the change in household composition, age (linear and quadratic) and wave dummies. The limited number of covariates used is in line with the approach in the consumption rate literature (for example Banks *et al.*, 1998 and Bernheim *et al.*, 2001). We use the following proxies for consumption from the HILDA dataset: (1) expenditure on groceries, (2) expenditure on food at home and (3) expenditure on food outside of home. The estimations are repeated for each of the proxies.

Table 4.4 shows the results for consumption defined as groceries expenditure. The model is first estimated with a linear age variable, a quadratic term is then included, followed by using age dummies instead in the pooled OLS estimations. The results show that there is a negative relationship between retirement and the rate of change in consumption as measured by spending on groceries: when an individual becomes retired, the fall in the rate of consumption is modest at around 0.6 to 0.8%. The coefficients are fairly consistent across all three specifications of age. However, the coefficients are not statistically significant. The change in household composition has a large effect on the percentage change in consumption. The addition of one extra person to the household leads to an 18% increase in consumption.

For the consumption rate measured by food eaten at home (reported in Table 4.5), the consumption rate based on meals eaten at home falls by 0.09% to 0.14% upon retirement for the different age specifications (although the coefficient is positive for the model using age dummies). The negative effect of retirement is again negligible and statistically insignificant. Change in household composition and its impact on consumption rate is also very large at 25%. The coefficients are similar across all of the three age specifications. However, data on expenditure on meals eaten at home is only collected in Waves 1, 3, 4 and 5. The limited amount of observations will likely affect the precision of the estimation compared to expenditure on groceries or food eaten outside of home which is collected in all 10 waves.

The last measure of consumption estimated is expenditure on food eaten outside of home, more specifically food eaten in restaurants and cafes. This measure is slightly different to spending on groceries and food at home as it is a substitute. When faced with budget tightening, households are more likely to cut food eaten out rather than groceries or food eaten at home. Therefore, this measure of expenditure may behave differently. The estimation results for this specification of consumption are shown in Table 4.6. The consumption rate based on meals eaten out drops by 9% to 10% upon retirement for the different age specifications. Most importantly, the coefficients are statistically significant. This result is consistent with the hypothesis that with the change in lifestyle and time use associated with retirement, this fall is relatively larger compared to spending on groceries or meals eaten at home. Once again, the coefficient on change in household composition is positive and significant.

The endogeneity of the retirement decision arises from retirement being correlated with unobserved shocks that leads to unexpected retirement. The retirement variable here captures both expected and unexpected retirement. Therefore, finding a drop in consumption at retirement does not distinguish the difference between the two types of retirement. Using subjective retirement expectations we can instrument for this endogeneity and separate out the effect of unexpected retirement. The most current expectations are used, instead of Wave 1's, to construct the instrumental variable 'expected to retire' used in the estimations. This is consistent with the idea that

Table 4.4 Retirement and consumption (groceries): Simple covariates

Dependent variable	Consumption (groceries)					
		Pooled OLS			IV	
	Age	Age, Age^2	Age dummies	Age	Age, Age^2	Age dummies
		Coefficient (Standard error)			Coefficient (Standard Error)	
Retired	-0.0062	-0.0059	-0.0077	0.336	0.3688	0.2278
	(0.020)	(0.020)	(0.019)	(0.233)	(0.241)	(0.159)
Age	-0.0009*	-0.0105		-0.0045*	-0.0179**	
	(0.000)	(0.007)		(0.003)	(0.008)	
Age2		0.0001			0.0001*	
		(0.000)			(0.000)	
Age (45-54)			1.1969***			1.2015***
			(0.018)			(0.018)
Age (55-64)			1.1855***			1.1743***
			(0.017)			(0.019)
Age (65-74)			1.1868***			1.1447***
			(0.021)			(0.036)
Age (75-84)			1.1754***			1.1509***
			(0.041)			(0.046)
Household composition	0.1787***	0.1789***	0.1787***	0.1741***	0.1739***	0.1750***
	(0.017)	(0.017)	(0.017)	(0.018)	(0.018)	(0.017)
Wave 3	-0.0446**	-0.0487**	-0.0450**	-0.0062	-0.0154	0.0079
	(0.022)	(0.022)	(0.021)	(0.033)	(0.035)	(0.025)
Wave 4	0.1098***	0.1073***	0.1093***	0.1494***	0.1423***	0.1614***
	(0.021)	(0.021)	(0.021)	(0.032)	(0.033)	(0.025)
Wave 5	-0.1055***	-0.1073***	-0.1062***	-0.0477*	-0.0520*	-0.0426*
	(0.023)	(0.023)	(0.023)	(0.026)	(0.027)	(0.024)
Wave 6	-0.0091	-0.0103	-0.0098	0.0504**	0.0470*	0.0539**
	(0.023)	(0.023)	(0.023)	(0.025)	(0.025)	(0.023)
Wave 7	-0.0276	-0.0285	-0.0285	0.0413*	0.0393	0.0410*
	(0.024)	(0.024)	(0.024)	(0.025)	(0.025)	(0.024)
Wave 8	0.0265	0.026	0.0256	0.0879***	0.0857***	0.0893***
	(0.024)	(0.024)	(0.024)	(0.025)	(0.026)	(0.025)
Wave 9	-0.0534*	-0.0536*	-0.0540*	0.0104	0.0089	0.0108
	(0.030)	(0.030)	(0.030)	(0.025)	(0.026)	(0.025)
Wave 10				0.0647**	0.0635**	0.0652**
				(0.030)	(0.030)	(0.029)
Wave 11	-0.0760***	-0.0759***	-0.0736***			
	(0.028)	(0.028)	(0.028)			
IV F-stat				41.64	38.23	27.79

Notes: The dependent variable is the growth rate of consumption. Household composition variable is the change in the household composition. *** at 1% level of significance, ** at 5% level of significance, * at 10% level of significance. Cluster robust standard errors are used. The sample size N=6821.

Table 4.5 Retirement and consumption (meal eaten at home): Simple covariates

Dependent variable	Consumption (meal eaten at home)					
	Pooled OLS			IV		
	Age	Age, Age^2	Age dummies	Age	Age, Age^2	Age dummies
	Coefficient (Standard error)			Coefficient (Standard error)		
Retired	-0.0009	-0.0014	0.0009	0.0059	0.0165	0.0562
	(0.036)	(0.037)	(0.036)	(0.469)	(0.439)	(0.320)
Age	-0.001	-0.0069		-0.001	-0.0066	
	(0.001)	(0.023)		(0.006)	(0.024)	
Age2		0.0001			0	
		(0.000)			(0.000)	
Age (45-54)			0.1725			0.1886
			(0.176)			(0.193)
Age (55-64)			0.1525			0.1639
			(0.176)			(0.183)
Age (65-74)			0.1655			0.169
			(0.179)			(0.179)
Household composition	0.2468***	0.2469***	0.2469***	0.2466***	0.2466***	0.2458***
	(0.028)	(0.028)	(0.028)	(0.029)	(0.029)	(0.028)
Wave 4	0.1495***	0.1502***	0.1501***	0.1495***	0.1503***	0.1500***
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
Wave 5	-0.0618**	-0.0607**	-0.0606**	-0.0614*	-0.0598*	-0.0580**
	(0.024)	(0.025)	(0.024)	(0.036)	(0.034)	(0.028)
IV F-stat				49.68	42.75	28.69

Notes: The dependent variable is the growth rate of consumption. Household composition variable is the change in the household composition. *** at 1% level of significance, ** at 5% level of significance, * at 10% level of significance. Cluster robust standard errors are used. Sample size N=2837.

Table 4.6 Retirement and consumption (meals eaten out): Simple covariates

Dependent variable	Consumption (food eaten at home)					
	Pooled OLS			IV		
	Age	Age, Age^2	Age dummies	Age	Age, Age^2	Age dummies
	Coefficient (Standard error)			Coefficient (Standard error)		
Retired	-0.0937**	-0.0944**	-0.0957**	-0.4414	-0.3753	-0.2937
	(0.041)	(0.041)	(0.040)	(0.635)	(0.616)	(0.408)
Age	-0.0005	-0.0229		0.0032	-0.023	
	(0.001)	(0.017)		(0.007)	(0.018)	
Age^2		0.0002			0.0002	
		(0.000)			(0.000)	
Age (45-54)			1.1667***			1.1623***
			(0.034)			(0.035)
Age (55-64)			1.1507***			1.1587***
			(0.033)			(0.038)
Age (65-74)			1.1729***			1.2069***
			(0.038)			(0.081)
Age (75-84)			1.1401***			1.1696***
			(0.120)			(0.134)
Household composition	0.1154***	0.1158***	0.1156***	0.1207***	0.1202***	0.1191***
	(0.026)	(0.026)	(0.026)	(0.027)	(0.027)	(0.026)
Wave 3	0.1392***	-0.0468	0.1326***	0.1758**	0.1584**	0.1484***
	(0.042)	(0.042)	(0.041)	(0.077)	(0.074)	(0.051)
Wave 4	0.2510***	0.0687*	0.2451***	0.2848***	0.2720***	0.2608***
	(0.042)	(0.040)	(0.041)	(0.073)	(0.071)	(0.052)
Wave 5	-0.6405***	-0.8209***	-0.6460***	-0.6191***	-0.6274***	-0.6363***
	(0.046)	(0.043)	(0.046)	(0.058)	(0.057)	(0.048)
Wave 6	0.7375***	0.5582***	0.7322***	0.7550***	0.7488***	0.7405***
	(0.045)	(0.044)	(0.045)	(0.055)	(0.054)	(0.048)
Wave 7	0.0856*	-0.0928**	0.0805*	0.0918**	0.0887**	0.0828*
	(0.044)	(0.042)	(0.044)	(0.046)	(0.045)	(0.044)
Wave 8	0.1110**	-0.0666	0.1061**	0.1255**	0.1218**	0.1137**
	(0.044)	(0.043)	(0.044)	(0.053)	(0.052)	(0.048)
Wave 9	0.0552	-0.1216**	0.051	0.0689	0.0663	0.0587
	(0.043)	(0.052)	(0.043)	(0.048)	(0.048)	(0.044)
Wave 10	0.1762***		0.1736***	0.1891***	0.1873***	0.1813***
	(0.053)		(0.053)	(0.057)	(0.056)	(0.054)
Wave 11		-0.1768***				
		(0.053)				
IV F-stat				34.79	32.13	22.35

