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Income Sufficiency in an Aging Population

A thesis presented in fulfilment of the requirements for the degree of

Doctor of Philosophy

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ABSTRACT

Using Household Economic Survey (HES) data in New Zealand and Household, Income and Labour Dynamics in Australia (HILDA) data in 2018, retiree direct financial market participation proves to be an effective approach to improve retirees' post-retirement financial wellbeing, shown in objective and subjective measurements. More specially, those retiree participants enjoy a higher annuitised net wealth and financial situation satisfaction in New Zealand, where universal superannuation is applied. Australian retiree participants have a higher replacement ratio and annuitised net wealth, along with a higher level of subjective financial situation satisfaction, and Australia uses the means-tested age pension system. Financial market participation strongly influences retiree income sufficiency in the objective and subjective measures in both universal and means-tested pension systems. Moreover, age, gender, partnership status, living area, eligibility for government pension, and employment status play certain roles in retiree post-retirement income sufficiency. Different methods, alternative calculations for income sufficiency, and alternative questions for subjective wellbeing results are all consistent with the main results. There is a clear policy implication for governments to encourage retiree financial market participation for better retirement life.

The retiree's income sufficiency gap is decomposed in Australia and New Zealand using the HILDA and HES datasets in 2018. The Oaxaca method decomposes different influences of

demographic traits, individual financial positions, and unobserved factors on retirees' income sufficiency in Australia and New Zealand with different pension systems. The results show that Australian retirees have a higher level of annuitised net wealth; New Zealand retirees have better life satisfaction. There is no significant difference in subjective financial situation satisfaction. Specifically, Australian retirees benefit more from individual financial positions, especially in homeownership, and New Zealand retirees enjoy better demographic traits, mainly self-rated health and unobserved variables. Relative income sufficiency comparison within each country and different distribution decomposition methods prove the same influence as the main result. The Australian government should improve retirees' health status for better life satisfaction, while the New Zealand government should encourage homeownership for higher annuitised net wealth.

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CHAPTER ONE

INTRODUCTION

This chapter discusses the background of this thesis, which consists of three essays. In particular, it discusses the motivation, objective, method, and contribution of each of the three essays. The chapter concludes with the structure of the overall thesis.

1.1 Introduction

An aging population has been a worldwide issue, and aging demographics pose great threats to every country. According to the Organisation for Economic Co-operation and Development (OECD), the elderly population is defined as 65 years and above. The aging population reached 8.92% of the worldwide population in 2018, and this ratio was 17.20% among OECD countries, with the pace of population aging projected to become much faster than in the past.¹

Median age is one way to measure aging demographics, and this age divides the population into two numerically equal groups. This indicator is the group's statistical measure of location, showing half of the population in the old group and half in the young group. Since 1950, the median age of the population among the developed countries—North America, Japan, Europe, Australia and New Zealand—has increased from 29 years to 37 years and is expected to reach 45 years by 2050. For Canada and Japan, this number has already reached 42.2 years and 48.6 years in 2022, respectively.² In contrast, the median ages in the developing countries—Africa, Asia (excluding Japan) and Latin America—have been stable during this period at about 24 years. However, declines in fertility and mortality in these regions have raised the median ages in recent years, especially for South Korea, and it reached 41.8 years by 2018.³

¹ <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>

² <https://worldpopulationreview.com/country-rankings/median-age>

³ <https://interactives.prb.org/2021-wpds/>

Another way to measure the aging population is the old-age dependency ratio. The dependency ratio indicates the roles governments and families need to play in caring for the young and the old. The World Bank standardised measurement for the dependency ratio is the ratio of children under 14 and the elderly above 65 to the working population between 15 and 64 years. Therefore, the old-age dependency ratio uses the number of those 65 and over to every 100 people in the 15 to 64 working-age group, which indicates for each group of 100 working-age people, how many elderly people they are supporting. In 1950, this dependency ratio was 8.4 and increased to 12.6 in 2015 worldwide.⁴ By 2045, this number is expected to be 47, which means there will be about two working people for one older person (Martin, 2011). This indicator of population aging is just head-count ratios, and it can only relate to the number of individuals in large age categories. However, it fails to take into account the age distribution within the large categories.

The increasing old-age dependency ratio requires a higher percentage of government expenditure for aged people, including public pensions and health insurance expenditures. As a result, there are urgent calls for governments to encourage retirees to take responsibility for their own retirement. At the same time, retirees also need to search for additional income sources besides government pensions to maintain their pre-retirement lifestyle due to the limited replacement ratios from the government pensions. For example, New Zealand superannuation provides a high coverage ratio for those aged 65 years above with certain

⁴ <https://population.un.org/wpp/Download/Standard/Population/>

residency requirements, but it could only meet 40% of the average NZ income (Noviarini et al., 2021). Australia has a means-tested pension system, and the qualifying age for Age Pension is projected to increase from 65 to 67 years from July 2017 to July 2023. The current age pension qualifying age is 66.5 years in 2022, and the age pensioners reached 63% consisting of 39% full Age Pension receivers and 24% partial pension receivers in March 2022.⁵ According to OECD, the net pension replacement rate reached 41% of a man's pre-retirement earnings.⁶

New Zealand does not have a mandatory individual funded retirement saving scheme like Australia's employer superannuation. KiwiSaver started on July 1st, 2007 and it is a voluntary option for retirement savings with an auto-enrolment and opt-out feature, which functions like a compulsory contribution scheme. KiwiSaver has proved to be an effective way to improve retirement adequacy; however, KiwiSaver investors still could not achieve an adequate retirement target (MacDonald et al., 2012). Similarly, Australia employer superannuation is a mandatory scheme, and it aims to supplement the government Age Pension. Government pensions and employer superannuation cannot guarantee retirees' pre-retirement lifestyle if retirees only gain their income from these two sources according to the targets of the pension system design.

⁵ <https://www.superguide.com.au/in-retirement/age-pension-rates/comment-page-1>

⁶ <https://data.oecd.org/pension/net-pension-replacement-rates.htm>

Therefore, alternative voluntary approaches are required to maintain retirees' financial wellbeing. An effective method for higher retirement income sufficiency should be researched, and individuals' direct financial market participation proves to be a driver for their wealth accumulation among the whole population (Cocco & Gomes, 2012). Direct financial market participation provides more flexibility for individuals, and it is an important retirement income and saving option for retirees besides retirement schemes. Individual retirees can maintain their pre-retirement lifestyle by the income or gains from the financial markets while capturing their proactive investment. The risk from the financial market can be managed by individuals efficiently by adjusting their portfolios; therefore, it is a feasible and important option to improve retiree income sufficiency.

Retirees are a special group in more need of financial support than the working group due to their limited income and savings. This thesis aims to study the influence of retirees' direct financial market participation on their post-retirement financial wellbeing under different pension systems. Moreover, comparisons are also made on how retirees fare under different pension systems and how demographic traits, individual financial positions, and unobserved variables, including macroeconomic and pension system differences, play different roles in retirees' retirement financial wellbeing under different pension systems.

The remainder of this chapter consists of a brief overview of each essay in order, including the motivation, objective, method, and contribution. The structure of the overall thesis is presented in section 1.5.

1.2 Essay One: Retirement income sufficiency and financial market participation in New Zealand

New Zealand, one of the OECD countries, witnesses the aging population trend, with the median age in New Zealand increasing from 25.6 years in 1970 to 37.6 years in 2013. According to Stats NZ, it is projected to increase to 40 years by the early 2030s, and this number is expected to reach 47 years by 2073.⁷ In other words, more than half of the population will be more than 40 years old by the 2030s in New Zealand. Also, those aged 65 years and above constituted 15% of the whole population by 2019 (Stats NZ). The increasingly aging population indicates tremendous pressure on the pension system, and New Zealand has universal superannuation. All retirees are eligible for the government superannuation when they reach 65 years by passing the residency test with certain requirements. This indicates that retirees can at least receive government pensions to maintain their retirement life regardless of their pre-retirement wealth accumulation situation. However, the New Zealand superannuation provides a basic standard of living in retirement, and other alternative income sources are necessary. Therefore, the objective of this essay is to test the impact of direct financial market participation

⁷ <https://www.stats.govt.nz/information-releases/national-population-projections-2020base2073>

on individual retiree post-retirement financial wellbeing in New Zealand, which has a generous pension system.

The annuitised net wealth with and without government pensions are used as two objective measures (Haveman, Holden, Romanov, & Wolfe, 2007a), and self-rated financial and life situation satisfaction are used as two subjective measurements (Bond & Lang, 2019; Finkelstein, Luttmer, & Notowidigdo, 2009) for retiree post-retirement wellbeing. The independent variable is a dummy variable, which equals one when retirees receive income from New Zealand company dividends, unit trusts, and/or managed funds, and zero otherwise, following the literature (Brown, Ivković, Smith, & Weisbenner, 2008). The direct financial market retiree participants have a value of one, and the non-participants are zero. I also control demographic characteristics (like age, gender, living area), education, relationship status, employment status, risk averseness, regular gross retirement income, and individual net wealth.

There might be possible endogeneity issues as financial market participation can improve retiree financial wellbeing, or those retirees in the better state of financial wellbeing tend to participate in the financial market. There are also omitted variable issues. Therefore, the instrumental variable is used to address these issues. I randomly select another retiree in the same regional area, and this selected retiree's participation status represents the sample retiree's participation situation (Zhang, Fang, Jacobsen, & Marshall, 2018). It is documented that retirees within the same regional geographical area influence each other's financial

participation decisions due to economic situations and peer effects (Zhang et al., 2018). However, the observation's financial wellbeing (both objective and subjective levels) is not influenced by other retirees' participation. Due to the binary characteristics of both independent and instrumental variables, the extended regression models (ERMs) are used as the main regressions to address all these issues.

This chapter contributes to the literature by studying the influence of direct financial market participation on retirees using Household Economic Survey (HES) data in New Zealand. To the best of my knowledge, financial market participation has been studied among the whole population, and retirees are a special group, which requires more financial support from different sources. However, this group is not yet sufficiently studied, and this research focuses on both objective and subjective measures, while the literature mainly emphasises one dimension. Moreover, HES data has rarely been used to study individual retirees' financial wellbeing in New Zealand, and pre-retirement and post-retirement savings are both studied. This essay also provides a timely solution for retiree income sufficiency via their financial market participation in New Zealand, whose pension system is universal.

1.3 Essay Two: The impact of direct financial market participation on retirement income sufficiency in Australia⁸

Australia's median age increased from 35 years to 37 years, and those aged 65 years and above increased from 12.3% to 15.9% over the past 20 years from 1999 to 2019.⁹ Australia has a means-tested pension system ranking 4th among the 39 studied countries, according to the 2020 Mercer report. The means-tested pension qualifies those who pass the income and asset tests to receive the Age Pension. Therefore, wealthy retirees do not qualify for the government pension. The Age Pension is not sufficient for low-income retirees, and higher-income retirees cannot benefit from it. Therefore, I aim to study how retirees' direct financial market participation influences retirees' income sufficiency in Australia, where the means-tested pension system is applied.

I use two alternative measures for retiree income sufficiency as my dependent variables: annuitised net wealth, and replacement ratio. Annuitised net wealth is the overall net wealth determined by the interview time plus the present value of the remaining government pensions, annuitised based on remaining life expectancy and an inflation-adjusted T-bill rate, to capture a retiree's wealth accumulation. The replacement ratio (Bernheim, Skinner, & Weinberg, 2001)

⁸ Essay one and essay two study similar issues in New Zealand and Australia context, and they share some common literature. However, the financial literacy is discussed in New Zealand and the financial market participation puzzle is mentioned in Australia due to data availability. Financial literacy is an important control variable, and it is not available in New Zealand. By explaining the financial literacy in New Zealand paper, I try to deal with this omitted variable by including other relevant control variables and instrumental variable. In Australian paper, financial market participation has been a puzzle in the literature, and Australia has a high domestic stock market participation rate. Therefore, financial market participation puzzled is discussed in Australia.

⁹ <https://www.abs.gov.au/ausstats/abs@.nsf/0/1cd2b1952afc5e7aca257298000f2e76>

is the retiree's regular gross retirement income divided by their average pre-retirement income. Due to the limitation of the data, I use the retiree's pre-retirement industry average income as their average pre-retirement income¹⁰, and this approach measures the retiree's income sufficiency from the income perspective. The independent variable is the individual's financial market participation situation, which equals one if they participate in the financial market and zero otherwise. I also use the selected retiree's participation situation within the same state as the instrumental variable for the observation due to the possible endogeneity issue. There could be a chance that wealthy retirees have higher possibilities to participate in the financial market, and omitted variables exist. The instrumental variable helps address these issues, and extended regressions (ERMs) are used for dummy independent and instrumental variables.

This essay contributes to the literature in terms of the data used and the application of income sufficiency measurements. To the best of my knowledge, the Household, Income and Labour Dynamics in Australia (HILDA) data in Australia have not been used sufficiently to study retirees' income sufficiency from financial market participation. Retirees are a unique group whose income and savings are limited, and they need more flexible income sources. Moreover, the retiree income sufficiency is measured from income (replacement ratio) and wealth (annuitised net wealth) levels, and most research focuses on only one measurement. Financial

¹⁰ HILDA survey provides panel data and it started in 2001. If one year before retirement income were used, the pre-retirement income would only be available for those retirees between 65 and 82 years. Those retirees aged 65 years in 2002 would be 82 years in 2018 and this group of retirees would be the last ones whose pre-retirement incomes were surveyed. Moreover, there are arguments in the literature (Biggs & Springstead, 2008) that the income from one year before retirement is not representative for pre-retirement income because pre-retirees start to reduce the workload and they are in transition to retirement.

situation satisfaction is also examined as the robustness check. This chapter provides an effective suggestion for the government to improve retiree income sufficiency via their financial market participation, which could be encouraged by higher financial literacy.