Notes: The dependent variable is the growth rate of consumption. Household composition variable is the change in the household composition. *** at 1% level of significance, ** at 5% level of significance, * at 10% level of significance. Cluster robust standard errors are used. Sample size N=5612.

individuals would revise their expectations as they receive new information. Therefore, expectations in period t is the best indicator of retirement in period $t + 1$.

The right hand side panel of Table 4.4 displays the 2SLS results for the growth of consumption as measured by spending on groceries. After instrumenting for unexpected retirement, of those individuals who retire as expected, the percentage change in consumption are now positive - increase by 20 to 37% depending on which age specification is used. However, the coefficients are not statistically significant. Similarly, for consumption measured using expenditure on food eaten at home, the coefficients are larger in the 2SLS estimations and are positive (as seen on the right panel of Table 4.5) but are again statistically insignificant. Lastly, when the rate of consumption is measured by expenditure on food eaten outside of home, it falls by 44% under the linear age specification and by 38% for the quadratic age specification and drops by 30% when the age dummies are used. Furthermore, the coefficients become statistically insignificant which seem to indicate that retirement does not have an effect on the rate of consumption, as measured by food away from home, for those who retire as expected.

These results suggest that there is a lack of a statistical relationship between retirement and consumption growth measured by spending on groceries and food eaten at home as the coefficients are not statistically significant before or after using the instrumental variable. We compare these results to those from literature where consumption growth is used as a dependent variable. We find that these results are largely consistent with those from Banks *et al.* (1998), Bernheim (1987) and Haider and Stephens (2004) – finding a negative relationship between consumption growth rate and retirement, although they also find statistical significance. However, Banks *et al.* (1998) and Bernheim (1987) use a constructed pseudo-panel dataset rather than an actual panel dataset. Haider and Stephens (2004) and Haider and Stephens (2007) find a decline in consumption growth after retirement with the magnitudes decreasing slightly with the use of IV indicating that the puzzle can be partly explained by unexpected retirement but not fully. In contrast, our results for consumption growth, as measured by meals eaten outside of home, indicate that unexpected retirement can explain the statistically significant decline after retirement as the coefficients on retirement become insignificant after being instrumented by retirement expectations.

4.5.2 Controlling for household and individual characteristics

Further to the simple covariates model estimated in the previous section, we add a more comprehensive list of covariates. This is to control for possible heterogeneity in households. Extra change variables (i.e. changes between period t and $t + 1$) included are: whether the partner is retired, whether households live in a major city, the health status of both household heads and partners and whether they have a long term illness/disability. This model is estimated first using pooled OLS for both the quadratic age relationship and age dummies. The results for consumption measured by grocery expenditure are displayed in the left panel of Table 4.7. It can be seen that the coefficients on being retired is negative in both age specifications and the magnitudes are smaller compared to the simple model, although the relationships again are not precisely estimated. The story is the same for the rate of consumption measured using meals eaten at home: although the coefficients' are positive they are still imprecisely estimated as seen in the middle panel of Table 4.7. Turning to consumption in the form of expenditure on meals eaten outside of home, in the right panel of Table 4.7, the size of the coefficients after controlling for more household and individual characteristics are similar to those produced from the simple model. For retired households, the rate of change in consumption falls by 9% compared to non-retired households under both types of age specifications. This result is precisely estimated and consistent with the simple model.

Next we use the most current retirement expectations to control for the endogeneity of the retirement decision. The results for groceries spending are on the left panel of Table 4.7. Interestingly, the 2SLS estimates show that for those retiring as expected, the rate of change in consumption is positive after retirement. However, the relationship is still imprecisely estimated. For spending on meals eaten at home, the 2SLS results (seen in the middle of Table 4.7) indicate a larger positive relationship compared to the pooled OLS results but are still statistically insignificant. More interestingly, for spending on food eaten in restaurants and cafes, the 2SLS estimates remain negative after controlling for unplanned retirement but they are now statistically insignificant. This indicates that the negative effect of retirement on consumption disappears once we disentangle the effect of unexpected shocks leading to early or planned retirement.

Once again, these results are similar to those from the simple covariates models in Section 4.5.1 and they are in direct contrast with those in Haider and Stephens (2004 & 2007) which found that the use of this instrumental variable on US dataset leads to a drop in consumption at retirement which is smaller in magnitude than without. Our results also examine first differences in the log of consumption, show that although there is a decrease in consumption at retirement for some of the consumption measures, these relationships are not statistically significant, only economically significant.

4.5.3 Consumption levels

Given the estimates using the first difference of log of consumption yield imprecise estimates in both the pooled OLS and 2SLS models for two of the consumption measures, we next test the retirement-consumption puzzle using the log levels of consumption. Following the formulation by Barrett and Brzozowski (2009, 2010 & 2012) which is partially comparable as the authors use earlier HILDA waves (up to 2007), we estimate Equation (4.7) using levels:

$$\ln C_{i,t} = \alpha_i + \beta Retired_{i,t} + \gamma X_{i,t} + \nu_{i,t} \tag{4.10}$$

The controls included in these levels models are largely in line with those used by Barrett and Brzozowski (2009, 2010 & 2012). They are: whether household heads are retired, their age, marital status, state of residence, number of resident children, partner's labour force status, and partner's health and disability status. These are the standard controls used in the retirement-consumption puzzle literature. Four models are estimated – firstly a simple pooled OLS with no covariates, secondly a pooled OLS with all controls, then 2SLS with current retirement expectations as IVs and lastly a random effects (RE) model. All estimations use a linear term plus a quadratic term for age. Similar to the baseline and extra covariates models estimated in Section 4.5.1 and 4.5.2, we again estimate the models for all three consumption proxies: expenditure on groceries, expenditure on food at home and expenditure on food outside of home. This time around we use the log values of consumption.

Table 4.7 Retirement and consumption: All covariates

Dependent variable	Consumption (groceries)				Consumption (meals eaten at home)				Consumption (meals eaten out)			
	Pooled OLS		Instrumental variables		Pooled OLS		Instrumental variables		Pooled OLS		Instrumental variables	
	Age, Age^2	Age dummies	Age, Age^2	Age dummies	Age, Age^2	Age dummies	Age, Age^2	Age dummies	Age, Age^2	Age dummies	Age, Age^2	Age dummies
	Coefficient (standard error)		Coefficient (Standard error)		Coefficient (Standard error)		Coefficient (Standard error)		Coefficient (Standard error)		Coefficient (Standard error)	
Retired	-0.0028	-0.0044	0.4687	0.2901	0.0073	0.0095	0.5004	0.1187	-0.0928**	-0.0938**	-0.5078	-0.3553
	(0.020)	(0.020)	(0.325)	(0.207)	(0.037)	(0.037)	(0.330)	(0.410)	(0.042)	(0.041)	(0.931)	(0.577)
Age	-0.0114*		-0.0195**		-0.0076		-0.0214**		-0.0221		-0.0226	
	(0.006)		(0.009)		(0.022)		(0.009)		(0.017)		(0.019)	
Age^2	0.0001		0.0001*		0.0001		0.0001**		0.0002		0.0002	
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Age (45-54)		1.1779***		1.1590***		0.165		0.191		1.1872***		1.1966***
		(0.021)		(0.025)		(0.172)		(0.191)		(0.039)		(0.044)
Age (55-64)		1.1667***		1.1325***		0.1464		0.1654		1.1735***		1.1956***
		(0.020)		(0.032)		(0.172)		(0.181)		(0.038)		(0.064)
Age (65-74)		1.1679***		1.1019***		0.1617		0.1684		1.1996***		1.2506***
		(0.024)		(0.053)		(0.176)		(0.176)		(0.043)		(0.122)
Age (75-84)		1.1622***		1.1190***						1.1631***		1.2074***
		(0.042)		(0.055)						(0.122)		(0.157)
Household composition	0.1783***	0.1782***	0.1725***	0.1740***	0.2463***	0.2465***	0.1713***	0.2442***	0.1176***	0.1175***	0.1235***	0.1216***
	(0.017)	(0.017)	(0.018)	(0.018)	(0.028)	(0.028)	(0.018)	(0.029)	(0.026)	(0.026)	(0.028)	(0.027)
City	-0.0015	-0.0019	0.0007	-0.0001	0.0041	0.0035	0.0007	0.005	-0.0135	-0.0138	-0.0141	-0.0143
	(0.005)	(0.005)	(0.006)	(0.005)	(0.012)	(0.012)	(0.006)	(0.013)	(0.011)	(0.011)	(0.011)	(0.011)
Good health	0.0159	0.0148	0.0300*	0.0236*	0.0201	0.0191	0.0309*	0.0243	-0.0414*	-0.0429*	-0.0508	-0.0484*
	(0.012)	(0.012)	(0.016)	(0.013)	(0.023)	(0.022)	(0.016)	(0.030)	(0.024)	(0.024)	(0.033)	(0.028)
Disability	-0.0028	-0.0025	-0.0292	-0.0197	0.0062	0.006	-0.0314	-0.0039	-0.0267	-0.0261	-0.0097	-0.0146
	(0.009)	(0.009)	(0.021)	(0.016)	(0.020)	(0.020)	(0.022)	(0.042)	(0.020)	(0.020)	(0.042)	(0.032)
Partner’s retired	-0.0026	-0.0033	-0.0595	-0.0408	-0.018	-0.0171	-0.0615	-0.0323	-0.0115	-0.0118	0.032	0.0179
	(0.010)	(0.010)	(0.041)	(0.028)	(0.022)	(0.021)	(0.042)	(0.059)	(0.023)	(0.023)	(0.101)	(0.069)
Partner’s good health	0.0123*	0.0119*	0.0199**	0.0172**	0.0286**	0.0283**	0.0202**	0.0319*	0.0004	-0.0002	-0.0037	-0.0033
	(0.007)	(0.007)	(0.009)	(0.008)	(0.013)	(0.013)	(0.009)	(0.019)	(0.014)	(0.014)	(0.017)	(0.015)

Table 4.7 Retirement and consumption: All covariates (continued)

Dependent variable	Consumption (groceries)				Consumption (meals eaten at home)				Consumption (meals eaten out)			
	Pooled OLS		Instrumental variables		Pooled OLS		Instrumental variables		Pooled OLS		Instrumental variables	
	Age, Age^2	Age dummies	Age, Age^2	Age dummies	Age, Age^2	Age dummies	Age, Age^2	Age dummies	Age, Age^2	Age dummies	Age, Age^2	Age dummies
	Coefficient (standard error)		Coefficient (Standard error)		Coefficient (Standard error)		Coefficient (Standard error)		Coefficient (Standard error)		Coefficient (Standard error)	
Partner disabled	0.00004	-0.0003	0.0115	0.0066	-0.0241	-0.0243	0.0114	-0.0225	0.016	0.0156	0.0092	0.0116
	(0.010)	(0.010)	(0.013)	(0.011)	(0.019)	(0.019)	(0.014)	(0.021)	(0.023)	(0.023)	(0.027)	(0.024)
Wave 3	-0.0490**	-0.0450**	-0.0202	0.006	0.0599**	0.0599**	-0.0654**	0.0545*	-0.0448	0.1348***	0.1713*	0.1539***
	(0.022)	(0.022)	(0.039)	(0.027)	(0.025)	(0.024)	(0.028)	(0.031)	(0.042)	(0.041)	(0.094)	(0.058)
Wave 4	0.1067***	0.1090***	0.1387***	0.1601***	0.2106***	0.2102***	0.0940***	0.2050***	0.0708*	0.2479***	0.2832***	0.2659***
	(0.021)	(0.021)	(0.037)	(0.026)	(0.027)	(0.027)	(0.025)	(0.033)	(0.040)	(0.042)	(0.087)	(0.056)
Wave 5	-0.1075***	-0.1062***	-0.0512*	-0.0413*			-0.0939***		-0.8189***	-0.6433***	-0.6206***	-0.6331***
	(0.023)	(0.023)	(0.027)	(0.024)			(0.017)		(0.043)	(0.046)	(0.062)	(0.049)
Wave 6	-0.0107	-0.01	0.0464*	0.0541**					0.5594***	0.7343***	0.7545***	0.7432***
	(0.023)	(0.023)	(0.026)	(0.023)					(0.044)	(0.045)	(0.059)	(0.049)
Wave 7	-0.0288	-0.0287	0.0384	0.0409*					-0.0929**	0.0813*	0.0912**	0.0839*
	(0.024)	(0.024)	(0.026)	(0.024)					(0.043)	(0.044)	(0.046)	(0.045)
Wave 8	0.0256	0.0254	0.0842***	0.0888***					-0.0666	0.1071**	0.1263**	0.1157**
	(0.024)	(0.024)	(0.027)	(0.025)					(0.043)	(0.044)	(0.056)	(0.049)
Wave 9	-0.0539*	-0.0543*	0.0085	0.011					-0.1216**	0.0522	0.0705	0.0606
	(0.030)	(0.030)	(0.026)	(0.025)					(0.052)	(0.043)	(0.052)	(0.045)
Wave 10			0.0631**	0.0652**						0.1747***	0.1917***	0.1836***
			(0.031)	(0.029)						(0.053)	(0.060)	(0.055)
Wave 11	-0.0761***	-0.0737***							-0.1779***			
	(0.028)	(0.028)							(0.053)			
IV F-stat			41.17	34.49			37.14	30.76			30.60	25.01

Notes: The dependent variable is the growth rate of consumption. Household composition variable is the change in the household composition. *** at 1% level of significance, ** at 5% level of significance, * at 10% level of significance. Cluster robust standard errors are used. The sample size for groceries, meals eaten at home and meals eaten out are 6,821, 2,837 and 5,612 respectively.

Table 4.8 shows the results for the log of groceries expenditure in the left panel and they indicate that for retired households, consumption decreases by 15% under the pooled OLS model without covariates. This drop decreases to 3% after controlling for various household and individual characteristics. Then after taking account of individual specific effects using the random effects model, the effect is smaller and becomes statistically insignificant. However, none of these models distinguished between planned versus unplanned retirement. Therefore, the current retirement expectations are used to construct an instrument, which is same as those used in the consumption growth estimations. The 2SLS coefficient shows the drop to be bigger after retirement, at 16%, although it is not statistically significant.

For consumption measured by food eaten at home (See the middle panel of Table 4.8), there is a negative relationship between being retired and consumption, a drop of 16%. After controlling for other characteristics in the pooled OLS model, the fall reduced to only 1%. This is a similar result to the RE coefficient. However, neither coefficients are statistically significant. Using IV, the 2SLS results indicate that there is a large increase in consumption for those who planned their retirement but once again this is not precisely estimated. We next examine expenditure relating to food eaten outside of home, which is seen in Table 4.8 on the right. The results imply that retired households tend to decrease their consumption by 24% without controlling for any other variables. After controlling for household and individual effects this decrease drops to only 14%. Both results are precisely estimated. After taking into consideration individual specific effects, the RE model estimate for retirement shows the decrease is only 9%. However, the 2SLS estimation shows a 56% increase in consumption but is statistically insignificant.