1.4 Essay Three: Retirement income sufficiency comparison in Australia and New Zealand

Australia and New Zealand have many characteristics in common; however, they have different pension systems. Australia has a means-tested age pension, and only those who pass the income and assets tests qualify for the government pension. In contrast, New Zealand has universal superannuation, and every retiree, provided they pass the residency test, qualifies for the government pension. The Australian and New Zealand pension systems perform well and have 74.2 and 68.3 overall index values in the 2020 Mercer report, consisting of adequacy, sustainability, and integrity.¹¹ Retirees under different pension systems prepare differently for their retirement, and this essay aims to study how different personal characteristics influence retiree income sufficiency between these two countries.

I use the Oaxaca method to decompose the average objective and subjective measures gap between Australia and New Zealand. The overall annuitised net wealth and annuitised net

¹¹ <https://www.mercer.com.au/my-thinking/global-pension-index.html>

wealth without pensions are used as the objective measures, and financial situation and overall life satisfaction as subjective wellbeing measures. I control demographic traits (including age, gender, living area, employment status, self-rated health, highest education, and partnership status) and individual financial positions (including savings in bank accounts, homeownership, pension funds, mortgage, other debts, home contents insurance, financial market participation, gross retirement income, and individual net wealth). These control variables can explain the financial wellbeing gap in the decomposition between the two countries; therefore, four different regressions decompose the influence from those demographic traits, individual financial positions, and all the unobserved variables, which include macroeconomic differences between Australia and New Zealand and factors resulting from differences in the two countries' pension systems.

The objective measurement decomposition results show that Australian retirees have a significantly higher annuitised net wealth in both measures. Specifically, Australian retirees have better individual financial positions, shown in the homeownership, and individual net wealth. On the other hand, these demographic traits, mainly in self-rated health and living areas, and unobserved variables benefit New Zealand retirees more.

The subjective measurement decomposition regressions show different results, that New Zealand and Australian retirees have no significant difference in financial situation satisfaction. In contrast, New Zealand retirees have significantly better average ratings for their life

satisfaction. In detail, New Zealand retirees benefit more from the average demographic characteristics and the unobserved variables. The influence from these unobserved variables places New Zealand retirees in a better average life satisfaction situation score.

There are three main contributions of this essay. Firstly, this research studies retiree financial wellbeing from both objective and subjective measures. Moreover, the objective perspective is divided into pre-retirement and post-retirement wealth levels, and the subjective wellbeing consists of overall life and financial situation satisfaction. Secondly, this essay also uses a novel method to decompose the influence from demographic traits, individual financial positions, and unobserved variables between Australia and New Zealand. Lastly, this essay shows important policy implications that the Australian government should improve retirees' health status to improve their average subjective life satisfaction. In contrast, the New Zealand government needs to encourage individual homeownership for better average objective annuitised net wealth.

1.5 Structure of the thesis

The overall structure of my Ph.D. thesis is organized as follows. The next chapter is essay one, studying the influence of retirees' direct financial market participation on their income sufficiency in New Zealand. Chapter three is essay two, research on the impact of direct financial market participation on retirement income sufficiency in Australia. Essay three is the

fourth chapter, a study on retiree income sufficiency comparison between Australia and New Zealand. The last chapter is the conclusion by summarizing the main findings and policy implications, followed by the limitations and suggestions for potential future research.

CHAPTER TWO

ESSAY ONE

RETIREMENT INCOME SUFFICIENCY AND FINANCIAL MARKET PARTICIPATION IN NEW ZEALAND¹²

Using New Zealand Household Economic Survey (HES) 2018 data, I examine the impact of direct financial market participation on retirement income sufficiency in New Zealand. My results document the importance of financial market participation to enhance retirees' post-retirement financial wellbeing. I conclude that retirees who participate in the financial market enjoy a 40% increase in overall annuitised net wealth; further analysis also reveals a substantial 178% increase if the government pension is excluded from the calculation of annuitised net wealth. This highlights the significant contribution from pre-retirement income to post-retirement income sufficiency through direct financial market participation. This paper sheds extra light on issues related to retirement income sufficiency and offers important implications for policy makers in New Zealand.

¹² Access to the data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in this study are the work of the authors, not Statistics NZ.

2.1 Introduction

The pension system plays a significant and vital role to support its citizens' retirement life worldwide. It should be designed to provide security for retirees to maintain a minimum living standard, especially for those with the government pension as their single source of income. The pension systems in many countries are organized and affected by demographic aging. The Organization for Economic Co-operation and Development (OCED) reported 17.2% of the aging population (those aged 65 years and above) across all OCED countries in 2018, while this number is expected to rise to 27.1% by 2050.¹³ The ongoing aging process implies less saving for retirees with longer life expectancy and poses significant challenges to the sustainability of the pension system. Therefore, it is necessary for the system to be reviewed and reformed to keep it adequate and sustainable.

New Zealand's three-pillar pension system is one of the world's most generous system and considered to be at the forefront for its adequacy and sustainability. However, the NZ superannuation (first pillar) rate does a good job for the low-income group if its intended purpose is to keep older people out of poverty, with its primary goal being to provide social protection rather than to replace earnings. For the high-income group, New Zealand's second and third pillars are not comparable to other countries with mandatory savings schemes and other programs. New Zealand Ministry of Social Development data shows there were 774,651 people receiving New Zealand Super in March 2019. By 2068, the number is projected to be

¹³ <https://data.oecd.org/pop/elderly-population.htm>.

1,838,100, representing 28.21% of the population.¹⁴ Moreover, New Zealand fell from 10th to 15th place among 43 countries according to Mercer's ranking in 2021, mainly due to the significant drop in the adequacy sub-index.¹⁵ This unarguably presents significant social and economic challenges to the New Zealand government. Kiwis have obviously become increasingly liable to save for their own retirements. In addition, there are voices to increase the pension qualifying age from 65 to 67¹⁶, New Zealand policymakers are forced to devote significant resources and time to encourage private savings through financial literacy education and direct financial market participation. It has been believed that financial markets are crucial to a nation's economic growth and financial market participation is the engine to drive an individual's net wealth. Thus, in this study, I attempt to answer the following important question: Does the financial market participation increase private savings so that enhancing retirement income sufficiency in New Zealand? The New Zealand Household Economic Survey (HES) 2018 data provide a venue to examine this important yet interesting question in the New Zealand context. I also investigate to what extent and through what channels the financial market participation affects retirement income sufficiency.

Giannetti and Koshinen (2010) document that New Zealand ranks the second with its domestic stock market participation, only behind Australia but ahead of the UK, Japan, Denmark, and

¹⁴ <https://www.stuff.co.nz/business/119288609/pension-age-debate-crunch-coming>

¹⁵ https://www.mercer.com/our-thinking/global-pension-index-2021.html?mkt_tok=NTIxLURFVi01MTMAAAGAd1aOK2i2tzei9r7fZTfu7s98i6YLVL8YytHDtsXCxuuzGmJJbWLDj4ygUAR2DVXlxbkv5MbgEvc953cdhSwotsHu8kXGI7-3ppc197oxfenzFHHug

¹⁶ <https://www.beehive.govt.nz/release/nz-superannuation-age-lift-67-2040>

the U.S.¹⁷ New Zealand equity market has experienced steady growth of 11.2% with a 7.2% return over the 2008 to 2018 period, according to NZ Stock Exchange and the Financial Markets Authority (FMA) report.¹⁸ Therefore, the financial market participation provides an alternative income source for retirees as a special group with limited earnings capacity. This is important and significant during the time when NZ interest rate is low. Retirees may have indirectly participated in the financial market from the defined contribution for their retirement plans, however, these are passive strategy and not the focus in this study. In this paper, I focus on the direct financial market participation including: the holding of shares, unit trusts, and managed funds, where retirees have direct and full control. Thus, if a retiree has invested in equity markets, unit trust, and/or managed funds, this retiree is considered to directly participate in the financial market. The HES 2018 data enable me to identify this information. The HES data also allows us to calculate the annuitised net wealth (with and without government pension) as my objective measurement for the retirement income sufficiency. The annuitised net wealth has been used in the existing literature as a way to measure the retirement income, as documented in the literature (Burnett, Davis, Murawski, Wilkins, & Wilkinson, 2018; Haveman, Holden, Wolfe, & Sherlund, 2006). In addition, I use the HES survey scores on retirees' overall life satisfaction and financial situation satisfaction as an alternative subjective measurement for the retirement income sufficiency.

¹⁷ 26 countries were studied by Giannetti and Koskinen (2010), New Zealand's participation rate reached 31%, only behind Australia (40.4%), and ahead of the United Kingdom (30%), Japan (29.7%), Denmark (28%), and the United States (26%).

¹⁸ <https://www.fma.govt.nz/assets/Reports/Growing-New-Zealands-Capital-Markets-2029.pdf>

For a sample of 2,175 retirees, I conclude that the direct financial market participation has a positive and significant impact on the retirement income sufficiency, when the retirement income sufficiency is proxied by the objective and subjective measurements. I find that retirees who directly participate in the financial market experience approximately 40% increase in annuitised wealth, compared to those who do not. This rate increases substantially to 178.78% when the government pension is not included when calculating the annuitised net wealth, indicating that the direct financial market participation increases the pre-retirement wealth which contributes significantly to the post-retirement income. Further investigation reveals that older wealthier male retirees with better education and more risk averseness likely experience higher retirement income. On the other hand, I find that living with a partner reduces the retirement income.

I further conduct my analysis using subsample including age, gender, partnership status, living area, and employment status subsamples. My results highlight the difference between younger and older retirees; for example, the positive impact of the financial market participation on the retirement income sufficiency is reflected through the annuitised wealth channel, for younger retirees. On the other hand, it is reflected through the subjective financial wellbeing channel, for older retirees. Other subsample results confirm my baseline results; for example, male retirees are more likely to participate in the financial market resulting a greater retirement income, retirees living with a partner have significant higher financial participation rate compared to retirees without a partner. I also find that the financial market participation increases retirement income regardless the living area and the employment status of retirees. I

use several alternative approaches to conduct the robustness checks and all results are consistent with my baseline results and suggesting that my main results are robust.

I contribute to the existing literature in several important ways: 1. I consider the impact of the direct financial market participation on retirement income using both objective and subjective measurements from New Zealand HES 2018 survey data. Many prior literature, either use the objective (Haveman, Holden, Wolfe, & Romanov, 2007b) or the subjective measurement (Bonsang & Klein, 2012), and I use both to gain a more comprehensive picture of retiree's retirement life. 2. I use the annuitised net wealth without government pension as an alternative proxy for the retirement income sufficiency, which enables me to determine the significant contribution from the pre-retirement income to the post-retirement income through the financial market participation; 3. I only focus on retirees, while prior literature mostly focuses on the entire population (Bilias, Georgarakos, & Haliassos, 2017; Fagereng, Gottlieb, & Guiso, 2017). Retirees, who have limited income and savings need more alternative methods to maintain their pre-retirement lifestyle as the government pension system aims to provide the minimum living standard; 4. My results have important policy implications that NZ policy makers should allocate adequate resources to promote financial literacy so that increase the direct financial market participation (Noviarini, Coleman, Roberts, & Whiting, 2021).

The remainder of the paper is organized as follows. Section 2.2 briefly discusses the institutional background of NZ retirement system and relevant literature. Section 2.3 describes the data and methodology. Section 2.4 presents the empirical results and Section 2.5 concludes.

2.2 Institutional background and literature review

2.2.1 Aging population and retirement pension system in New Zealand

The median age of New Zealander population increased from 35.9 years old in 2006 to 37.4 years old in 2018, with the aging population (aged 65 and above) rising from 12.1% in 2001 to 15.2% in 2018, expected to reach 22.22% in 2036. The growth rate of 65-plus is 10.5 times faster than those 14-under, with an old-age dependency rate of 23.5 for every 100-working people. This ratio reveals how many retirees are supported by young working generations. For the period from 2017 to 2019, the life expectancy is 80 for males and 83.5 years for females, while it is 67.2 for males and 71.3 for females during 1950-1952. The increase in life expectancy represents the extension of each age group. However, the gross cost of New Zealand superannuation is projected to increase from 4.8% of GDP in 2015 to 7.2% in 2045 and reach 7.9% by 2060 according to the NZ Treasury 2017 report.¹⁹ However, on an after-tax basis, this is equivalent to 4.2% of GDP in 2016, 6.1% in 2040, and 6.7% by 2060 (Davey & Stephens, 2018). Thus, the rising of the aging population imposes significant pressure on the government pension system over time. Therefore, raising the compulsory retirement age may

¹⁹ <https://www.treasury.govt.nz/sites/default/files/2017-03/sup-3753700.pdf>

provide an effective way to release the burden for government expenditure on public pensions. Alternatively, an even more effective way to address this issue is to promote private savings through the direct financial market participation.

The aging population also puts considerable pressure on public health systems (de Meijer, Wouterse, Polder, & Koopmanschap, 2013), and the health expenditure of GDP has increased from 7.47% in 2000 to 9.21% in 2018, according to the World Bank. The reduction of health and housing subsidies will again cause poverty among aging people (Davey & Stephens, 2018), which in turn puts more pressure on the government. The increasing need for care for older people may also indicate a shortage of skilled workers (Jackson, 2002). According to the OECD Stats, the employment rate of older workers (those between 65-69 years) is 44.0%, and the effective labour market exit ages are 69.8 and 66.4 years for male and female, respectively. On average, one in four people aged 65 years and above are in paid employment (Statistic NZ), and New Zealand has a higher aging employee ratio among OECD countries.²⁰ The expected years in retirement are 15.6 and 20.5 years for males and females, according to the Allianz pension report 2020.²¹

New Zealand has a generous three-pillar pension system. New Zealand Superannuation (NZ Super) is the first pillar, and retirees are qualified for the NZ Super if they pass the residency test, where they must be a citizen, permanent resident, or a residence class visa holder with

²⁰ My sample shows that more than 20% of retirees are still working after reaching retirement age.