Table 4.8 Retirement and consumption: Consumption levels

Dependent variable	Consumption (groceries)				Consumption (meals eaten at home)				Consumption (meals eaten out)			
	OLS	OLS	IV	RE	OLS	OLS	IV	RE	OLS	OLS	IV	RE
	Coefficient (Standard error)				Coefficient (Standard error)				Coefficient (Standard error)			
Retired	-0.1461***	-0.0322	-0.1622	-0.0159	-0.1604***	-0.0133	0.6598	-0.0113	-0.2379***	-0.1420***	0.5639	-0.0870**
	(0.023)	(0.020)	(0.428)	(0.016)	(0.033)	(0.030)	(0.597)	(0.027)	(0.045)	(0.046)	(1.153)	(0.036)
Age		0.0152	0.0149	0.0208		0.0169	0.0316	0.0158		0.0236	0.0338	-0.0417
		(0.018)	(0.018)	(0.013)		(0.020)	(0.023)	(0.018)		(0.039)	(0.043)	(0.033)
Age^2		-0.0002	-0.0002	-0.0002**		-0.0002	-0.0003	-0.0002		-0.0003	-0.0004	0.0003
		(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)
Female		0.0296	0.0305	-0.0141		0	-0.0068	-0.0121		-0.1685**	-0.1693**	-0.1996***
		(0.038)	(0.038)	(0.036)		(0.040)	(0.041)	(0.038)		(0.070)	(0.070)	(0.068)
Married		0.0698*	0.0668*	0.0596**		0.0469	0.052	0.0325		-0.1138	-0.0969	-0.0217
		(0.038)	(0.039)	(0.029)		(0.039)	(0.041)	(0.036)		(0.070)	(0.078)	(0.060)
No partner		-0.3934***	-0.4021***	-0.4163***		-0.4294***	-0.3922***	-0.4557***		-0.1795*	-0.1346	-0.1306*
		(0.048)	(0.056)	(0.038)		(0.051)	(0.062)	(0.048)		(0.093)	(0.117)	(0.073)
Resident children		0.1867***	0.1861***	0.1745***		0.2100***	0.2147***	0.2087***		0.0323	0.0355	0.0399**
		(0.012)	(0.012)	(0.010)		(0.012)	(0.013)	(0.010)		(0.026)	(0.026)	(0.018)
NSW		-0.0877	-0.0906	0.0338		-0.1494**	-0.1404**	-0.0937		-0.0612	-0.0416	-0.1115
		(0.063)	(0.064)	(0.065)		(0.063)	(0.065)	(0.059)		(0.153)	(0.159)	(0.127)
VIC		-0.1194*	-0.1218*	0.004		-0.1968***	-0.1870***	-0.1336**		-0.063	-0.0458	-0.0873
		(0.064)	(0.064)	(0.063)		(0.063)	(0.066)	(0.059)		(0.153)	(0.159)	(0.130)
QLD		-0.1502**	-0.1509**	-0.0386		-0.2246***	-0.2310***	-0.1624***		-0.3155**	-0.3095**	-0.3173**
		(0.065)	(0.065)	(0.064)		(0.064)	(0.067)	(0.060)		(0.154)	(0.157)	(0.132)
SA		-0.2032***	-0.2045***	-0.0521		-0.3371***	-0.3381***	-0.2734***		-0.2309	-0.2184	-0.2505*
		(0.068)	(0.068)	(0.065)		(0.065)	(0.068)	(0.062)		(0.162)	(0.166)	(0.139)
WA		-0.0715	-0.0726	0.0433		-0.1522**	-0.1478**	-0.0931		-0.1786	-0.1671	-0.2109
		(0.069)	(0.069)	(0.068)		(0.069)	(0.071)	(0.066)		(0.164)	(0.167)	(0.145)
TAS		-0.2242***	-0.2247***	-0.1091		-0.3753***	-0.3894***	-0.3049***		-0.5118***	-0.5020***	-0.5505***
		(0.086)	(0.086)	(0.082)		(0.081)	(0.085)	(0.079)		(0.186)	(0.192)	(0.181)
NT		0.1197	0.1137	0.1547		-0.0379	-0.0065	-0.0677		0.1298	0.1605	0.3364
		(0.083)	(0.085)	(0.099)		(0.094)	(0.101)	(0.126)		(0.269)	(0.277)	(0.244)

Table 4.8 Retirement and consumption: Consumption levels (continued)

Dependent variable	Consumption (groceries)				Consumption (meals eaten at home)				Consumption (meals eaten out)			
	OLS	OLS	IV	RE	OLS	OLS	IV	RE	OLS	OLS	IV	RE
	Coefficient (Standard error)				Coefficient (Standard error)				Coefficient (Standard error)			
Partner health		0.0176	0.0207	-0.0037		0.0145	0.0085	0.0004		0.0252	0.0109	-0.0044
		(0.021)	(0.023)	(0.015)		(0.026)	(0.028)	(0.022)		(0.047)	(0.056)	(0.030)
Partner disability		0.0011	0.0021	0.004		0.0151	0.009	0.0177		-0.1259***	-0.1301***	-0.0374
		(0.021)	(0.021)	(0.014)		(0.024)	(0.026)	(0.021)		(0.048)	(0.048)	(0.030)
Partner labour status		0.0395*	0.0274	0.0057		0.0400*	0.0983*	0.0261		0.0804*	0.1374	0.1094***
		(0.022)	(0.045)	(0.015)		(0.023)	(0.058)	(0.021)		(0.048)	(0.104)	(0.032)
Wave 3	-0.0311**	-0.0186	-0.0075	-0.0198	-0.0177	-0.0237	-0.0798	-0.0203	0.0339	0.0405	-0.0136	0.0532**
	(0.013)	(0.013)	(0.039)	(0.013)	(0.016)	(0.015)	(0.052)	(0.015)	(0.027)	(0.028)	(0.092)	(0.026)
Wave 4	0.1080***	0.1144***	0.1268***	0.1091***	0.1298***	0.1168***	0.0529	0.1168***	0.1891***	0.1909***	0.1324	0.2112***
	(0.015)	(0.014)	(0.043)	(0.013)	(0.016)	(0.015)	(0.058)	(0.015)	(0.031)	(0.032)	(0.102)	(0.030)
Wave 5	0.0095	0.0228	0.0288	0.0194	0.0420**	0.0361**	0.0047	0.0373**	-0.4924***	-0.4907***	-0.5243***	-0.5002***
	(0.017)	(0.017)	(0.026)	(0.016)	(0.018)	(0.017)	(0.033)	(0.016)	(0.036)	(0.038)	(0.065)	(0.036)
Wave 6	0.0101	0.0303	0.0363	0.0265					0.1620***	0.1671***	0.1347**	0.1653***
	(0.019)	(0.018)	(0.027)	(0.017)					(0.035)	(0.038)	(0.067)	(0.037)
Wave 7	0.0013	0.0232	0.0261	0.0192					0.1793***	0.1886***	0.1794***	0.1822***
	(0.020)	(0.020)	(0.023)	(0.019)					(0.036)	(0.041)	(0.045)	(0.039)
Wave 8	0.0404**	0.0687***	0.0744***	0.0640***					0.2169***	0.2277***	0.1953***	0.2092***
	(0.020)	(0.021)	(0.028)	(0.019)					(0.037)	(0.044)	(0.072)	(0.042)

Table 4.8 Retirement and consumption: Consumption levels (continued)

Dependent variable	Consumption (groceries)				Consumption (meals eaten at home)				Consumption (meals eaten out)			
	OLS	OLS	IV	RE	OLS	OLS	IV	RE	OLS	OLS	IV	RE
	Coefficient (Standard error)				Coefficient (Standard error)				Coefficient (Standard error)			
Wave 9	-0.0004	0.0285	0.0336	0.019					0.1598***	0.1743***	0.1496**	0.1650***
	(0.021)	(0.023)	(0.028)	(0.021)					(0.038)	(0.046)	(0.064)	(0.044)
Wave 10	0.001	0.0414*	0.0465	0.033					0.2302***	0.2512***	0.2289***	0.2572***
	(0.022)	(0.023)	(0.029)	(0.022)					(0.040)	(0.050)	(0.065)	(0.047)
Wave 11	-0.0707***	-0.0213	-0.0203	-0.0292					0.1087**	0.1375**	0.1294**	0.1534***
	(0.023)	(0.025)	(0.025)	(0.022)					(0.042)	(0.055)	(0.058)	(0.051)
IV F-stat			27.52				24.45				23.53	

Notes: The dependent variable is consumption levels. *** at 1% level of significance, ** at 5% level of significance, * at 10% level of significance. Cluster robust standard errors are used. The sample size for groceries, meals eaten at home and meals eaten out are 7,886, 4,438 and 6,903 respectively.

Although the results for 'consumption levels' estimations obtained here are not directly comparable with those in Barrett and Brzozowski (2010), as the sample used in this study has observations beyond Wave 7 used by the aforementioned authors and that the construction of the samples differ, some simple but useful comparisons can still be made. The pooled OLS results with no covariates for all three forms of consumption expenditures are of the same sign and magnitude as Barrett and Brzozowski (2010) (although in our study the coefficients are slightly smaller). Furthermore, the coefficient on retired is largest for expenditure on food outside of home, followed by expenditure on groceries then expenditure on meals eaten at home, which is in line with Barrett and Brzozowski (2010). Similarly, for the RE model results, the coefficients we obtained are smaller than those in the earlier paper and only spending on food outside of home is statistically significant. Barrett and Brzozowski (2010) also explicitly controlled for expected and unexpected retirement and find the statistical significance on the coefficient for planned retirement on consumption disappears, while for those with unexpected retirement, a drop in consumption is statistically significant. This is in line with our results: after controlling for unexpected retirement, those with planned retirement do not appear to experience a statistically significant drop in consumption at retirement.

4.5.4 Delayed effects of retirement on consumption

A possible explanation for the lack of a statistical relationship between retirement and the percentage change in consumption is the way by which the sample is constructed. That is, once the head of the household retires, the first year of retirement is observed and after which she drops out of the sample. Essentially, consumption is compared between the not retired group and first year of retirement group. There is a strong possibility that the impact of retirement is not instantaneous. Households can draw on their savings or borrow at the beginning of retirement so as not to affect their current standard of living.

Furthermore, the timing of retirement is unclear – the individual can choose to retire at the beginning of the year or at the end of the year relative to the survey period. The two different retirement points in the year can have a large effect on when the impact of retirement affects consumption. Bernheim *et al.* (2001) further demonstrates these two points by estimating the impact of retirement within one year and two years of retirement, and finds that only half of the decline in consumption occurs in the first year. Therefore, the model and samples used here to examine the percentage change in consumption do not capture this possibility.

With these considerations, we estimate a two-year difference model in log consumption in order to capture the possible delayed impact of retirement on consumption. Previously, the sample consisted of up to first year of retirement observations. Here we add to the sample to also include the second year of retirement observations, as the impact of retirement may not filter through within a year. We estimate the simple covariates model using a two-year difference in log consumption. The variable of interest is whether the household head is retired during the two years being differenced. The number of observations being estimated decreases due to the two-year difference process. The controls are the same as the one-year difference in consumption models – household composition (two-year difference), age and age squared[44] and wave dummies.