²¹ https://www.mirovinskifondovi.hr/media/uploads/allianz_global_pension_report_2020.pdf

certain amount of time spent in NZ. The NZ Super is a flat-rate pension for all qualified retirees, around NZD 25,000 a year before tax paid to a single person, and NZD 40,000 to a couple in 2021²², and NZ Super is taxable income. NZ Super is designed to keep up with the rising cost during the retirement life, as it rises with inflation or the average after-tax wages. However, NZ Super cannot guarantee the standard of living for those who are in relatively higher income before retirement, and they have to top-up their private savings in order to maintain a similar standard of living (Makhlouf, 2011). Thus, NZ Super only satisfies those lower-income retirees who made less than 50% of the average wages before retirement. New Zealanders held different views on the role of NZ Super; some consider it as a way to meet the basic standard of living, while others see it as a reward for working hard and paying taxes, according to the Commission for Financial Capability.²³ From both points of view, it indicates that Kiwis consider NZ Super as a minimum standard for retirement living, and retirees may be unable to reach the desired level of living from this single source of income. Moreover, New Zealand Retirement Expenditure Guidelines (2021) report an increase in retirement spending in excess of NZ Super, and the gap is widening.²⁴

KiwiSaver is a defined voluntary contribution scheme, considered as the hybrid of the second and third pillar of the New Zealand retirement system, introduced in July 2007.²⁵ It is a

²² The NZ super payment is different according to the partnership status and with a dependent child situation. These payments are the highest levels for living with a dependent child.

²³ <https://cffc.govt.nz/news-and-media/news/purpose-of-nz-retirement-income-system-defined/>

²⁴ https://www.massey.ac.nz/massey/fms/Colleges/College%20of%20Business/School%20of%20Economics%20&%20Finance/FinEd/documents/RetExpBudget_Report_June2021.pdf

²⁵ According to World Bank categorisation, KiwiSaver belongs to the third pillar as it is voluntary. However, due to its auto-enrolment and opt-out feature, I consider it as a combination of the second and third pillar in this paper in order to make the pillar level consistent. Otherwise, NZ pension system does not have the second pillar.

combined contribution from employees and employers, and the minimum contribution rate for an employee is 3% of the before tax income. KiwiSaver is an auto-enrolment scheme, and it functions like compulsory superannuation from its design, as employees rarely withdraw from it. Retirees benefit tremendously from the default option as people tend to keep the status quo and reluctant to make changes. Due to the short span of this scheme, however, many retirees (those aged 65 and above) do not benefit from this scheme, and some employees have withdrawn from the scheme despite the low withdrawn rate.²⁶ Before the introduction of KiwiSaver, the occupational savings scheme (provided both by the government and the private sector) has around 15% of the workforce, and the enrolment rate has been declining (2015, NZIER report).²⁷ In addition, KiwiSaver helps to improve the financial situation for those retirees with low to the middle level of wealth, but not significant for those high income retirees, as wealthy retirees tend to have alternative plans to maintain their pre-retirement lifestyle.

The third pillar is the voluntary saving scheme. It refers to any type of retirement saving schemes from self-selected defined contribution and/or defined benefit plans, annuities, life insurance, and other types of savings. Retirees may choose their own supplementary third-pillar retirement plans before or after retirement to secure sufficient income for retirement life. The third pillar is not compulsory, and it serves as an additional source of retirement income to supplement the first two pillars and provides retirees with their desired retirement lifestyle.

²⁶ According to Inland Revenue Department and Statistics New Zealand, by May 2015, the participation rate for those 18 to 64 years has reached 76.5% and opt-out rate was 9.3%.

²⁷ <https://www.fsc.org.nz/site/fsc1/Reports/Kiwisaver%20&%20the%20wealth%20of%20NZers-NZIER%20report%20to%20FSC,%20Aug15.pdf>

However, it is difficult for retirees to maintain their pre-retirement life without savings from the third pillar. There is a broad range of voluntary retirement pension plans. In this paper, I only focus on the direct financial market participation, which is the retiree's direct holding of New Zealand company shares, managed funds, and unit trust. I attempt to examine the role of the direct financial market participation in enhancing retiree income sufficiency.

Makhlouf (2011) documents that New Zealand has the lowest poverty rate among aging populations, while Dang, Immervoll, Mantovani, Orsini and Sutherland (2006) conclude that countries with more support for the aging population may result in a higher level of poverty among retirees. However, the low poverty ratio among various countries is a result of complete home ownership among retirees, as most pay off their mortgages upon retirement. This phenomenon implies that the poverty rate is significantly affected by the homeownership in aging population. Property can be considered as an extra pillar to provide another layer of income (Kronick & Laurin, 2016), and it is normally considered as the last resort (Skinner, 2007). Furthermore, Statistic NZ (2020) reveals that the homeownership has been deteriorating and the household income in NZ is relatively lower among all OECD countries.²⁸ It is therefore the time for New Zealanders to focus on private savings for retirement, especially when the life expectancy tends to increase over time.

²⁸ <https://www.stats.govt.nz/reports/housing-in-aotearoa-2020>.

2.2.2 Literature review on retiree income sufficiency

Retirees encounter income sufficiency challenges when they retire. Haveman et al. (2006) find that 30% of retirees are unable to maintain a level of income equivalent to 70% of the pre-retirement income. This ratio would reach 40% if longer life expectancy is expected in the U.S. Chansarn (2013) reveals that working-age people (between 50-59) in Thailand have reasonable economic preparation. Love, Smith and McNair (2008) document that 18% of the households have less wealth than needed for basic retirement income and 13% have a replacement ratio of less than 50% in the U.S. Bresser and Knoef (2015) conclude that 20% of the Dutch are unable to meet their minimal expenditure even if they draw down from their housing. Moreover, retirees have very limited sources of income and many retirees with longer life expectancy are forced to rely only on the basic pension in Korea (Sung, 2016) due to inadequate preparation for longer life expectancy before retirement. Kim and Hanna (2015) suggest that half of their sample individuals failed to meet their expected financial wellbeing in the U.S. As a result, retirees are forced to reduce their expenditure due to the drop in their retirement income, rather than changing their lifestyles (Denton, Mountain, & Spencer, 2006). The lifecycle model implies that individuals substitute leisure time for their consumption (Bonsang & Klein, 2012); however, retirees in Japan do not immediately change their behaviour on expenditure when they retire. Only those less likely to receive enough retirement income drop consumption (Unayama, 2011). Luhrmann (2009) finds that the 17% drop of pre-retirement expenses at retirement is substituted by an extra 21% increase on chores, and Butrica (2005) concludes that housing is the largest expenditure, followed by the health care in the U.S. Scobie et al. (2004) find that New Zealand superannuation provides the floor for those pre-retirees, who are at the

lowest 40% of the income distribution and reduces the inequality of retirement wealth accumulation. According to OECD, the net pension replacement rate in New Zealand was 43% of pre-retirement male earnings in 2020, compared with the OECD average of 63%.²⁹ Noviarini et al. (2021) show that the New Zealand pension system puts great pressure on retirees to personally manage their wealth, while 70% of the retirees are unprepared for retirement, with only 43% understanding the different strategies and approaches to investing their money (Financial Services Report, 2020).

The objective measurement for the retirement income sufficiency focuses on the value of wealth, and it calculates the cash flow to be distributed to the remaining retirement life. This measurement is defined as the annuitised net wealth (Haveman et al., 2007a; Haveman et al., 2006), where the individual net wealth is annuitised based on the expected life expectancy. The annuitised net wealth is a reliable way to gauge retirees' retirement wealth, as the life expectancy and risks as reflected by the discount rate are taken into account. However, it is difficult to define the threshold for income sufficiency, for example, it is documented that 30% of retirees are unable to meet the 70% of the pre-retirement income benchmark, with 5% having inadequate resources measured by the national poverty line in the U.S. (Haveman et al., 2006). The annuitised net wealth provides a benchmark amount that retirees are expected to receive during retirement, however, it does not provide sufficient information on the sustainability of the retirees' pre-retirement lifestyle after retirement (Bernheim et al., 2001). Therefore,

²⁹ <https://data.oecd.org/pension/net-pension-replacement-rates.htm>

alternative measurements would provide insights into a comprehensive understanding of retirement income sufficiency. Subjective wellbeing has been widely applied and considered to be a good proxy to measure utility function (Finkelstein, Luttmer, & Notowidigdo, 2009). Bonsang and Klein (2012) document that involuntary retirement schemes result in negative impacts on overall satisfaction on retirement financial wellbeing. Elder and Rudolph (1999) conclude that the pre-retirement financial literacy education enhances the financial wellbeing in the U.S. Therefore, I use the overall life and financial situation satisfaction as my subjective measurements for the retirement income sufficiency.

Life satisfaction is related to a wide range of factors, such as health, income (Layard, Mayraz, & Nickell, 2008), and other personal characteristics, while financial satisfaction is more related to the wealth position. Therefore, the overall life satisfaction and the financial situation satisfaction may exhibit distinct patterns. For example, Alan, Atalay, & Crossley (2008) report that the life satisfaction appears to fall with age, while the financial situation satisfaction seems to rise with age in Canada. They also document that the financial dissatisfaction is more related to involuntary retirement. Barrett and Kecmanovic (2013) derive similar results that subjective wellbeing either improves or remains unchanged after the retirement for majority of retirees, those with deteriorating wellbeing are largely due to job losses and/or bad health conditions. However, subjective measurements may not necessarily closely relate to income or wealth as they are only one ingredient of the overall life satisfaction. For example, Bond and Lang (2019) document that the subjective measurement may not be as reliable as the objective

measurement. Nevertheless, the subjective life satisfaction and financial wellbeing measurements may still provide an indispensable angle for retiree income sufficiency.

2.2.3 Financial literacy and financial market participation

The Commission for Financial Capability (CFFC) Statement of Intent 2021-2024³⁰ highlights that 14% to 18% of NZ employers are actively planning for an aging workforce, 26% of men and 41% of women under 65 are ignorant on how much they need for a comfortable retirement. Thus, there exists an urgency to promote financial literacy and financial market participation, as the financial literacy and the retirement income sufficiency are significantly correlated (Fong, Mitchell, & Rohwedder, 2020).

Financial literacy is the ability to understand and use financial skills to manage financial resources effectively for a lifetime of financial wellbeing (Hung, Parker, & Joanne, 2009). Three terminologies are commonly used in designing survey questionnaires to evaluate an individual's level of financial literacy including inflation, compounding, and diversification (Bernheim, 1998; Gustman & Steinmeier, 2005; Lusardi, 2006). A number of demographic factors are also considered to be related to the financial literacy for example, gender (Lusardi & Mitchell, 2008) and the level of education (Worthington, 2006). In addition, many evidences

³⁰ <https://cffc-assets-prod.s3.ap-southeast-2.amazonaws.com/public/Uploads/Corporate-reports/Statement-of-Intent/CFFC-Statement-of-Intent-2021-2024.pdf>

have been documented in international settings (Almenberg & Säve-Söderbergh, 2011; Boisclair, Lusardi, & Michaud, 2017; Bucher-Koenen & Lusardi, 2011; Kalmi & Ruuskanen, 2018; Moure, 2016). Crossan, Feslier and Hurnard (2011) reveal that financial literacy is insignificantly associated with the retirement planning in New Zealand among those aged 18 years and above. This may be due to the New Zealand's universal public pension systems. However, a more recent study (Noviarini et al., 2021) surveying those aged 55 and older argues that financial literacy is important for retirement preparedness.

Financial market participation is a product of financial literacy (Cardak & Wilkins, 2009; Van Rooij, Lusardi, & Alessie, 2011), although it may also be affected by other factors (Yogo, 2016). Financial literate individuals are more likely to participate in the financial market and invest in stocks (Almenberg & Dreber, 2015; Van Rooij et al., 2011). Furthermore, Fong et al. (2021) report that a one unit increase in literacy scores was associated with 8.3% points higher likelihood of stock market participation among adults aged 50 to 70 years in Singapore. Financial literate individuals are more likely to be savvy to manage their financial portfolios and deal with the respective risks as well (Hastings & Mitchell, 2020). Financial literacy can not only encourage financial market participation but also influence financial portfolio management. It plays a fundamental role in promoting financial market participation effectively.

The financial market participation enables a wide range of improvements in an individual's income and wealth positions (Calvet, Campbell, & Sodini, 2007; Cocco & Gomes, 2012). Under a simple assumption, the fraction of stock market ownership is expected to be independent of age and wealth; however, using a more complicated model, Ameriks and Zeldes (2004) conclude that individuals do not decrease their equity holdings over time. As a matter of fact, the low stock market participation rate is persistent across different age cohorts. Moreover, people tend to participate in the financial market during a bullish market and are reluctant to do so during a bearish market (Mitchell & Utkus, 2006). New Zealand equity market is relatively small by international standards with a market capitalization represents 30% of the GDP, while the U.S. and Australia are 120% and 90% of their GDP in 2014, respectively, according to the Reserve Bank of New Zealand.³¹ On the other hand, New Zealand equity market has performed well compared to other major equity markets, mainly due to the increase in liquidity provided by new market participants and the lower interest rate over the last decade. Many believed that the financial market participation enables individuals to accumulate sufficient wealth for their retirement, therefore, citizens in any nation should always be encouraged to participate in the financial markets. Instead of indirect participation, the direct financial market participation in my paper refers to an individual's own willingness and control over their investment in the financial market. I do not consider the voluntary pension scheme or the holding of bonds³² as they are rather passive strategies. The direct financial market participation can capture an investor's risk preference and the desire towards investment which

³¹ <https://www.rbnz.govt.nz/financial-stability/financial-stability-report/fsr2014-11/the-role-of-capital-markets-in-the-new-zealand-financial-system#fn3>

³² Moreover, my results can be lifted by including these passive operations as well and due to the availability of the data, the passive methods are not included.

may contribute towards the retirement income. Therefore, I choose the direct financial market participation as my main independent variable in my paper, and I conjecture that the direct financial market participation can enhance the retirement income sufficiency in New Zealand.