Table 4.9 show the results for the pooled OLS model for all measures of expenditure – groceries, meals eaten at home and meals eaten out. The coefficients for retirement using all three expenditure measures are negative with the groceries measure having the smallest magnitude at 1%, followed by meals eaten in at 4% and meals eaten outside of home at 7%. Only the meals eaten outside the home measure is statistically significant. Furthermore, after controlling for endogeneity through the use of subjective retirement expectations from the most current expectations as an instrument for retirement, the coefficient on groceries expenditure becomes positive but statistically insignificant. For meals eaten at home, the coefficient also becomes positive and remains insignificant. Interestingly, the coefficient for meals eaten outside of home remains negative and statistically insignificant once retirement is instrumented. The coefficients from the IV estimations are larger in magnitude.

[44] We also estimated other age specifications including linear age and found the results to be similar.

Table 4.9 Retirement and 2-year difference consumption: Simple covariates

Dependent variable	Groceries	Meals eaten in	Meals eaten out	Groceries	Meals eaten in	Meals eaten out
	Pooled OLS			IV		
	Coefficient (Standard error)			Coefficient (Standard error)		
Retired	-0.0105	-0.0428	-0.0737**	0.0123	0.0607	-0.0824
	(0.019)	(0.036)	(0.037)	(0.640)	(2.133)	(1.057)
Age	-0.0128	-0.0138	-0.0531**	-0.0135	-0.0099	-0.0533*
	(0.012)	(0.035)	(0.023)	(0.025)	(0.085)	(0.031)
Age ^{2}	0.0001	0.0001	0.0004**	0.0001	0.0001	0.0004
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Household composition	0.1769***	0.2494***	0.0753***	0.1764***	0.2459***	0.0755**
	(0.017)	(0.025)	(0.024)	(0.021)	(0.077)	(0.033)
Wave 5	-0.0665***	-0.0681***	-0.7682***	-0.0656**	-0.0646	-0.7685***
	(0.019)	(0.023)	(0.040)	(0.032)	(0.075)	(0.050)
Wave 6	-0.2050***		-0.2309***	-0.2030***		-0.2314***
	(0.025)		(0.048)	(0.065)		(0.074)
Wave 7	-0.1038***		0.4840***	-0.1011		0.4833***
	(0.023)		(0.044)	(0.077)		(0.105)
Wave 8	-0.0459*		-0.1298***	-0.0432		-0.1306
	(0.026)		(0.041)	(0.078)		(0.100)
Wave 9	-0.1050***		-0.1890***	-0.1025		-0.1897**
	(0.028)		(0.042)	(0.074)		(0.094)
Wave 10	-0.1358***		-0.1171***	-0.1331		-0.1178
	(0.026)		(0.042)	(0.085)		(0.095)
Wave 11	-0.1120***		-0.1763***	-0.1086		-0.1772
	(0.027)		(0.046)	(0.101)		(0.117)
IV F-stat				57.37	52.78	48.89

Notes: The dependent variable is the growth rate of consumption. Household composition variable is the change in the household composition. *** at 1% level of significance, ** at 5% level of significance, * at 10% level of significance. Cluster robust standard errors are used. The sample size for groceries, meals eaten at home and meals eaten out are 6,300, 1,997 and 5,104 respectively.

Table 4.10 Retirement and 2-year difference consumption: All covariates

Dependent variable	Groceries	Meals eaten in	Meals eaten out	Groceries	Meals eaten in	Meals eaten out
		Pooled OLS			IV	
		Coefficient (Standard error)			Coefficient (Standard error)	
Retired	-0.0079	-0.0406	-0.0800**	-0.0588	0.3418	-0.3428
	(0.020)	(0.036)	(0.037)	(0.999)	(133.727)	(1.885)
Age	-0.0135	-0.017	-0.0560**	-0.0121	-0.0016	-0.0618
	(0.012)	(0.035)	(0.023)	(0.030)	(5.367)	(0.047)
Age^2	0.0001	0.0001	0.0005**	0.0001	-0.00005	0.0005
	(0.000)	(0.000)	(0.000)	(0.000)	(0.064)	(0.001)
Household composition	0.1672***	0.2331***	0.0670***	0.1684***	0.223	0.0728
	(0.018)	(0.025)	(0.024)	(0.027)	(3.529)	(0.048)
City	-0.0432	-0.0963	-0.0621	-0.0511	-0.0408	-0.0948
	(0.040)	(0.086)	(0.062)	(0.158)	(19.402)	(0.242)
Good health	0.0377*	0.0253	-0.0208	0.0368	0.033	-0.0268
	(0.020)	(0.026)	(0.032)	(0.026)	(2.721)	(0.054)
Disability	-0.0305**	-0.0899***	-0.0438	-0.029	-0.1059	-0.0378
	(0.015)	(0.026)	(0.027)	(0.033)	(5.581)	(0.050)
Partner retired	-0.0103	-0.0059	0.0246	-0.0037	-0.0529	0.0537
	(0.015)	(0.028)	(0.023)	(0.131)	(16.414)	(0.213)
Partner good Health	0.0631**	0.0723**	0.0721**	0.0636**	0.0611	0.0762*
	(0.027)	(0.033)	(0.034)	(0.031)	(3.922)	(0.043)
Partner disabled	0.018	-0.0055	-0.0029	0.018	-0.0063	-0.0019
	(0.019)	(0.033)	(0.038)	(0.019)	(0.309)	(0.038)
Wave 5	-0.0677***	-0.0692***	-0.7669***	-0.0694*	-0.0587	-0.7733***
	(0.019)	(0.023)	(0.040)	(0.038)	(3.663)	(0.061)
Wave 6	-0.2059***		-0.2312***	-0.2101**		-0.2442**
	(0.024)		(0.048)	(0.088)		(0.104)
Wave 7	-0.1084***		0.4817***	-0.1138		0.4603***
	(0.023)		(0.044)	(0.106)		(0.159)
Wave 8	-0.0524**		-0.1338***	-0.058		-0.1549
	(0.026)		(0.041)	(0.108)		(0.154)
Wave 9	-0.1109***		-0.1904***	-0.1158		-0.2093
	(0.028)		(0.042)	(0.099)		(0.141)
Wave 10	-0.1392***		-0.1164***	-0.1444		-0.1347
	(0.026)		(0.042)	(0.110)		(0.138)
Wave 11	-0.1156***		-0.1756***	-0.1221		-0.1983
	(0.027)		(0.046)	(0.133)		(0.169)
IV F-stat				50.90	29.98	40.42

Notes: The dependent variable is the growth rate of consumption. Household composition variable is the change in the household composition. *** at 1% level of significance, ** at 5% level of significance, * at 10% level of significance. Cluster robust standard errors are used. The sample size for groceries, meals eaten at home and meals eaten out are 6,300, 1,997 and 5,104 respectively.

We then include a more comprehensive set of covariates in estimating the pool OLS and IV models. The covariates are: retirement status of household head and partner age and age squared of the household head, household composition, live in a major city, whether household head and partner are in good health, whether household head and their partner have a long term illness/disability and wave dummies. The results are displayed in Table 4.10 and are similar to those estimated using the simple covariates. The coefficient on groceries expenditure is negative and small in magnitude, a fall of 1%, but is not statistically significant. Similarly, retirement leads to a 4% decrease in meals eaten at home and once again this is not statistically significant. For meals eaten outside of home, retirement leads to an 8% fall with the result being precisely estimated at the 5% level of significance. The estimates obtained from the IV estimations show that although the fall in groceries expenditures increases in magnitude, it remains imprecisely estimated along with the coefficient for meals eaten at home which is now positive. However, after instrumenting for retirement, the coefficient on meals eaten out remains negative but becomes statistically insignificant.

A comparison of the results from the one-year log difference in consumption estimations versus the two year log difference in consumption show that a two year delayed effect of retirement does not exist. The conclusions drawn from the results show that there is no retirement-consumption puzzle where groceries and meals eaten in are used as proxies for consumption for expenditure. However, for expenditure as measured as meals eaten out, it is a different story. The OLS results show that there is a drop in meals eaten out at retirement and this drop becomes statistically insignificant after controlling for unexpected retirement. Thus it indicates that for those households who do expect to retire, retirement does not have an effect on the rate of consumption as measured by food eaten out.

We then test out this possible delay effect using consumption levels rather than consumption growth. The hypothesis is that the decline in consumption levels may be felt by households in the first and second year of retirement rather than just in the first year given the timing of retirement or that the individuals may dip into their savings or incur borrowings to make sure their consumption remain unaffected by taking retirement. We estimated a pooled OLS, RE and 2SLS models identical to the models estimated in

Section 4.5.3 using the new sample which includes extra observations of the second year of retirement.

Table 4.11 shows the results for all three measures of consumption. The estimation results for consumption as approximated by the expenditure on groceries show that the pooled OLS coefficient is negative and statistically significant. After accounting for individual heterogeneity using a RE model, the coefficient still show a statistical significant decline albeit a fall in magnitude. However, after accounting for endogeneity through the use of 2SLS model, the coefficient becomes statistically insignificant. Similarly, the OLS and RE results for spending on meals eaten at home show statistically significant falls upon retirement. However, once retirement is instrumented by retirement expectations, the coefficient in the 2SLS estimation is positive but statistically insignificant. For expenditure on meals eaten outside of home, the coefficients for retired are negative and of statistical significance for both pooled OLS and RE, but cease to be in the 2SLS estimation. These results indicate for consumption as measured by spending on groceries, on meals eaten at home and outside of home, unexpected retirement can be used to explain the decline in consumption upon retirement.