2.3 Data and methodology

2.3.1 New Zealand Household Economic Survey Data

My data are collected from the New Zealand Household Economic Survey (HES) 2018 data. HES data is a cross-sectional survey dataset conducted by Statistics NZ at the national level. It randomly selects households and individuals above 15 years old and collects information on household income, savings, expenditure, and demographics, at both the household and the individual levels. HES survey questionnaires are designed to collect important household economic information and frequently used by the central bank, the government and its agency, and research institutions. For example, HES Expenditure data is used to estimate NZ inflation rate calculated from the consumer price index (CPI). HES Income data is used to project the number of low-income families, and HES Savings data is used to calculate the net wealth for the individual/household. Data on household income and housing expenditure are updated on an annual basis, while data on wealth and other expenditure are updated every three years. I only collect the HES 2018 survey data with individual/household members who are 65 years old and above. My sample contains 2,175 retiree observations, of which 1,050 households have

one individual retiree, 552 households have two individual retirees, and the rest has more than two retirees within the same household.³³

I select the responses from the survey questionnaires and define the relevant variables used in this paper, including individual net wealth, direct financial market participation, life satisfaction, and financial situation satisfaction. I use the annuitised net wealth as my objective measurement for the retirement income sufficiency (my dependent variable), as documented in Haveman et al. (2007b). Specifically, both the overall annuitised net wealth with and without government pension are calculated using the individual retiree's net wealth, discounted by the inflation-adjusted Treasury-bill rate while considering the retiree's life expectancy. Using the annuitised net wealth without government pension enables us to examine the significance of the pre-retirement wealth towards the retirement income. I also use the overall life satisfaction and the financial situation satisfaction from the retirees as my subjective measurements to proxy the retirement income sufficiency, similar to Bonsang and Klein (2012). Life satisfaction is a question asked for retirees to consider their overall life situation. It provides a subjective rating score ranging from 1 to 5 (very dissatisfied to very satisfied). The second subjective measurement is the financial situation satisfaction, it is a question about how retirees' income and needs are met, with a rating score ranging from 1 to 4 (not enough to more than enough).³⁴ My independent variable is the direct financial market participation, it is a dummy variable

³³ Due to the confidentiality issue, I could not give detailed compositions of the rest households.

³⁴ In case only one member in a household answers these questions, then the same score will be assigned to other members within the same household.

which equals one if a retiree receives income from equity holdings (dividend)³⁵, unit trust, and/or managed funds, and zero otherwise, following Brown et al. (2008).³⁶

I also identify the following control variables: age, gender (male=1, female=0), living area (major urban area = 1, otherwise = 0), employment status (not working = 1, less than 30 hours per week = 2, more than 30 hours per week = 3), self-rated health (poor = 1, fair = 2, good= 3, very good = 4, excellent = 5), level of education (secondary school or below = 1, certificate or diploma = 2, university degree or above = 3), partnership status (with partner = 1, otherwise = 0), risk averseness (with home contents insurance = 1, otherwise = 0), net wealth (assets minus debt), annual gross retirement income, and self-control spending. A detailed description of all variables is presented in Table A.1 in the Appendix.

³⁵ This equity holdings are limited to New Zealand domestic stock, and overseas financial market participation is not included. On the one hand NZ equity market is less volatile so the investment is more aligned with retirees' risk preference. On the other hand NZ retirees are more familiar with domestic markets so prefer to invest domestically due to home bias. Moreover, QuayStreet Asset Management also reported the relative return from key investment assets from 1998 to 2008, explaining investing in local companies does not cut investors out of the global action; many of NZ listed firms – such as Fisher & Paykel Healthcare, Fonterra and the A2 Milk Company – do much of their business offshore. Besides, managed funds can capture part of overseas investment as well.

³⁶ This variable is from three income sources, which are income from dividends from New Zealand companies, income from returns of unit trust and income from returns of managed funds. The income from KiwiSaver is a separate category so this variable captures individual's proactive investment..

2.3.2 Methodology

The following regression is applied to examine the impact of the direct financial market participation on the retirement income sufficiency:

$$INCOME_SUFFICIENCY_i = \alpha_i + \beta_1 FINANCIAL_MARKET_PARTICIPATION_IV_i + \beta_{i1} \sum_{i=1}^n X_i + \varepsilon_i \quad (1)$$

In Equation (1), *INCOME_SUFFICIENCY_i* is the dependent variable, measured by the annuitised net wealth both with and without government pension as my objective ways, the overall life satisfaction, and the financial situation satisfaction as my subjective measurements.

My main independent variable, *FINANCIAL_MARKET_PARTICIPATION_i* is a dummy variable equals one if a retiree directly participates in the financial market, and zero otherwise.³⁷

I are fully aware that the current financial market participation may not necessarily represent their past status, due to data availability I am unable to examine the impact from the past financial participation. However, it is reported that the financial activities are well maintained by Americans who are over 35 years old, according to the 2017-2018 Gallup poll.³⁸ Therefore, retirees' current financial market participation is a suitable proxy for the pre-retirement participation status. *X_i* is a vector of control variables including age, gender, living area, employment status, self-rated health, level of education, partnership status, risk averseness, gross retirement income, and individual net wealth.

³⁷ Cameron et al. (2007) show NZ firms have dividend payout ratios that are significantly higher than other countries, therefore, dividend is a good proxy for financial participation from retirees.

³⁸ <https://www.cnbc.com/2018/05/16/gallup-why-younger-americans-arent-investing-in-the-stock-market.html>

In order to address the possible endogeneity issue, I follow Zhang et al. (2018) and use the randomly selected an individual's financial market participation status in the same region to represent this particular individual's direct financial market participation status, as retirees living in the same region are exposed to the same macroeconomic condition and peer effect (Brown et al., 2008). Moreover, the randomly selected retiree's financial market participation is unlikely to correlate with the retiree's wealth accumulation and this largely eliminates the endogeneity and omitted variable issues. *Financial Market Participation_IV* in Equation (1) represents the randomly selected retiree's financial market participation situation in the same region and considered as an instrumented variable (IV).

Furthermore, my dependent variables are in continuous format for the annuitised net wealth and in ordered format for the overall life and financial satisfactions, and my instrumented independent variable is in binary values. Therefore, I apply non-linear regression for the first stage and linear regression for the second stage when the instrumental variable is used in the regression. The results may not be consistent due to the combined non-linear and linear regressions in both stages (Wooldridge, 2002). Therefore, I use maximum likelihood methods for both stages to ensure the consistent and unbiased results, and I also use the extended regression models (ERMs) to address this issue as documented in Cameron and Trivedi (2005). In addition, standard OLS, regional fixed effects, 2SLS, and a three-stage model proposed by Adams, Almeida and Ferreira (2009) are also applied to conduct the robustness tests.

2.4 Empirical results

2.4.1 Summary statistics

Table 2.1 presents the summary statistics of all variables for my sample observations used in this paper. The average annuitised net wealth with government pensions is NZD 44,802 and the annuitised net wealth without government pensions is NZD 17,854.³⁹ I find 13% of my sample observations directly participate in the financial market. The average overall life satisfaction is 4.23 out of 5, and the financial situation satisfaction is 2.89 out of 4, indicating the overall life satisfaction is relatively higher than the financial situation satisfaction for NZ retirees. The average age of my sample retirees is 74 years old and 49% are males. Based on a question on the accessibilities to various services, 67% of my sample retirees live in major urban cities, and the self-rated health condition is 3.42 out of 5. The employment status is 1.34 out of 3 (from zero as no employment to three as full-time employment), and further investigation of my data reveals that more than 21%⁴⁰ of retirees are still working either full-time or part-time. For the level of education, 19.1% of my sample retirees have university degree or above, 36.2% have certificates or diplomas, and 44.7% have secondary school level education or below. I also observe that 62% of my sample retirees live with a partner, and 85% purchase home contents insurance which is used as a proxy for risk averseness in the regression analysis. The average regular annual gross retirement income is approximately NZD 39,860, and the average individual net wealth is NZD 600,000.

³⁹ The annuitised net wealth presented in Table 2.1 is in logarithm value, I therefore convert these values into $\exp^{(10.71)} = 44,802$ and $\exp^{(9.79)} = 17,854$, respectively.

⁴⁰ This number is not reported in Table 2.1.

Table 2.1
Summary Statistics

This table presents summary statistics of the 2,175 aging observations aged 65 years and above. Overall Annuitised_Net_Wealth and Annuitised_Net_Wealth (without government pensions) are the natural logarithm value.⁴¹

	N	Mean	Std. Dev.	P1	P99
Overall_Annuitised_Net_Wealth	2,163	10.71	0.80	7.51	12.95
Annuitised_Net_Wealth (without government pensions)	2,136	9.79	1.66	3.49	12.90
Financial_Market_ Participation	2,175	0.13	0.34	0	1
Overall_Life_Satisfaction (Measure 1)	1,848	4.23	0.79	1	5
Financial_Situation_Satisfaction (Measure 2)	1,848	2.89	0.85	1	4
Age	2,175	74.00	6.84	65	91
Gender	2,175	0.49	0.50	0	1
Living_Area	2,175	0.67	0.47	0	1
Employment_Status	2,166	1.34	0.69	1	3
Highest_Education	2,133	1.75	0.76	1	3
Partnership_Status	2,175	0.62	0.49	0	1
Risk_Averseness	1,848	0.85	0.35	0	1
Regular_Gross_Retirement _Income (in 1,000)	2,175	39.86	55.09	0	227.41
Individual_Net_Wealth (in 1,000,000)	2,175	0.60	1.12	0	5.48
Spending_Range	1,815	4.25	1.10	1	5

2.4.2 Regression analysis: objective measurements

2.4.2.1 Baseline results: annuitised net wealth

Table 2.2 presents my baseline results using the annuitised net wealth as the independent variable to measure the retirement income sufficiency.⁴² I report results from both the annuitised net wealth with and without government pensions. The coefficients on the financial market participation variable are positive and statistically significant at the 1% level for both

⁴¹ Due to the confidentiality rules, I can only present 1% and 99% of the value instead of minimum and maximum values.

⁴² The first-stage results are presented in Appendix Table A.2 suggesting that the instrumental variable is valid.

models, revealing that retirees who directly participate in the financial market experience a 39.93%⁴³ more in annuitised net wealth compared to those who do not directly participate.⁴⁴ This rate increases to 178.78%⁴⁵ when the government pension is not included in the annuitised net wealth, indicating that the direct financial market participation increases the pre-retirement wealth which contributes significantly to the post-retirement income. Both results highlight the importance and significance of the direct financial market participation to enhance the retirement income sufficiency. My results document an imperative obligation New Zealand government carries to promote the financial literacy so that increase the likelihood of the direct financial market participation.

For the control variables in the first column (the overall annuitised net wealth), the coefficients on age, individual net wealth, and risk averseness, are all positive and statistically significant at the 1% level. The coefficients on gender and the level of education are also positive and statistically significant at the 5% level. I, therefore, conclude that older wealthier male retirees with better education and risk averseness likely enjoy sufficient retirement income. On the other hand, I find that living with a partner reduces the annuitised net wealth, as the coefficient on the partnership status is negative and statistically significant at the 1% level. The coefficients on living area, employment status, self-rated health condition, are all statistically insignificant, suggesting that these factors do not contribute to retirement income. The overall results for the

⁴³ $\text{Exp}^{(0.336)} - 1 = 39.93\%$.

⁴⁴ I also conduct the same regressions without controlling individual net wealth to prevent the endogenous issue. Results are similar and available upon request.

⁴⁵ $\text{Exp}^{(0.518)} - 1 = 178.78\%$

second column (the annuitised net wealth without government pensions) are similar, except I find that the self-rated health condition and living with a partner have a positive impact on the annuitised net wealth as the coefficients are both positive and statistically significant at the 5% level. This highlights the importance of the pre-retirement income for retirees living with a partner⁴⁶ when the government pension is excluded. The individual retiree's health condition is also positively related to the retirement income sufficiency. This finding is in stark difference when the overall annuitised net wealth is used to measure the retirement income in Column 1, due to the unique setting of the NZ government pension system.⁴⁷

Table 2.2
Baseline Objective Income Sufficiency Results

This table presents the regression results of post-retirement income sufficiency measured by retirees' financial market participation, using an instrumented variable. Overall_Annuitised_Net_Wealth and Annuitised_Net_Wealth (without government pensions) are presented in the logarithm value. The variable Financial_Market_Participation is a dummy variable that equals one if the retiree receives income or dividends from New Zealand company shares, managed funds, and unit trusts, and zero otherwise. The control variables include age, which represents the age of the retiree; Gender, a dummy variable that equals one if the retiree is male, and zero otherwise; Living_Area is a dummy variable that equals one if the retiree lives in a major urban area, and zero otherwise; Employment_Status is equal to one if the retiree does not work; two if the retiree works less than 30 hours a week, and three if the retiree works more than 30 hours a week; Self-Rated_Health is the retiree's self-perception of health conditions, ranging from one to five, from poor to excellent; Highest_Educaiton is the highest education level achieved by the retiree at the time of the interview, which equals one if it is secondary school or below, two if the retiree has a certificate or diploma, and three if the retiree has a university degree; Partnership_Status is a dummy variable that equals one if the retiree has a partner, and zero otherwise; Regular_Gross_Retirement_Income is the retiree's regular annual retirement income before tax, in thousands of dollars; Individual_Net_Wealth is the individual retiree's net wealth, in millions of dollars, which is overall assets minus debts and Risk_Averseness is the individual's ownership of contents insurance, which equals to one if the retiree has home contents insurance and zero otherwise; The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

⁴⁶ Gender subsample test in next section provides more evidence and explanations.

⁴⁷ The pension paid to a couple is less than the sum of the two individual payments.

Table 2.2 Continued

	Overall Annuitised Net Wealth	Annuitised Net Wealth (without government pensions)
Financial_Market_Participation_IV	0.336*** (6.90)	0.518*** (4.84)
Age	0.035*** (15.37)	0.061*** (13.04)
Gender	0.066** (2.68)	0.042 (0.77)
Living_Area	0.040 (1.73)	-0.017 (-0.34)
Employment_Status	-0.014 (-0.50)	0.071 (1.46)
Self-Rated_Health	0.013 (1.03)	0.078** (2.82)
Highest_Education	0.047** (2.72)	0.190*** (5.36)
Partnership_Status	-0.097*** (-3.59)	0.166** (2.82)
Risk_Preference	0.459*** (8.43)	1.665*** (13.07)
Regular_Gross_Retirement_Income	0.002* (2.05)	0.001 (1.01)
Individual_Net_Wealth	0.389*** (7.91)	0.639*** (7.13)
Constant	7.339*** (39.05)	2.604*** (6.30)
Observations	1,821	1,806

2.4.2.2 Subsample tests: objective measurements

I perform subsample tests in this section. My sample is divided into subsample by age, gender, partnership status, living area, and employment status. Results are reported in Table 2.3 when the income sufficiency is measured by the overall annuitised net wealth and in Table 2.4 when the income sufficiency is measure by the annuitised net wealth without government pensions, Panel A for age subsample, Panel B for gender subsample, Panel C for partnership status

subsample, Panel D for living area subsample, and Panel E for employment status subsample, respectively.

Panel A in Table 2.3 and Table 2.4 presents results for my age subsample. My retirees are divided by the median age of 72 years old, a younger group and an older group. In Table 2.3, the coefficients on the financial market participation are positive and statistically significant at the 1% level, with an approximate 13% of direct financial market participation, for both age groups. Similar results are reported in Panel A Table 2.4, the coefficients on the financial market participation are also positive for both age groups. However, the coefficient for the younger age group is twice as big as for the older age group and it is statistically significant at the 1% level for the younger age group and at the 10% level for the older age group. This indicates that the direct financial market participation contributes significant amount to their retirement income for younger retiree group, compared to older retiree group. Further investigation on the risk averseness reveals that older retirees are more likely to purchase home contents insurance than younger retirees, indicating that younger age group are less risk averse.⁴⁸

Panel B presents results for the gender subsample. Säve-Söderbergh (2012) documents that males are more risk-taking than females and have a higher financial market participation rate of 14.8%. Female retirees, on the other hand, have a 11.1% of participation rate. My results are

⁴⁸ Statistics on the risk averseness are not presented in Tables 3 and 4, but available upon request.

consistent with the findings documented in Säve-Söderbergh (2012), the coefficients on the financial market participation are positive and statistically significant at the 1% level for the male group, indicating male retirees are more likely to participate in the financial market resulting a greater retirement income. I do not find a significant result for the female group. This is consistent with results from the overall sample, that 60% of my retiree financial participants are male.

Panel C in both tables presents results from the partnership status subsample. I conclude that retirees living with a partner have significant higher participation in the financial market compared to retirees without a partner, as the coefficients are positive and statistically significant at the 1% level. Results in Panel D for the living area subsample suggest that the financial market participation contribute to increase retirement income significantly regardless of the living area. Similar results are concluded for the employment status subsample in Panel E, that regardless of the employment status, the financial participation contributes significantly to improving the retirement income sufficiency.

Table 2.3**Subsample Tests for Overall Annuitised Net Wealth**

This table presents the regression results for age, gender, partnership status, living area, and employment status subsamples. I only present results in this table for the Financial_Market_Participation_IV variable. I include all the control variables (age, gender, living area, employment status, self-rated health, level of education, partnership status, risk averseness, income, and wealth), but do not tabulate them. Panel A reports the age groups for younger retirees (65–72 years old) and older retirees (73 years and older). Panel B reports the male and female subsample test results. Panel C reports the results for the subsamples of retirees with and without a partner, respectively. Panel D reports the test results for the subsamples of retirees living in urban major and other cities. Panel E reports the test results for the subsamples of retiree employment status, where working includes both part-time and full-time working status. The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Overall Annuitized Net Wealth				
Subsample	Variable	Estimates	Observations	Financial Market Participation Rate
Panel A: Age groups				
Younger retirees	Financial_Market_Participation_IV	0.424*** (6.63)	1,056	12.9%
Older retirees	Financial_Market_Participation_IV	0.327*** (5.06)	1,062	13.0%
Panel B: Gender groups				
Male	Financial_Market_Participation_IV	0.490*** (8.94)	1,041	14.8%
Female	Financial_Market_Participation_IV	0.190 (1.63)	1,077	11.1%
Panel C: With partner groups				
With partner	Financial_Market_Participation_IV	0.481*** (9.10)	1,308	15.8%
Without partner	Financial_Market_Participation_IV	0.057 (0.42)	810	8.7%
Panel D: Living area groups				
Living in a major urban city	Financial_Market_Participation_IV	0.453*** (7.33)	1,422	14.1%
Living in other cities	Financial_Market_Participation_IV	0.360*** (5.00)	693	11.0%
Panel E: Employment status				
Not working	Financial_Market_Participation_IV	0.410*** (6.72)	1,662	11.8%
Working	Financial_Market_Participation_IV	0.187** (2.68)	192	16.9%

Table 2.4**Subsample Tests for Annuitised Net Wealth without Government Pensions**

This table presents the regression results for age, gender, partnership status, living area, and employment status subsamples. I only present results in this table for the Financial_Market_Participation_IV variable. I include all the control variables (age, gender, living area, employment status, self-rated health, level of education, partnership status, risk averseness, income, and wealth), but do not tabulate them. Panel A reports the age groups for younger retirees (65–72 years old) and older retirees (73 years and older). Panel B reports the male and female subsample test results. Panel C reports the results for the subsamples of retirees with and without a partner, respectively. Panel D reports the test results for the subsamples of retirees living in urban major and other cities. Panel E reports the test results for the subsamples of retiree employment status, where working includes both part-time and full-time working status. The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Annuitised Net Wealth without Pension			
Subsample	Variable	Estimates	Observations
Panel A: Age groups			
Younger retirees	Financial_Market_Participation_IV	0.840*** (5.39)	1,035
Older retirees	Financial_Market_Participation_IV	0.435* (2.40)	1,056
Panel B: Gender groups			
Male	Financial_Market_Participation_IV	0.832*** (7.28)	1,026
Female	Financial_Market_Participation_IV	-1.303 (-1.93)	1,065
Panel C: Partnership status groups			
With partner	Financial_Market_Participation_IV	0.847*** (9.19)	1,293
Without partner	Financial_Market_Participation_IV	0.196 (0.80)	798
Panel D: Living area groups			
Living in a major urban city	Financial_Market_Participation_IV	0.712*** (4.54)	1,407
Living in other cities	Financial_Market_Participation_IV	0.648*** (4.55)	684
Panel E: Employment status groups			
Not working	Financial_Market_Participation_IV	0.670*** (4.34)	1,641
Working	Financial_Market_Participation_IV	0.432** (2.66)	189

2.4.2.3 Robustness tests: alternative approaches

In this section, I use several alternative approaches to conduct the robustness checks, including standard OLS, standard OLS adjusted for region fixed effect, 2SLS, and the 3-stage regression (Adams et al., 2009). The OLS model illustrates a fundamental linear relation of the variables, the standard OLS adjusted for region fixed effect is also used to eliminate the variations among different regions, the 2SLS is used to deal with any possible endogeneity issue. In addition, I follow Adams et al. (2009) and use the 3-stage OLS to deal with the binary endogenous independent and instrumental variables. Results of these alternative models are reported in Table 2.5. All coefficients on the financial market participation are positive and statistically significant at the 1% level, confirming my baseline results in Table 2.2 that the financial market participation help to enhance retirement income sufficiency. This phenomenon is stronger when I only consider the pre-retirement income from retirees, as the magnitude of the coefficients on the annuitised net wealth without government pension is greater than those on the overall annuitised net wealth, across all alternative models. Therefore, the results in Table 2.5 are consistent with my baseline results and confirm that my main results are robust. The financial market participation help to enhance the retirees' overall annuitised net wealth, and this impact was strengthened when the government pension is excluded when calculating the annuitised net wealth.

Table 2.5
Alternative Methods for Objective Measurements

This table presents four alternative regression methods for objective income sufficiency measurements. The first one is Ordinary Least Squares, the second one is region fixed effect, the third is 2SLS and the last one is 3-stage strategy. All these methods have been applied on the overall annuitised net wealth (overall ANW) and the annuitised net wealth without government pensions (ANW). The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	OLS		Region fixed effect		2SLS		3-stage strategy	
	Overall ANW	ANW	Overall ANW	ANW	Overall ANW	ANW	Overall ANW	ANW
Financial_Market_Participation_IV	0.231*** (5.93)	0.355*** (4.87)	0.231*** (6.25)	0.357*** (4.47)	0.310*** (6.47)	0.458*** (4.45)	0.304*** (6.50)	0.401*** (3.97)
Age	0.035*** (15.38)	0.061*** (13.06)	0.034*** (18.21)	0.060*** (14.73)	0.035*** (18.36)	0.061*** (14.89)	0.035*** (18.37)	0.061*** (14.91)
Gender	0.067** (2.72)	0.044 (0.80)	0.065** (2.67)	0.038 (0.73)	0.066** (2.72)	0.043 (0.81)	0.066** (2.73)	0.043 (0.82)
Employment_Status	-0.020 (-0.73)	0.061 (1.26)	-0.019 (-0.89)	0.065 (1.42)	-0.015 (-0.07)	0.067 (1.46)	-0.015 (-0.72)	0.064 (1.38)
Self-Rated_Health	0.015 (1.15)	0.081*** (2.90)	0.013 (1.15)	0.078** (3.10)	0.014 (1.18)	0.079*** (3.14)	0.014 (1.19)	0.080** (3.18)
Highest_Education	0.052** (2.99)	0.199*** (5.60)	0.051** (3.11)	0.196*** (5.50)	0.048** (2.91)	0.194*** (5.40)	0.048** (2.93)	0.197*** (5.49)
Partnership_Status	-0.093*** (-3.44)	0.173** (2.93)	-0.095*** (-3.74)	0.168** (3.06)	-0.096*** (-3.78)	0.169** (3.06)	-0.096*** (-3.77)	0.171** (3.11)
Risk_Averseness	0.464*** (8.40)	1.673*** (13.03)	0.467*** (13.07)	1.688*** (21.43)	0.460*** (12.98)	1.668*** (21.39)	0.002*** (4.54)	0.001 (1.81)
Regular_Gross_Retirement_Income	0.002* (2.23)	0.001 (1.21)	0.002*** (5.15)	0.002* (2.13)	0.002*** (4.51)	0.001 (1.69)	0.391*** (28.94)	0.645*** (22.13)
Individual_Net_Wealth	0.395*** (7.90)	0.648*** (7.18)	0.391*** (29.16)	0.639*** (22.02)	0.390*** (28.88)	0.642*** (21.99)	0.461*** (12.99)	1.671*** (21.43)
Constant	7.320*** (38.83)	2.574*** (6.24)	7.377*** (45.72)	2.674*** (7.60)	7.334*** (45.27)	2.593*** (7.34)	7.333*** (45.27)	2.582*** (7.32)
R-squared	0.57	0.53						
Observations	1,821	1,806	1,821	1,806	1,821	1,806	1,821	1,806

2.4.3 Regression analysis: subjective measurements

2.4.3.1 Baseline results

Two survey questions are designed to rate the overall life satisfaction and the financial situation satisfaction in the survey. Therefore, I use these as my subjective measurements to proxy the retirement income sufficiency in my regression and results are reported in Table 2.6. In Table 2.6, the first model is the regression for the overall life satisfaction and the second model is the regression for the financial situation satisfaction. I find that the coefficient on the financial market participation is positive and statistically significant at the 5% for the second model, it is negative but statistically insignificant in the first model. This indicates that the direct financial market participation enhances the financial wellbeing. Results for all control variables are all in line with my main results when using annuitised net wealth as a proxy for the retirement income. Therefore, using subjective measurements, my results are consistent with those when using objective measurements.

Table 2.6
Baseline Subjective Income Sufficiency Results

This table presents the regression results for subjective income sufficiency measurements. One is the overall life satisfaction towards life, and the other is the financial situation satisfaction considering financial incomes and needs. All the control variables are the same as in the objective measurement results. The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Overall Life Satisfaction	Financial Situation Satisfaction
Financial_Market_Participation_IV	-0.036 (-0.33)	0.335** (2.79)
Age	0.009* (2.11)	0.023*** (5.55)
Gender	-0.077 (-1.40)	-0.077 (-1.44)
Living_Area	-0.037 (-0.66)	-0.016 (-0.28)
Employment_Status	0.103* (1.98)	0.100 (1.60)
Self-Rated_Health	0.292*** (10.42)	0.168*** (6.35)
Highest_Education	0.019 (0.50)	0.112** (2.92)
Partnership_Status	0.316*** (5.60)	0.248*** (4.20)
Risk_Averseness	0.084 (1.11)	0.255** (3.14)
Regular_Gross_Retirement_Income	-0.001 (-0.44)	0.007** (3.00)
Individual_Net_Wealth	0.115** (2.97)	0.290*** (4.10)
Observations	1,827	1,827

2.4.3.2 Subsample tests: subjective measurements

In this section, I perform the subsample tests using the subjective measurements to proxy the retirement income sufficiency. Table 2.7 presents my results, Panel A for the age group, Panel B for the gender group, Panel C for the partnership status group, Panel D for the living area group, and Panel E for the employment status group, respectively. I only conduct analysis using the financial situation satisfaction, as the impact of the financial participation on the overall

life satisfaction is insignificant as reported in Table 2.6. In addition, the financial situation satisfaction is a better subjective proxy to measure an individual's financial wellbeing.⁴⁹ My results in Table 2.7 are basically consistent with the results reported in Table 2.6. In addition, I find that older retirees, male retirees, retirees living in major cities, and retirees not currently working, have significant higher financial situation satisfaction due to actively participate in the financial market. My results in Tables 2.3 and 2.4 document that younger retiree age group experiences a greater annuitised net wealth with active financial market participation, while older retirees enjoy a better financial situation satisfaction. Moreover, retirees without a partner benefit more from the financial market participation even though the coefficients on both partnership status groups are positive and statistically significant at the 5% level. Retirees living in major urban cities with financial market participation gain greater annuitised wealth and experience a higher financial situation satisfaction. Interestingly, those retirees not currently working express a significant higher satisfaction of their financial wellbeing.

Table 2.7
Subsample Tests for Subjective Financial Situation Satisfaction

This table presents the regression results for age, gender, living status, living area and employment status subsamples. I only present results in this table for the `Financial_Market_Participation_IV` variable. I include all the control variables (age, gender, living area, employment status, self-rated health, highest education, living status, risk averseness, income, and wealth), but do not tabulate them. Panel A reports the age groups for younger retirees (65–72 years old) and older retirees (73 years and older). Panel B reports the male and female subsample test results. Panel C reports the results for the subsamples of retirees living with and without a partner, respectively. Panel D reports the test results for the subsamples of retirees living in urban major and other cities. Panel E reports the test results for the subsamples of retiree employment status, where working includes both part-time and full-time working status. The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

⁴⁹ I have also done the subjective life satisfaction subsample tests and the results are the same as the main result. No group has statistically significant impacts.