Furthermore, when comparing these results with the estimation results from the first year of retirement only sample (as seen in Table 4.8), it can be seen that the coefficients for groceries and meals eaten at home in the smaller sample are statistically insignificant for all specifications except the simple OLS model, unlike those from the 2-year sample. This indicates a delayed impact of retirement on consumption as the sample that includes observations from the second year of retirement has more statistical power compared to the smaller sample. One possible reason that this delayed effect is seen in the estimation using consumption level rather than growth rate is that the differencing to obtain the growth rate results in fewer observations which may drive down the estimation power of the data. Or alternatively, there is a weak relationship between consumption growth and retirement in the HILDA dataset.

Table 4.11 Retirement and consumption levels: 2-year retirement data

Dependent variable	Consumption (groceries)			Consumption (meals eaten at home)			Consumption (meals eaten out)		
	OLS	IV	RE	OLS	IV	RE	OLS	IV	RE
		Coefficient (Standard error)			Coefficient (Standard error)			Coefficient (Standard error)	
Retired	-0.0484**	-0.9634	-0.0333**	-0.0513**	1.277	-0.0451**	-0.1271***	0.8696	-0.0742**
	(0.021)	(0.883)	(0.017)	(0.026)	(1.866)	(0.023)	(0.042)	(1.471)	(0.032)
Age	0.0114	0.0049	0.017	0.0083	0.0462	0.0146	0.0159	0.0436	-0.0459
	(0.018)	(0.025)	(0.015)	(0.020)	(0.057)	(0.018)	(0.038)	(0.058)	(0.031)
Age ^{2}	-0.0001	0	-0.0002	-0.0001	-0.0006	-0.0001	-0.0002	-0.0005	0.0003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
Female	0.0178	0.0291	-0.0169	-0.0028	-0.0236	-0.0167	-0.1865***	-0.1939***	-0.2228***
	(0.038)	(0.042)	(0.038)	(0.038)	(0.054)	(0.037)	(0.068)	(0.072)	(0.067)
Married	0.0622	0.0246	0.0545*	0.0469	0.0783	0.0459	-0.1143*	-0.0666	-0.021
	(0.040)	(0.058)	(0.030)	(0.039)	(0.064)	(0.037)	(0.069)	(0.104)	(0.059)
No partner	-0.3784***	-0.4809***	-0.4054***	-0.4266***	-0.2995	-0.4452***	-0.1701*	-0.0552	-0.1114
	(0.051)	(0.114)	(0.039)	(0.050)	(0.190)	(0.047)	(0.090)	(0.193)	(0.072)
Resident children	0.1834***	0.1775***	0.1696***	0.2068***	0.2165***	0.2055***	0.0311	0.0372	0.0384**
	(0.012)	(0.015)	(0.010)	(0.012)	(0.020)	(0.011)	(0.025)	(0.027)	(0.018)
NSW	-0.1074*	-0.1414*	-0.0043	-0.1448**	-0.1264	-0.0875	-0.0774	-0.0296	-0.0908
	(0.062)	(0.076)	(0.062)	(0.062)	(0.084)	(0.060)	(0.147)	(0.170)	(0.122)
VIC	-0.1324**	-0.1579**	-0.0284	-0.1965***	-0.1688*	-0.1354**	-0.0927	-0.0578	-0.0854
	(0.063)	(0.073)	(0.061)	(0.063)	(0.089)	(0.060)	(0.148)	(0.163)	(0.127)
QLD	-0.1623**	-0.1695**	-0.0586	-0.2226***	-0.2488***	-0.1598***	-0.3299**	-0.3115**	-0.2737**
	(0.064)	(0.072)	(0.061)	(0.063)	(0.091)	(0.061)	(0.148)	(0.157)	(0.128)
SA	-0.2185***	-0.2296***	-0.0843	-0.3217***	-0.3251***	-0.2550***	-0.2461	-0.2249	-0.2109
	(0.067)	(0.077)	(0.063)	(0.065)	(0.084)	(0.062)	(0.156)	(0.167)	(0.135)
WA	-0.0838	-0.0975	0.0158	-0.1456**	-0.1237	-0.0881	-0.2013	-0.1725	-0.2123
	(0.068)	(0.076)	(0.066)	(0.069)	(0.090)	(0.066)	(0.158)	(0.169)	(0.141)
TAS	-0.2462***	-0.2509**	-0.1519*	-0.3794***	-0.4218***	-0.3057***	-0.5197***	-0.4991**	-0.4405***
	(0.082)	(0.099)	(0.078)	(0.081)	(0.134)	(0.078)	(0.177)	(0.195)	(0.170)
NT	0.1208	0.0658	0.1475	-0.04	0.024	-0.0487	0.1003	0.1545	0.4112
	(0.083)	(0.112)	(0.095)	(0.093)	(0.147)	(0.123)	(0.260)	(0.278)	(0.253)

Table 4.11 Retirement and consumption levels: 2-year retirement data (continued)

Dependent variable	Consumption (groceries)			Consumption (meals eaten at home)			Consumption (meals eaten out)		
	OLS	IV	RE	OLS	IV	RE	OLS	IV	RE
		Coefficient (Standard error)			Coefficient (Standard error)			Coefficient (Standard error)	
Partner health	0.038	0.0636	0.0133	0.0258	0.0217	0.0088	0.0276	0.0043	-0.0045
	(0.025)	(0.040)	(0.021)	(0.026)	(0.036)	(0.022)	(0.046)	(0.062)	(0.030)
Partner disability	-0.0027	0.0086	0.0038	0.0151	-0.0117	0.0101	-0.1247***	-0.1319***	-0.0299
	(0.022)	(0.027)	(0.017)	(0.024)	(0.050)	(0.021)	(0.046)	(0.049)	(0.029)
Partner labour status	0.0338	-0.1019	0.0016	0.0369	0.2128	0.0217	0.0809*	0.2129	0.1126***
	(0.023)	(0.133)	(0.018)	(0.023)	(0.251)	(0.020)	(0.046)	(0.199)	(0.031)
Wave 3	-0.0158	0.0535	-0.0179	-0.0203	-0.0985	-0.017	0.0395	-0.0289	0.0532**
	(0.013)	(0.069)	(0.013)	(0.015)	(0.112)	(0.015)	(0.028)	(0.106)	(0.026)
Wave 4	0.1124***	0.2589*	0.1078***	0.1133***	-0.0782	0.1142***	0.1886***	0.0494	0.2152***
	(0.014)	(0.143)	(0.013)	(0.015)	(0.271)	(0.015)	(0.032)	(0.210)	(0.030)
Wave 5	0.0246	0.1443	0.0173	0.0365**	-0.1169	0.0339**	-0.5035***	-0.6190***	-0.5042***
	(0.017)	(0.116)	(0.016)	(0.016)	(0.216)	(0.016)	(0.037)	(0.174)	(0.035)
Wave 6	0.0081	0.0888	0.0033				0.1744***	0.0844	0.1742***
	(0.022)	(0.080)	(0.021)				(0.038)	(0.140)	(0.036)
Wave 7	0.0093	0.0665	0.0047				0.1944***	0.1347	0.1935***
	(0.023)	(0.062)	(0.022)				(0.041)	(0.100)	(0.039)
Wave 8	0.0613***	0.1196*	0.0560***				0.2284***	0.1652	0.2147***
	(0.022)	(0.062)	(0.021)				(0.044)	(0.106)	(0.042)
Wave 9	-0.0026	0.0686	-0.0109				0.1777***	0.1061	0.1666***
	(0.026)	(0.077)	(0.025)				(0.046)	(0.118)	(0.043)
Wave 10	0.0217	0.0914	0.0093				0.2528***	0.18	0.2611***
	(0.027)	(0.073)	(0.026)				(0.049)	(0.122)	(0.047)
Wave 11	-0.0139	0.0302	-0.0254				0.1519***	0.1013	0.1716***
	(0.024)	(0.051)	(0.022)				(0.053)	(0.096)	(0.051)
IV F-stat		50.26			43.89			43.65	

Notes: The dependent variable is consumption levels. *** at 1% level of significance, ** at 5% level of significance, * at 10% level of significance. Cluster robust standard errors are used. The sample size for groceries, meals eaten at home and meals eaten out are 8,404, 4,698 and 7,300 respectively.

4.6 Discussion

The key research question in this chapter is the existence of the retirement-consumption puzzle in Australia and whether it can be explained by unanticipated retirement through the use of retirement expectations as an instrument. We estimated pooled OLS models for percentage changes in consumption and then instrumented for retirement. We also estimated OLS and IV models for consumption and retirement in levels. It is evident from our results that there is a negative relationship between retirement and consumption. That is, there is a drop in consumption when the household retires. Depending on how consumption is measured (whether as a growth rate or a level) or how consumption is defined (whether it is 'expenditure on groceries' or 'expenditure on meals at home' or 'expenditure on meals outside of home') the statistical relationship is stronger or weaker.

When consumption is measured as expenditure outside of home (that is, food eaten at restaurants and cafes), the drop in consumption at retirement is strong but disappears after taking into account unexpected retirement. This holds true for both the level of consumption and the rate of change of consumption. For expenditure on groceries and meals eaten at home, the coefficient on retirement is imprecisely estimated for all specifications. However, for the 2-year consumption levels sample, estimates show a statistically significant drop when retired for both expected and unexpected retirement. And after taking account of unplanned retirement using an instrumental variable, the households which retire as planned do not experience a decline in consumption on average.

Overall our results support the hypothesis that the retirement-consumption puzzle exists in Australia but only for those households not retiring as planned, i.e. external shocks contributing to unforeseen retirement. For those who retire as planned, there is no drop in consumption post retirement. This implies that individuals are behaving consistently with the life-cycle portfolio theory of consumption. Agents are forward looking and rational but in the face of unforeseen/unplanned retirement, their consumption does take a hit. This result is in line with Barrett and Brzozowski (2009, 2010 & 2012) who found the drop in consumption at retirement disappears once voluntary retirement has been accounted for. Therefore the decrease only occurs when there are unexpected shocks leading to unexpected retirement. This is within the life-cycle theory. Households that retire on their own accord do not suffer from a marked decline in consumption as measured by expenditures on groceries and meals.

4.7 Limitations

The imprecision in the estimates in the models should not be ignored. It could simply be that consumption data is known to be fairly noisy and the noise is amplified when transformed into log difference form. As a result, the data does not allow the coefficient to be precisely estimated. In this case, we cannot simply draw the conclusion that the retirement-consumption puzzle does not exist (in Australia) for planned retirees. This needs to be explored further in order to draw valid conclusions.

The estimation models we used also do not take into consideration different wealth levels of the household. Bernheim *et al.* (2001) hypothesises that the shape of the consumption profile will depend on the household's earning replacement rate and retirement savings. A worthy extension would be to investigate this further and use a model similar to that in Bernheim *et al.* (2001) which accounts for the wealth ratio and income replacement rates as well as the different stages in the transition to retirement: pre, first year, second year and post retirement. This will give a bigger picture relating to retirement consumption behaviour beyond just at the point of retirement and would provide some interesting conclusions.

4.8 Conclusion and further research

The aim of this chapter is to investigate the retirement-consumption puzzle in the Australian context and answer the question of whether older Australian household exhibit a fall in consumption (i.e. expenditure) at the point of retirement. We use subjective retirement expectations as an instrument for retirement in order to separate those who retire as planned from those who retire unexpectedly. We utilise the HILDA dataset from 2001 to 2011 and constructed an instrumental variable based on the individual responses regarding their expected retirement age. Then we estimated both a first difference log consumption and log consumption models. We find a statistically significant drop in consumption upon retirement for some definitions of consumption and samples. However, the statistically significant drop at retirement disappears once expected retirement is factored into the estimation.

The bulk of retirement and consumption literature has been devoted to the drop in consumption at retirement. However, this is just a small part of the bigger picture – even if a retired household is able to smooth their consumption as they transition into retirement, they may be unable to maintain that level for the rest of their life (Hurst, 2008). With individuals living longer, a possible extension to this work is to investigate whether there are other drops in consumption after retirement, and whether households are able to maintain their desired consumption.

Chapter 5: A Conclusion

5.1 Research motivation and questions

The overall aim of this thesis is to examine the retirement behaviour of older Australian households. In particular, households 45 years and over are of interest as this is the age group where individuals are most likely to consider and make choices and financial decisions relating to retirement. Two important decisions made by households in this age group are: the allocation of assets between risky and safe; and the allocation of income and wealth between consumption and saving. We investigate these two retirement behaviours via two perspectives. Firstly, a theoretical approach to examine the optimal consumption and risky portfolio share paths in a life-cycle framework, and secondly, an empirical approach where the hypotheses are motivated by the findings drawn from the theoretical model.

The research questions being raised in this thesis are:

- Given the Australian retirement income framework, what are the optimal life-cycle consumption and portfolio choice profiles for an individual 45 years old and over?
- For older Australian households, do retired households exhibit behaviour that is consistent with holding a smaller proportion of risky assets compared to working households? Do labour market characteristics affect asset allocations?
- Does the consumption of these households fall as they move into retirement? If so, can this fall be explained by subjective retirement expectations?

These research questions aim to contribute to the existing literature on household investment and consumption behaviour in a number of ways:

- The theoretical literature in lifetime consumption and portfolio choice started with constant lifetime portfolio choice under restrictive assumptions. Subsequent works focus on relaxing these assumptions and obtaining the optimal paths such as incorporating risky labour income and social security. We follow this same spirit in solving a simple life-cycle optimisation problem for older households incorporating elements of Australian retirement income provisions.
- The theoretical literature on household portfolio choice calls for less risky asset in retirement with some support empirically. However, there is limited empirical literature

on the relationship between retirement and portfolio choice. We add to the Australian empirical literature by using the three available wealth modules of the HILDA dataset and employing panel data estimation techniques in examining the relationship between retirement and asset allocation specifically.

- The existing literature on the retirement-consumption puzzle investigates the reasons for the empirically observed phenomenon of a drop in consumption at the point of retirement and whether these explanations are in line with the life-cycle theory. We extend to the existing Australian literature by using a more up to date HILDA survey and employing subjective retirement expectations as an instrumental variable.

5.2 Main results

We investigate the research questions by starting with the theoretical approach - solving a life-cycle model for individuals 45 years and over under a standard constant relative risk aversion utility framework. The model incorporates a simple representation of the Age Pension and the Superannuation Guarantee as well as basic earnings shock and asset return shock. We use the HILDA dataset to simulate the optimal consumption, wealth and risky portfolio share paths for 10,000 individuals and find the average optimal paths. We also examine other assumptions and scenarios including risk aversion, no labour income risk and an alternative treatment of the superannuation balance.

A key finding is that the optimal consumption path throughout the individual's life-cycle is fairly smooth with no large drop at retirement. Individuals are able to anticipate the drop in income after retirement by increasing precautionary savings and drawing down on wealth after they retire. The optimal portfolio share in risky assets is high at the beginning of the life-cycle but drops gradually when approaching retirement. Although it recovers slightly just after retirement, it is substantially lower compared to while the individual is working. This is due to human capital being a safe asset early in life causing the portfolio tilt in risky assets. However, as the individual ages, she expends human capital, and the portfolio moves towards holding the safe asset.

The model is not designed to fully replicate the features of the Australian retirement income system as the means tests and tax implications are not modelled. Instead, it is designed to give a flavour of what the optimal paths would be like under simplified assumptions of the system. It provides motivation for the hypotheses used in the empirical investigation of consumption and asset allocation behaviour of older households.

We then proceed to examine household asset allocation using Waves 2, 6 and 10 of the HILDA dataset. We employ a pooled ordinary least squares model, a fixed effects model, a random effects model and also use instrumental variables estimations in answering the question of whether retired households hold less risky assets compared to working households. We find some evidence of a decrease in the proportion of risky assets held for retired single households but for couple households only when both are retired, the proportion decreases. This largely supports the optimal asset allocation derived from the theoretical models in which simulations show a decrease in the path of optimal portfolio share in risky asset at the point of retirement. It also adds to the existing Australian empirical literature on household asset allocation, by using a longitudinal dataset rather than cross-sectional and we find other factors which affect risky asset holdings include years to retirement, risk aversion, self-employment and investment substitutes.

Lastly, we utilise Waves 1, 3 to 11 of the HILDA survey to test whether households experience a drop in consumption upon retirement. This phenomenon is known as the retirement-consumption puzzle as the life-cycle theory implies agents are rational and forward-looking, resulting in smooth consumption paths. This is evident in the optimal consumption profiles generated in our simple model. We examine this empirical question using instrumental variables estimation where subjective retirement expectations are used as an instrument for retirement. We find that there is a drop in consumption at retirement but only for those who do not retire as planned, which means only when there are external shocks contributing to an early retirement. This suggests individual behaviour is consistent with the life-cycle theory. Our study uses a different methodology to that which is used in existing Australian literature and is also based on more up to date data. Overall, the results we obtain largely support those in existing literature regarding the explainable existence of the puzzle (for example Barrett & Brzozowski 2009, 2010, 2012).

5.3 Implications

The design of the Australian retirement income system is complex due to the tax rules, regulations and means tests in the integration between the public and private retirement provisions. As a result, it is important to investigate the impact of the system on retirement behaviour. When it comes to the ageing of the population, one of the key issues policymakers are interested in is whether or not retirement provisions are adequate for individuals to maintain their standard of living. What matters here for future wealth and consumption is both household asset portfolio allocation and household consumption expenditure.