Table 2.7 *Continued*

Subsample	Financial Situation Satisfaction		Observations
	Variable	Estimates	
Panel A: Age groups			
Younger retirees	Financial_Market_ Participation_IV	0.244* (1.98)	870
Older retirees	Financial_Market_ Participation_IV	0.292** (3.33)	960
Panel B: Gender groups			
Male	Financial_Market_ Participation_IV	0.283** (3.12)	861
Female	Financial_Market_ Participation_IV	0.225* (2.06)	969
Panel C: Partnership status groups			
With partner	Financial_Market_ Participation_IV	0.250** (2.85)	1,110
Without partner	Financial_Market_ Participation_IV	0.362** (2.94)	720
Panel D: Living area groups			
Living in a major urban city	Financial_Market_ Participation_IV	0.300*** (3.45)	1,206
Living in other cities	Financial_Market_ Participation_IV	0.243 (1.90)	624
Panel E: Employment status			
Not working	Financial_Market_ Participation_IV	0.368*** (4.48)	1,470
Working	Financial_Market_ Participation_IV	-0.053 (-0.20)	162

2.4.3.3 Robustness tests: subjective measurements

I apply alternative models and survey questions to conduct further analysis for the robustness checks in this section. Firstly, the Ordered Probit Model is used as an alternative model to examine the impact of the financial market participation on the overall life satisfaction and the

financial situation satisfaction. Results are reported in the first two columns in Table 2.8. Results for the alternative model are consistent with my results reported in Table 2.6. The coefficient of the financial market participation is positive and statistically significant at the 5% level, when the financial situation satisfaction is used to proxy the retirement income sufficiency. Secondly, I use another question in the survey to define an alternative variable ‘the self-control spending’ to proxy the retirement income as the dependent variable. This survey question asks how much money on average a retiree has each week for spending on things without consulting anyone else.⁵⁰ Results are reported in Table 2.8, Column 3 for the Order Probit Model and Column 4 for the Extended Regression Model. The coefficients on the financial market participation are positive and statistically significant at the 5% levels for both models. Overall, results in Table 2.8 are consistent with my baseline results regardless of models and proxy used. Therefore, I conclude that the financial market participation can improve retirees’ subjective financial wellbeing.

⁵⁰ None = 1, under \$10 = 2, \$10-\$25 = 3, \$26-\$50 = 4, more than \$50 =5.

Table 2.8
Robustness Checks for Subjective Measurements

This table presents an alternative model and an alternative survey question for subjective income sufficiency measurements. Ordered probit model is used as the alternative method and the personal dispensable spending range is the alternative survey question used for subjective income sufficiency measurement. The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Alternative Method		Alternative Question	
	Ordered Probit Model		Ordered Probit Model	Extended Regression Model
	Overall Life Satisfaction	Financial Situation Satisfaction	Self-control Spending	Self-control Spending
Financial_Market_Participation(_IV)	0.010 (0.12)	0.301** (3.23)	0.311** (2.91)	0.382** (2.87)
Age	0.009* (2.10)	0.023*** (5.56)	0.015*** (3.33)	0.015*** (3.32)
Gender	-0.077 (-1.41)	-0.077 (-1.43)	0.061 (1.02)	0.060 (1.01)
Living_Area	-0.037 (-0.67)	-0.015 (-0.27)	-0.192** (-3.03)	-0.193** (-3.04)
Employment_Status	0.106* (2.04)	0.098 (1.57)	0.209** (3.18)	0.212** (3.22)
Self-Rated_Health	0.291*** (10.40)	0.168*** (6.37)	0.091** (3.10)	0.091** (3.10)
Highest_Education	0.017 (0.45)	0.114** (2.97)	0.067 (1.60)	0.064 (1.53)
Partnership_Status	0.314*** (5.57)	0.249*** (4.22)	-0.126* (-2.07)	-0.129* (-2.12)
Risk_Averseness	0.082 (1.08)	0.256** (3.15)	0.140 (1.63)	0.138 (1.60)
Regular_Gross_Retirement_Income	-0.001 (-0.50)	0.007** (3.02)	0.000 (0.24)	0.000 (0.19)
Individual_Net_Wealth	0.112** (2.94)	0.292*** (4.16)	0.353** (2.59)	0.345* (2.53)
Observations	1,827	1,827	1,791	1,791

2.5 Conclusion

Using the dataset from the 2018 New Zealand Household Economic Survey, this paper examines the impact of the direct financial market participation on the retirement income sufficiency. I use the annuitised net wealth with and without government pensions as my

objective measurements to proxy the retirement income sufficiency. I also use retirees' overall life satisfaction and financial situation satisfaction as subjective measurements to proxy the retirement income sufficiency. For a sample of 2,175 retirees, I conclude that the direct financial market participation has a positive and significant impact on the retirement income sufficiency, when using both the objective and subjective measurements. I find that retirees who directly participate in the financial market experience approximately 39.93% increase in annuitised wealth, compared to those who do not. This rate increases substantially to 178.78% when the government pension is not included when calculating the annuitised net wealth, indicating that the direct financial market participation increases the pre-retirement wealth which contributes significantly to the post-retirement income. Further investigation reveals that older wealthier male retirees with better education and risk averseness likely experience sufficient retirement income. On the other hand, I find that living with a partner reduces the retirement income. Other factors such as areas of living, employment status, health condition have no impact on the retirement income.

I further conduct my analysis using subsample including age, gender, partnership status, living area, and employment status subsamples. My results highlight the difference between younger and older retirees, for example, the impact of the financial market participation on the retirement income sufficiency is reflected through the objective annuitised wealth channel, for younger retirees. On the other hand, it is reflected through the subjective financial wellbeing channel, for older retirees. Other subsample results confirm my baseline results, for example, male retirees are more likely to participate in the financial market resulting a greater retirement

income, retirees living with a partner have significant higher financial participation rate compared to retirees without a partner, and the financial market participation increases retirement income regardless the living area and the employment status. I use several alternative approaches to conduct the robustness checks and all results are consistent with my baseline results and suggesting that my main results are robust.

This paper addresses an important issue relating to retirement income sufficiency and the direct financial market participation. My paper documents an effective solution for retirees to enhance the post-retirement lifestyle. I find that New Zealand retirees benefit significantly from participating in the financial market. However, the low financial market participation rate has been an issue worldwide (Grinblatt, Keloharju, & Linnainmaa, 2011), policy makers in New Zealand carry imperative obligations to promote financial literacy so that increase the likelihood of direct financial market participation. Therefore, my paper has important policy implications and sheds extra lights on the significance of the financial market participation in helping individuals obtain a better and more secured retirement life.

CHAPTER THREE

ESSAY TWO

THE IMPACT OF DIRECT FINANCIAL MARKET PARTICIPATION ON RETIREMENT INCOME SUFFICIENCY IN AUSTRALIA

Using HILDA survey data, this paper documents a strong positive relationship between direct financial market participation and retiree income sufficiency in Australia. I find a 4.7% improvement in the income replacement ratio and an 81% higher annuitised net wealth for financial market participants compared to non-participants. Retiree characteristics play a role in determining the strength of this relationship. The results highlight the value of financial market participation in facilitating household retirement security. My findings have important policy implications and provide further support for the active promotion of household financial market participation, both in Australia and globally.

3.1 Introduction

A well-designed pension system protects people against poverty and smooths people's income throughout the life cycle. In order to achieve these goals, countries set up their own pension system but these can differ in significant ways. While it is difficult to compare one country's pension system with another, there are certain universal elements that can lead to adequate and stable support for pensioners, including adequacy, sustainability, and integrity.⁵¹ The pension systems in many western countries are organized and affected by demographic aging (OECD, 2013). According to the Organization for Economic Co-operation and Development (OECD), the aged (those aged 65 years and above) represented 17.20% of the entire population across all OECD countries in 2018. This number was 10.76% in 1980 and 13.08% in 2000 and expected to increase to 27.1% by 2050.⁵² Therefore, a good system needs to be reviewed and reforms may be required to keep it sustainable and adequate. Australia, one of the OECD countries, at a time when pension systems around the world are creaking, is a standout, documented by Bloomberg in March 2020.⁵³ As reported in the survey from the Melbourne Mercer Global Pension Index (MMGPI), in terms of financial security for retirees, Australia ranked third globally behind the Netherland and Denmark. However, there are calls for reforms to a system that will see employer retirement contributions projected to grow from A\$3 trillion to A\$5.4 trillion within a decade. This is mainly due to the aging of the population, which is expected to increase from 15.66% in 2018 to 19.1% by 2050.⁵⁴ This unarguably presents

⁵¹ <https://www.ai-cio.com/news/netherlands-denmark-australia-rated-worlds-top-pension-systems/>.

⁵² <https://data.oecd.org/pop/elderly-population.htm>.

⁵³ <https://www.bloomberg.com/news/articles/2020-03-06/why-australia-s-pension-system-isn-t-super-enough-quicktake>.

⁵⁴ <https://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/3101.0Feature%20Article1Jun%202018>.

significant social and economic challenges to be faced by the Australian government, even though Australia has a well-established three-pillar pension system. Australians have become increasingly liable to save for their own retirements. Further, the Australian government expects to increase the qualifying age for its age pension from 65 to 67 years by July 2023. In addition, the Superannuation (Objective) Bill 2016⁵⁵ Section 5 specifies the objective of the superannuation reform: “provide income in retirement to substitute or supplement the Age Pension.” To achieve this goal, policy makers have devoted significant resources and time to promote financial literacy and encourage household savings through financial market participation. Thus, financial market participation has become significantly more important, as it is considered to be the engine to drive an individual’s net wealth. Motivated by the above, this paper examines the relationship between financial market participation and retirees’ income sufficiency in Australia. The Household, Income and Labor Dynamics Australia (HILDA) survey data provides an excellent platform to undertake the current study. I attempt to answer the following questions: Does financial market participation help to enhance the retirees’ income sufficiency, and, if so, to what degree and through what channels?

As documented by Giannetti and Koskinen (2010), Australia has the highest domestic stock market participation rate among 26 countries examined, followed by New Zealand, the United

⁵⁵ On November 9, 2016, the Australian Government introduced the Superannuation (Objective) Bill 2016, enshrining the objective of superannuation into legislation. This objective is to guide the superannuation changes in the government’s superannuation reforms.

Kingdom, Japan, Denmark, and the United States.⁵⁶ While there is ample evidence in the existing literature to show that the financial market participation enhances individuals' financial position (Calvet et al., 2007; Cocco & Gomes, 2012), very few studies focus on retirees as a standalone group. I believe this group deserves special attention, because their financial behavior differs from that of other age groups. While asset accumulation remains a key target for the working-age groups, asset decumulation defines the tone for retirement financial planning. Also, individuals' income generally decreases significantly after the retirement; retirees live mainly on savings and/or pension. In addition, it is important for retirees to pay attention to longevity risk. The average life expectancy in Australia increased by 4.06 years over the 20-year period from 2000 to 2020, with an average life expectancy of 83.50, according to the World Health Organization.⁵⁷ This highlights the importance of recognizing the dynamics of life expectancy (i.e., the planning window) in assessing the adequacy of retirement income sufficiency.

Using the HILDA⁵⁸ 2018 survey data from 3,527 retirees in Australia, I examine the impact on retirees' income sufficiency from financial market participation, using the retirement income replacement ratio (Bernheim et al., 2001; Biggs & Springstead, 2008) and the retiree's annuitised net wealth (Love, Palumbo, & Smith, 2009) as two key measures of the retirees' income sufficiency. The replacement ratio is calculated as the ratio of the gross post-retirement

⁵⁶ Across all 26 countries studied by Giannetti and Koskinen (2010), Australia's participation rate reached 40.4%, followed by New Zealand, the United Kingdom, Japan, Denmark, and the United States, at participation rates of, respectively, 31.0%, 30.0%, 29.7%, 28.0%, and 26.0%.

⁵⁷ [https://www.who.int/data/gho/data/indicators/indicator-details/GHO/life-expectancy-at-birth-\(years\)](https://www.who.int/data/gho/data/indicators/indicator-details/GHO/life-expectancy-at-birth-(years)).

⁵⁸ See Section 3.1 for more details on HILDA.

income to the gross pre-retirement income. It identifies retirees' income sufficiency from the income channel. My second measure is the annuitised net wealth. It is calculated as the annuitised present value of a retiree from all his/her current and future financial resources including net assets, social security payments, and any pensions paid. This measure determines the income sufficiency from the wealth channel. Both measures are tailored to consider individual retiree's unique income patterns and respective planning window.

My baseline results highlight the significant benefits for retirees to participate in financial markets. I find that the replacement ratio for financial market participants is 4.7% greater than that of non-participants. That is, a retiree who participates in financial markets enjoys 4.7% more post-retirement income, compared to those who do not participate in the financial markets. Moreover, on average, retiree (financial market) participants show 81% more annuitised net wealth than non-participants. Using subsamples, my analysis further reveals that retiree characteristics play certain roles in determining the channel to benefit from for financial market savings. I find for retirees who are older, male and live in major cities, they benefit more from financial market participation by being able to 'replace' more of their pre-retirement incomes (that is, higher income replacement ratios). For younger and female retirees and for retirees who live in non-major cities, financial market participation allows them to accumulate more wealth in the long-term (i.e., higher annuitised net wealth). Lastly, I find that financial market participation improves non-pension receivers' income replacement ratio and annuitised net wealth both.

All my main results are based on 2SLS analysis where instrumental variables are employed to deal with common statistical problems which could result in endogeneity. I also further conduct several robustness tests including: using the standard ordinary least squares (OLS) with fixed effects as the model instead; following a three-step approach per Adams et al. (2009) as an alternative way to address any endogeneity issue; employing different methods to calculate the key measures for retirement income sufficiency; and additionally adopting two measures to assess subjective retirement financial wellbeing.⁵⁹ My results from these tests widely support my baseline results.

I contribute to the existing literature in several important ways: 1. To the best of my knowledge, this is the first empirical research to address the importance of the financial market participation on the retirees' income sufficiency in Australia. Existing literature almost exclusively focuses on the benefits of financial market participation for the overall population (for example, Calvet et al., 2007; Cocco & Gomes, 2012), no specific study focuses on retirees. 2. My study has important policy implications given the Australian government's initiative to encourage more private savings toward retirement. My results provide new timely evidence to support governments' allocation of greater resources for financial education that encourages financial market participation (Fong et al., 2020; Niu, Zhou, & Gan, 2020). Although the financial

⁵⁹ In addition to objective measures, two subjective measures from the survey data are used to determine the retirees' financial wellbeing when conducting the robustness test. These are questions related to the level of satisfaction on the financial situation and how well the current financial needs and responsibilities are met. I am aware of different measurements for subjective wellbeing in the literature (e.g. Diener et al. (1985), Diener et al. (2009) and Netemeyer et al. (2018)). However, due to the focus of my research and the limitation of the data, I applied those two questions, which best reflected retirees' subjective financial wellbeing.

market participation rate is relatively high in Australia, Campbell (2006) documents that most households neither follow portfolios theories nor hold sufficient portfolios. Therefore, for the regulators, financial literacy education should go beyond simply encouraging participation. Households should be educated for the detrimental effect on their ultimate retirement wellbeing if they do not invest adequately and efficiently. In addition, financial literacy education should be tailored to accommodate individuals' financial habits (Eugster, 2019). Relevant strategies should be applied when targeting retirees of different backgrounds (Lusardi, Mitchell, & Curto, 2009). When retirees plan better collectively, it will ease the strain on the current pension system, and in turn, help promote sustainable economic growth in the long run. Therefore, my paper contributes to the existing literature, sheds extra light on the impact of the financial market participation, and provides important social, economic, and political implications.

The rest of the paper is organized as the follows: Section 3.2 presents background information on the Australian pension system and existing literature; Section 3.3 describes the data and the methodology used; Section 3.4 presents my baseline results and further results from subsample analysis; Section 3.5 conducts my robustness tests and Section 3.6 concludes.

3.2 Institutional background and literature review

3.2.1 The Australian three-pillar retirement income system

In this section, I briefly discuss the three-pillar architecture of Australia's retirement income system, consisting of a publicly funded Age Pension, a privately managed superannuation system, and voluntary savings. The first pillar is the means-tested Age Pension; it provides a minimum standard of living in retirement for Australians with limited financial means. The qualifying age was increased to 65 years and 6 months on 1 July 2017; it is scheduled to increase by 6 months every two years until it reaches 67 years on 1 July 2023. The amount of the Age Pension is determined after assessing the retirees' income and assets. All eligible retirees with the same level of income and assets receive the same amount which could be zero if they have more income or assets than the thresholds. As of 1 July 2021, the maximum Age Pension, an eligible person, can receive is A\$868.30 per fortnight for singles and A\$1,309.00 for couples combined.⁶⁰ According to the World Bank, the objective of this pillar is to ensure all Australians receive a safety net level of income throughout their retirement that is adequate to provide a reasonable minimum standard of living. However, according to the Association of Superannuation Funds of Australia, the Age Pension is inadequate for many retirees to maintain the minimum standard of living (Chambers, Walker, Feng, & Gu, 2019).

Thus, the second pillar is introduced as a superannuation scheme that includes both a compulsory element and a voluntary contribution. This pillar ensures a reasonable minimum

⁶⁰ <https://www.servicessaustralia.gov.au/individuals/services/centrelink/age-pension/how-much-you-can-get#a1>.

share of employee income is saved to contribute extra resources towards retirement. The compulsory element serves as mandatory defined-contribution insurance. Employers in Australia are required to contribute to employees' superannuation accounts once certain conditions are met (e.g., minimum working hours and wages). The current minimum Superannuation Guarantee (SG) increased to 10% of certain wages and salaries into a superannuation fund as of 1 July 2021, and this ratio is scheduled to increase to 12% in 0.5% annual increments by 1 July 2025. This is the first time the SG has been increased since 2014. Connolly and Kohler (2003) suggest such compulsory superannuation has contributed to enhance both household savings and wealth. However, these schemes are only available to individuals who are employed and thus benefit just a portion of the population. For example, only 37.26% of my sample received employer superannuation income during the survey period. The voluntary superannuation contribution provides certain flexibility for people not covered by the SG, to make some catch-up contribution when they are out of the workforce, and also for those who want to make additional contributions.

The third pillar, the voluntary savings (including the voluntary contribution from the second pillar), is also an important element influencing post-retirement financial wellbeing, according to the Australian Treasury Retirement Income Review published in July 2020. Homeownership is the most important component of voluntary savings, as homeownership supports retirement income by reducing housing expenses and acts as a store of wealth, that can be drawn on in retirement. For example, Evans and Razeed (2019) and Yates and Bradbury (2010), document

that retirees liquidate or downsize their houses to make up savings for retirement, even though it is considered to be a last resort for retirement savings as suggested in Skinner (2007).

Overall, global retirement income systems are under an increasing level of pressure due to aging population. Australia aims to ensure retirement income system is sustainable over the long-term. There are several factors that affect the sustainability including: the state age pension, compulsory superannuation, voluntary savings, and the balance between the numbers of workers and retirees. Therefore, there is an immediate need to undertake certain reform for the Australian retirement income system (Ganegoda & Evans, 2017). Because less public pension support will be available in the future, and regulators are placing greater emphasis and responsibility on employers' and individuals' own retirement savings (Gerrans, Moulang, Feng, & Strydom, 2018). The limitations of the first and second pillars highlight the importance of the third pillar in securing a desirable post-retirement lifestyle (Hurley, Breheny, & Tuffin, 2017).

3.2.2 Literature review on retiree income sufficiency

Retirees face various challenges to maintain their financial wellbeing. On the income side, retirees' income invariably reduces significantly when they stop working. Munnell, Webb and Delorme (2006) document that 43% of U.S. households experience a reduction in retirement

income even after financial assets and housing are taken into account. Bardasi, Jenkins, and Rigg (2002) report that more than 30% of retirees remained in the poorest fifth income group in Great Britain during 1990s, among which 25% are male retirees and more than 30% are female retirees. Denton et al. (2011) reveal a 60% before-tax income replacement ratio for 1982 male retirees in Canada during the first two post-retirement years. Even though there is a decline in the poverty rate for the aged Canadian as documented in Prus (2000), 20% of elderly families remain under the poverty line. Yates and Bradbury (2010) conclude that Australian retirees without home ownership are disadvantaged in many ways due to the higher housing expenses and lower disposable incomes. The number of retirees in this cohort keeps increasing persistently. A similar pattern is also observed by Bresser and Knoef (2015) using a Dutch sample. Results indicate that a fifth of the sample retirees are unable to meet minimum expenditure levels even upon the liquidation of their houses.

Therefore, it is important that retirees are well prepared for retirement, however, retirement savings are often insufficient. For example, Yuh, Montalto and Hanna (1998) document that only 52% of U.S. households are adequately prepared for retirement needs. Rhee (2013) also concludes that more than half of U.S. households do not have sufficient retirement savings and the retirement income gap has been increasing over time. Mitchell and Moore (1998) showed that it was necessary to save 20% more from the age of 55 to 62 years for Americans, in order to achieve a comfortable retirement life.

On the consumption side, previous studies document consistent deterioration in post-retirement consumption (e.g., Bernheim et al. (2001) and Denton et al. (2006)). Retirees' post-retirement financial needs can vary, and retirees need to not only support their basic retirement expenditure, but also fund leisure activities, such as travel and social activities for their retirement wellbeing (Adams, Leibbrandt, & Moon, 2011). Hurst (2008) documents consumption heterogeneity could also be related to the fact that some retirees fail to recognize the change in their income patterns. Therefore, existing literature documents heterogeneous income sufficiency after retirement. For example, Binswanger and Schunk (2012) find the replacement ratio ranges from 45% to 95% in the U.S. and from 60% to 75% in the Netherlands.

Moreover, retirees are exposed to significant longevity risk over time. Purcell (2012) reports U.S. retirees' replacement ratio drops as the retirement years become longer, which implies a longer life expectancy results in a decreasing replacement ratio. Dudel, Ott, and Werding (2016) also find the replacement ratios deteriorate with age in Germany. Cocco and Gomes (2012) document that a defined benefit (DB) pension plan enables a 29% wealth increase for 65-year-old male retirees to support a longer life expectancy in the U.S., for the period from 1970 to 2007. De Nardi, French, and Jones (2009) conclude that there is a significant impact on one's saving behavior due to longevity risks. Bloom, Canning, and Graham (2003) document surges in savings to finance longer retirement life at every age, with better health delaying the retirement age. In addition, there is also evidence of more challenging retirement planning in recent decades. Haveman et al. (2007b) examine the annuitised net wealth for two age cohorts,

namely, those retired in the 1980s and 1990s, and conclude that those who retired in the 1990s encounter substantial challenges to maintain their post-retirement financial wellbeing.

Given the amount of heterogeneity and uncertainty in post-retirement financial planning, I follow the previous literature in studying how financial market participation helps to improve the post-retirement financial wellbeing, using the retirement replacement ratio and annuitised net wealth. The two measures focus on retirees' income and wealth sufficiency, respectively. As defined by Bernheim et al. (2001), Biggs and Springstead (2008), Goss, Clingman, Wade, and Glenn (2014), and Mitchell and Phillips (2006), the retirement replacement ratio measures post-retirement income as a percentage of pre-retirement income, to assess whether the same standard of living can be maintained after retirement. This measure captures the dynamic flows of post-retirement income without consuming lifelong savings at given time points. My second measure is annuitised net wealth according to Haveman et al. (2007a). This measure first calculates an individual's total net wealth by including existing net wealth and the present value of any projected future incomes (e.g., pensions). The measure then estimates the annuitised value of total net wealth based on the individual's estimated life expectancy. This value is then compared to a benchmark to define sufficiency/insufficiency. A common benchmark in the literature consists of multiples of the local poverty line, for example, 1.5 times or twice the poverty line (Butrica, Iams, & Smith, 2007). I follow the literature in using the two measures which I discuss in more detail in Section 3.3.2.

3.2.3 Financial market participation puzzle

Previous evidence shows that individuals benefit from participating in financial markets, which increases individuals' savings in the long run (Gustman & Steinmeier, 2002). For example, Bovenberg, Koijen, Nijman, and Teulings (2007) employ a stylized life cycle savings model and document a 12% loss in wealth when individuals do not participate in the stock market at all (either directly or indirectly via pension savings managed by superannuation funds). In addition, Cocco and Gomes (2012) report a loss of up to 4% in wealth for those who do not participate in the stock market, using different values for several parameters of interest and comparing to a benchmark situation that takes borrowing constraints into account. Calvet et al. (2007) estimate an annual loss of 4.3% in return by Swedish households due to a lack of participation in the stock market.

Despite the benefits, however, governments around the world have found it challenging to encourage financial market participation. Grinblatt et al. (2011) reveal a participation puzzle, in that only 50% of U.S. households invest in stocks either directly or indirectly, and this number is rather lower in Europe. Gomes and Michaelides (2005) use a life cycle asset allocation model with uninsurable labor income to explain the low stock market participation rates in the U.S. among those younger than 75 years from 1976 to 1993. A similar puzzle has been documented in Australia. According to a survey conducted by the Australian Securities Exchange (ASX) in 2014, individuals' direct and indirect financial market participation rates

have dropped since 2004.⁶¹ The indirect ownership dropped from 32% in 2004 to 10% in 2014, and 44% of Australians invested directly in 2004, compared with 33% in 2014.

Retirees, who have different risk preferences, income patterns, and investment horizons from those still in the workforce, may be disadvantaged even more from non-participation in the financial markets. For example, Australia's interest rates were around only 1.5% during the 2017–2018 financial year, but the inflation rate was 1.91% - the real purchasing power of retirees' savings could be diminishing if they only invest in passive term deposits. While younger generations can afford to wait longer, retirees who rely on interest incomes will be significantly disadvantaged if they keep their savings as bank deposits. Boyle Torrey and Teuber (1986) have also shown that other post-retirement incomes, for example, rent from investment properties and interest incomes from passive investments such as bonds, are also significantly reduced in a low-interest rate environment.

Few studies specifically address the importance of financial market participation for retirees. Therefore, it is important and interesting to examine the role of direct financial market participation in improving retirees' financial wellbeing. Following the literature (Brown et al.,

⁶¹ The ASX Australian Share Ownership Study was conducted between September and November 2014. The survey aims to provide a comprehensive insight into the behaviors, attitudes, and knowledge of direct financial market participants in Australia. In the survey, a direct investor refers to an individual who holds shares and/or listed investments directly in his or her own name through a private portfolio, a self-managed superfund, or a company structure. An indirect investor refers to an individual who owns shares and/or listed investments through unlisted managed funds outside of superannuation funds.

2008), an individual is considered a direct participant if the individual buys financial products under his or her own discretion, such as shares, trusts, or managed funds under his or her name. In contrast, indirect financial market participation refers to passive financial market participation through retirement schemes or insurance. Participating in financial markets is not the main goal of the individuals in these scenarios, and they do not make the decisions about their investments either. For example, an individual can indirectly participate in financial markets through an employer pension scheme, but the contribution is made by the employer and enforced by the law, so it does not reflect the individual's active decision to save and benefit from the financial markets.

3.3 Data and methodology

3.3.1 The HILDA survey data

I use data from the HILDA Survey. The HILDA survey is a household-based panel study that collects information on household economic and personal wellbeing, labor market dynamics and family life. The survey started in 2001 and is funded by the Australian Government through Department of Social Services and administered by the Melbourne Institute at the University of Melbourne. It collects information on household and family relationships, income, employment, health, and education from more than 17,000 Australians each year. My study focuses on the 2018 wave of the HILDA Survey, primarily because it provides sufficient variables and observations to draw meaningful conclusions. I include only those aged 65 years

and above as of June 2018, since my focus is on retirees. I thus obtain 3,527 observations from 2,565 households: 1,604 households in the sample have one aged person, 960 households have two aged people, and one household has three aged people.