Although we find some evidence that retirement households hold less risky assets compared to their working counterparts, the evidence is not overwhelming. Many older Australians have few assets outside of their superannuation account and their own home. Furthermore, for those retirees who keep money in the superannuation system, the default strategy within Australian superannuation funds has 68% risky asset allocation. However, a number of superannuation funds are offering life-cycle products in their MySuper products - as a part of the 'Stronger Super' initiative by the Australian Federal Government. Another policy related issue is whether means tested Age Pension acts as an incentive to engage in risky investment behaviour. That is, the income and asset tested Age Pension acts as a form of 'down-side' insurance when income and/or assets in retirement fall. This suggests that Age Pension eligibility could be associated with risky investment behaviour. We do not find any evidence to support this in the HILDA data. However, we do not make the distinction between full and part pensions. Specifically, taking account of full and part pensions in the investigation of retiree investment behaviour is an avenue for further research.

The consumption expenditure pattern at retirement is of interest to policymakers as it gives an indication of whether individuals have saved enough for retirement and whether they have maintained their living standards from their working years. The empirical evidence suggests a fall in consumption expenditure of Australian households at retirement. Within the literature, the fact that there is this drop at retirement is never in question. The reason for the drop and whether it is within the life-cycle portfolio theory of consumption is up for debate. Our results show that external shocks leading to unexpected retirement drive the drop in consumption at retirement. This is within the life-cycle framework where agents are rational and forward looking. It means that those who are prepared for retirement, contingent on no unexpected health or adverse shocks, do not suffer from a drop in standard of living.

5.4 Further research

Given the ageing of the Australian population, the importance of investigating various aspects of retirement decisions is paramount to ensure the adequacy and sustainability of the retirement income system and the welfare of the retired households. This thesis attempts to answer some of those questions and provide empirical evidence to the theories arising from the life-cycle framework. However, there are many more unanswered questions and we wish to mention several interesting avenues which are worthy of further investigations in future research.

In Chapter 2, we employ a basic life-cycle model that incorporates some features of the Australian retirement income system. Our model can benefit from further improvements in modelling the income process of Australian households. We can use the HILDA dataset to derive the transient and permanent shocks associated with earnings along with finding the income processes for different occupation groups as there are heterogeneity associated with different occupations. Furthermore, retirement is often unplanned, thus another feature that can be included is endogenous retirement where the model jointly determines the optimal retirement age. Subjective mortality rates can also be added to reflect the uncertainty of death. Given the importance of means tests for the Age Pension, it would be interesting to incorporate into the model and examine the interactions with the optimal paths.

In the empirical investigation of retirement and asset allocation in Chapter 3, it is noted that many households in HILDA dataset hold limited or zero risky assets outside of their superannuation accounts. Therefore, in future research, the use of a truncated model or a selection model to more accurately reflect this feature of the data may lead to interesting results.

Lastly, we examine the consumption retirement puzzle in Australia in Chapter 4. A worthy extension would be to also account for the wealth differences between households and their relationship with consumption. It would be useful to also examine consumption behaviour beyond the point of retirement to see whether the desired consumption path can be maintained well into retirement.

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Appendix A - Data descriptions for Chapter 3

Variable	Description
Dependent variable	
Proportion of financial risky assets (narrow definition)	[equity holdings + risky component of superannuation balance]/total financial assets total financial assets = equity holdings + cash + trust funds + bank accounts + life insurance + superannuation risky component of superannuation balance: Wave 2 = 60% Wave 6 = 65.1% Wave 8 = 62%
Proportion of risky assets (broad definition)	[equity holdings + risky component of superannuation balance + business + other properties (not including own home)]/total assets Total assets = equity holdings + cash + trust funds + bank accounts + life insurance + superannuation + business + properties + cars + other assets (art, antiques, cemetery plots or other substantial asset)
Retirement	
Retired	Household head/partner is retired from the workforce completely if they are no longer working or looking for employment (dummy) Derived from: self-identifying question "have you retired completely from the workforce?" and supplemented by labour force status.
Both retired	Both household head and partner are retired from the workforce completely if they are no longer working or looking for employment (dummy)
At least one retired	At least one member of the household is retired from the workforce completely if they are no longer working or looking for employment (dummy)
Years to intended retirement	Number of years to intended retirement age. Derived from expected retirement age – actual age
Not retiring	The household head or partner has no intention to retire (dummy)
Employment	
Self-employed	The individual is self-employed
Casual employment	Employee with no entitlements such as paid annual leave or sick leave
Financial services industry	Employee works in the financial services industry
Individual characteristics	
Age	Age of the household head or partner in years
Female	Household head is female (omitted dummy)
Male	Household head is male (dummy)
Divorced	The household head is divorced or separated (dummy)
Widowed	Household head is widowed (dummy)
Income	Gross yearly income ('$100,000)
NESB	Household head or partner is born in a non-English speaking background (dummy)
Age pension	Household head or partner receiving Age Pension paid by the Australian government (dummy)
Overseas pension	Household head or partner receiving pensions or benefits paid by overseas governments (dummy)
Arriving post 1992	Household head or partner arriving in Australia after 1992 (dummy)

Variable	Description
Education attainment	
Below high school	Household head/partner’s highest educational qualification obtained is below high school (omitted dummy)
High school	Household head/partner’s highest educational qualification obtained is high school (dummy)
Diploma or certificate	Household head/partner’s highest educational qualification obtained is diploma or certificate (dummy)
Higher degree	Household head/partner’s highest educational qualification obtained is bachelor’s or higher (dummy)
Risk attitudes	
Risk averse	Not willing to take any financial risks with cash used for savings or investment (dummy)
No cash	Never has any spare cash for savings or investment (dummy)
Short planning horizon	Financial planning horizon is less than a year (omitted dummy)
Medium planning horizon	Financial planning horizon is the next year (dummy)
Long planning horizon	Financial planning horizon is next two years or more (dummy)
Health	
Poor health	Household head/partner’s self-assessed general health is poor (omitted dummy variable)
Fair health	Household head/partner’s self-assessed general health is fair (dummy)
Good health	Household head/partner’s self-assessed general health is excellent or very good or good (dummy)
Household characteristics	
Number of resident children	Number of resident children living in the household
Net worth	Household net worth (assets - debts) (‘$100,000)
Business equity	Business/farm equity (asset – debts) owned by the household (‘$100,000)
Home equity	Equity in home owned by household (‘$100,000)
Property equity	Other property value less other property debt for household (‘$100,000)
Interaction variable	
Retired*Income	Retirement × income
Wave indicator	
Wave 2	Indicator for Wave 2 observations (omitted dummy)
Wave 6	Indicator for Wave 6 observations (dummy)
Wave 10	Indicator for Wave 10 observations (dummy)

Appendix B - Data descriptions for Chapter 4

Variable	Description
Dependent variable	
Consumption (groceries)	Weekly spending on groceries averaged across individuals who provided responses in each household (deflated using 2011 food CPI). This variable is derived from the question "How much does this household spend on groceries in a normal week?" 2 forms are used: Natural log of consumption levels First difference of natural log of consumption levels
Consumption (meals eaten at home)	Weekly spending on food and drinks eaten at home averaged across individuals who provided responses in each household (deflated using 2011 food CPI). This variable is derived from the question: "About how much of the weekly grocery bill goes on food and drink (but not alcohol)?" 2 forms are used: Natural log of consumption levels First difference of natural log of consumption levels
Consumption (meals eaten out)	Weekly spending on meals eaten out averaged across individuals who provided responses in each household (deflated using 2011 food CPI). This variable is derived from the question: "Approximately, how much would this household usually spend per week on meals outside the home; that is, restaurants, takeaways, bought lunches and snacks? Do not include anything spent on alcohol" 2 forms are used: Natural log of consumption levels First difference of natural log of consumption levels
Independent variable	
Retired	The individual is retired from the workforce completely if they are no longer working or looking for employment (dummy) Derived from: self-identifying question "have you retired completely from the workforce?" and supplemented by labour force status.
Age	Age of the individual in years
Household composition	The number of people who live in the household (including partners and children)
City	The individual lives in a major city
Good health	The individual's self-assessed general health is excellent or very good or good (dummy)
Disability	The individual has a disability
Partner's retired	The individual's partner is retired (if they have a partner)
Partner's good health	The individual's partner's self-assessed general health is excellent or very good or good (if they have a partner)
Partner's disability	The individual's partner has a disability
Wave 1	Indicator for Wave 1 observations (omitted dummy)
Wave 3	Indicator for Wave 3 observations (dummy)
Wave 4	Indicator for Wave 4 observations (dummy)
Wave 5	Indicator for Wave 5 observations (dummy)
Wave 6	Indicator for Wave 6 observations (dummy)
Wave 7	Indicator for Wave 7 observations (dummy)
Wave 8	Indicator for Wave 8 observations (dummy)

Variable	Description
Wave 9	Indicator for Wave 9 observations (dummy)
Wave 10	Indicator for Wave 10 observations (dummy)
Wave 11	Indicator for Wave 11 observations (dummy)
Female	Whether the individual is female
Married	Whether the individual is married
No partner	Whether the individual has a partner
Resident children	Number of resident children in the household
NSW	Residing in New South Wales
VIC	Residing in Victoria
QLD	Residing in Queensland
SA	Residing in South Australia
WA	Residing in Western Australia
TAS	Residing in Tasmania
NT	Residing in Northern Territory
ACT	Residing in the Australian Capital Territory
Instrumental variable	
Expected to retire	The individual is expected to retire in the year of the survey/a year after the survey/two years after the survey (dummy)