I select all relevant variables from the survey data for all observations, including both dependent and explanatory variables. My dependent variables include: the regular retirement income replacement ratio (calculated as the ratio of the weekly regular gross retirement income to the weekly average pre-retirement income) and the individual annuitised net wealth as two objective measurements. I also include two subjective measurements for post-retirement financial wellbeing as robustness checks. My main explanatory variable is financial market participation, a dummy variable that takes a value of one if an individual retiree participates in the financial markets, and zero otherwise. Following Brown et al. (2008), I define those who receive an income or dividends from company shares, managed funds, or property trusts⁶² as participating directly in the financial market. I acknowledge the fact that someone can participate in the financial market but not receive any dividend or capital gain. However, the likelihood of such a case should be relatively low in my sample. According to the Reserve Bank of Australia⁶³, from July 2017 to June 2018, 93% of Australian companies reported a profit, and 90% paid dividends.

⁶² In the HILDA survey, income from bonds is not included in the question regarding income from financial assets. The nature of income from bonds is somewhat similar to passive and fixed interest income from term deposits. Therefore, investments in bonds might not well represent an individual's proactive approach to benefit from financial markets. In any case, the inclusion of bond investments in the analysis should only emphasize further the importance of participating in financial markets.

⁶³ See Mathews (2019), *A History of Australian Equities*, Reserve Bank of Australia.

Other variables include age, gender, living area (major city=1, elsewhere=0), employment status (unemployment=1, less than 35 hours per week=2, more than 35 hours per week =3), self-rated health (poor=1, fair=2, good=3, very good=4, excellent=5), highest education (year 12 or below=1, certificate or diploma=2, university degree or above=3), financial literacy (score 1 to 5 from five financial literacy questions), living status (living with a partner=1, otherwise=0), risk preference (no risk=1, average risk=2, above-average risk=3, substantial risk=4), gross retirement income (used to calculate the replacement ratio), individual net wealth (assets minus debts by interview time), and the Age Pension eligibility. A detailed description of each variable and related survey questions is presented in Table B.1 in the Appendix.

3.3.2 Income sufficiency measures

I use the retirement income replacement ratio and the annuitised net wealth to measure post-retirement income sufficiency. The post-retirement income replacement ratio is the product of the post-retirement gross income to the gross pre-retirement income. The post-retirement income is the sum of any wages and salaries (if the individual is still employed), business income, investment income, private pension, private transfers, and Australian public transfers. All values are before tax, and these represent the main sources of post-retirement income. I do not include the irregular or less frequent items, such as gifts, because it is more appropriate to assess the overall post-retirement financial wellbeing based on foreseeable regular incomes that are affected by individuals' decision to participate in financial markets. This also ensures

consistency, since the pre-retirement income does not include irregular items. However, I include irregular incomes when undertaking robustness test in Section 3.5.

Pre-retirement incomes are not readily available from the survey data. I use average salaries by industry and gender as a proxy for the pre-retirement income, based on the pre-retirement occupation.⁶⁴ The following rules apply in identifying the pre-retirement industries. First, if an individual is under employment after retirement, I use the individual's post-retirement industry, because it is unlikely that the individual changes industry after retirement. Second, for individuals who are not employed, I use the pre-retirement industry. Third, if I cannot determine either the post- or pre-retirement industry from the 2018 wave data, I trace it back to the 2017 wave data. Similarly, I use the post-retirement industry first, if possible, and then the pre-retirement industry. I continue adopting this approach until the 2001 wave data, which constitute the first wave of the HILDA survey. All 18 waves of the survey cover 2,477 observations of individuals' pre-retirement industries. I then match the pre-retirement industries to the Australian and New Zealand Standard Industry Classification (ANZSIC) 2006 categories to obtain the pre-retirement income, since the Australian Bureau of Statistics records average weekly salaries by gender, based on full-time ordinary time earnings for these industries. Therefore, an individual's retirement replacement ratio is measured as the weekly post-retirement income divided by the weekly pre-retirement industry average earnings, by

⁶⁴ Pre-retirement income has been calculated in different ways in the literature, often driven by data availability (Denton et al., 2011; Purcell, 2012), and there is no consensus on the best solution. Therefore, I choose the average income by industry and gender as a proxy for pre-retirement income.

gender. By definition, this ratio ranges between zero and one, since the post-retirement income is usually less than the pre-retirement income.⁶⁵

For the second measure, annuitised net wealth, I first obtain the individual's estimated life expectancy and the net wealth. I use the life expectancy published by the Australian Bureau of Statistics for 2016–2018, correspondence to the individual's gender and living territory. The net wealth is further decomposed into net wealth at the time of the survey and the present value of any projected future cash inflows. I calculate the total net wealth at the time of the survey as the difference between total household assets and debts, and I divide it by two if the individual has a partner or spouse.⁶⁶ Total household assets include the balances of joint and individual bank accounts and the value of superannuation, business assets, cash, equity investment, collectables, home and other property assets, life insurance, trust funds, and vehicles. Total household debt includes the balances of any student loans, joint and individual credit cards, other personal debt, business debt, home and other property debt, and any overdue household bills.

⁶⁵ Due to data limitations, the sample contains five negative replacement ratios and 264 replacement ratios greater than one. These are replaced by the two extreme values zero and one, respectively, for the following analysis, to allow as many observations as possible. Alternatively, I also exclude them from the analysis to check my results. The results are consistent.

⁶⁶ Some argue that an individual with a partner/spouse could be entitled to more than half of the household wealth. Therefore, I also check my results by using household annuitised net wealth. All the results are consistent.

The present value of projected future cash flows equals the total Age Pension for the remaining years of life. I use the current Age Pension as a proxy for future pension (standard inflation-adjusted increases in pension offset the need to discount), and I multiply the current pension by the number of remaining years of life, calculated based on life expectancy, to obtain the present value of total projected future cash flows. Finally, total net wealth is annuitised by the remaining number of years of life, using the inflation-adjusted T-bill rate in 2018 as the discount rate. To ensure statistical soundness, I use the natural logarithm of the annuitised net wealth in the regression analysis below.

3.3.3 Methodology

I run the following regression for two income sufficiency measures separately:

$$\begin{aligned}
 INCOME_SUFFICIENCY_i &= \alpha_i + \beta_1 FINANCIAL_MARKET_PARTICIPATION_IV_i + \beta_2 AGE_i \\
 &+ \beta_3 MALE_i + \beta_4 LIVING_AREA_i + \beta_5 EMPLOYMENT_STATUS_i \\
 &+ \beta_6 SELF_RATED_HEALTH_i + \beta_7 HIGHEST_EDUCATION_i \\
 &+ \beta_8 FINANCIAL_LITERACY_i + \beta_9 LIVING_STATUS_i \\
 &+ \beta_{10} RISK_PREFERENCE_i \\
 &+ \beta_{11} REGULAR_GROSS_RETIREMENT_INCOME_i \\
 &+ \beta_{12} INDIVIDUAL_NET_WEALTH_i + \varepsilon_i
 \end{aligned}
 \tag{1}$$

where $INCOME_SUFFICIENCY_i$ represents the replacement ratio or the natural logarithm of annuitised net wealth, and $FINANCIAL_MARKET_PARTICIPATION_i$ is a dummy variable that equals one when the individual directly participates in financial markets, and zero otherwise. I also include basic demographic factors as control variables that have been documented to influence retiree income sufficiency, including age (Alan et al., 2008), gender (Jefferson & Preston, 2005), living area (Metzger, 2017), employment status, self-rated health (Rosen & Wu, 2004), highest level of education (Yuh et al., 1998), financial literacy (Agnew, Bateman, & Thorp, 2012), living status (Khongboon, Pongpanich, & Tangcharoensathien, 2016), risk preference, regular gross retirement income, and individual net wealth.⁶⁷

I note there could be a possible endogeneity problem. For example, one could choose to participate in financial markets if one tended to have adequate income. I use an instrumented ‘participation’ to address this problem following Zhang et al. (2018). Specifically, for each observation, I randomly select another individual who lives in the same state and use this individual’s participation as the instrumented ‘participation’ variable, defined as ‘*Financial_Market_Participation_IV*’. I document that the decision to participate in financial markets for individuals who live in the same state are correlated, due to factors such as the same access to financial products and similar macroeconomic conditions and social interactions.

⁶⁷ I control for regular gross retirement income only for the annuitised net wealth measure. I do not control for regular gross retirement income when examining the replacement ratio to avoid endogeneity, since regular retirement income is the numerator for calculating the replacement ratio. Similarly, I only control individual net wealth for the replacement ratio measure and I do not control individual net wealth for annuitised net wealth as individual net wealth is part of the calculation for annuitised net wealth.

For example, Brown et al. (2008) find that the average level of stock market participation within a community can influence an individual's decision to own stock. However, it is unlikely that a randomly selected individual's participation decision will impact another individual's retirement income sufficiency. Following a similar rationale, I also employ an alternative instrumental variable (Brown et al., 2008), which is the state average financial market participation rate to check out results. However, this instrument shows fewer individual-level variations compared to a randomly selected instrument.⁶⁸

To accommodate continuous dependent, endogenous binary independent, and binary instrumental variables, I use the extended regression model (ERM) to estimate my parameters following Wooldridge (2002, 2010). This model is similar to a standard two-stage least squares (2SLS) model, which allows us to run a probit model (instead of OLS) in the first stage, because both the instrumented and instrumental variables are binary. In the second stage, I run a standard OLS model by using the predicted values of the instrumented variable from the first stage. A standard 2SLS model is inappropriate in my situation, since the first stage is nonlinear. Wooldridge (2002) refers to this as the forbidden regression problem, and, as Cameron and Trivedi (2005) point out, only a modified 2SLS estimator that correctly specifies the first stage is appropriate. More specifically, the ERM applies maximum likelihood estimation in both stages to ensure the first-stage result is specified to avoid any inconsistency issues (Wooldridge,

⁶⁸ Results are available upon request.

2010). In Section 3.5, I apply three alternative models, namely, standard OLS, standard OLS with fixed effects, and a three-stage model proposed by Adams et al. (2009).

3.4 Empirical analysis

3.4.1 Summary statistics

Table 3.1 presents summary statistics for all variables. My sample retirees have an average replacement ratio of 0.44, suggesting Australian retirees maintain 44% of their pre-retirement income after retirement. The average annuitised net wealth for my sample is 10.86, which is equivalent to A\$52,052 per annum.⁶⁹ I observe that 29% of the retirees in my sample participate directly in the financial markets. The average age in my sample is 74.34 years, 46% are male, 57% live in a major city, 62% live with a partner, and 63% receive Age Pension. Interestingly, the average financial literacy score is 3.98 out of 5, indicating a relatively higher level of financial literacy among Australian retirees, even though the overall level of education is lower with an average score of 1.68. This is not surprising given the fact that Australia has the highest financial market participation rate in all OECD countries. On average, the risk preference score is 1.4 out of 4, consistent with my expectation of a low risk preference for retirees (Chambers et al., 2019). Among all the observations, 3,027 are reported as unemployed, representing 85.82% of the sample. For the two subjective financial wellbeing measures, firstly, retirees are asked to self-rate the level of satisfaction toward their financial situation (with a score ranging from

⁶⁹ The annuitised net wealth is in natural logarithm.

1 to 10), my sample average is 7.46. Secondly, retirees are asked to answer a question about their financial status given the current needs and financial responsibilities (with a score ranging from 1 to 6), my sample average is 3.90.

Table 3.1
Summary Statistics

This table presents summary statistics. The overall samples include 3,527 observations of individuals aged 65 years and above. The values of Regular_Gross_Retirement_Income are in thousands of dollars, and those of Individual_Net_Wealth are in millions of dollars. Anuitised_Net_Wealth is the natural logarithm value.

	N	Mean	Std. dev.	Min	Max
Regular_Retirement_Income_Replacement_Ratio	2,477	0.44	0.29	0	1
Annuited_Net_Wealth	3,521	10.86	1.00	3.02	14.29
Financial_Market_Participation	3,333	0.29	0.45	0	1
Subjective_Financial_Wellbeing (Measure 1)	3,351	7.46	2.04	0	10
Subjective_Financial_Wellbeing (Measure 2)	3,100	3.90	0.75	1	6
Age	3,526	74.34	7.22	65	99
Gender	3,527	0.46	0.50	0	1
Living_Area	3,527	0.57	0.50	0	1
Employment_Status	3,524	1.18	0.51	1	3
Self-Rated_Health	3,084	2.94	0.94	1	5
Highest_Education	3,360	1.68	0.77	1	3
Financial_Literacy	3,193	3.98	1.37	0	5
Living_Status	3,359	0.62	0.49	0	1
Risk_Preference	3,038	1.40	0.58	1	4
Regualr_Gross_Retirement_Income	3,527	0.77	1.33	-0.29	30.40
Individual_Net_Wealth	3,527	0.85	1.08	-0.12	9.43
Age_Pension_Eligibility	3,359	0.63	0.48	0	1

3.4.2 Baseline results

I present my baseline results in Table 3.2. Both the replacement ratio and the annuitised net wealth are used as the dependent variable to represent the income sufficiency in Equation (1).⁷⁰ The coefficients on the financial market participation variables are positive and statistically significant at the 1% level for both the replacement ratio and the annuitised net wealth, respectively. This suggests a positive impact on retirement income sufficiency from direct financial market participation. Specifically, retirees who participate in the financial market enjoy a 4.7% higher post-retirement replacement ratio than non-participants. In addition, the annuitised net wealth of those who participate in financial markets is 81% higher than that of non-participants.⁷¹ Results from both income sufficiency measures reveal the importance of direct financial market participation, which enhances the post-retirement financial wellbeing for Australian retirees through the short-term income channel represented by the replacement ratio and the long-term wealth channel represented by the annuitised net wealth.

Furthermore, I find retiree income sufficiency to be greater for those who are male, single, living in a major city, healthy, still in employment, healthy with a higher level of education and financial literacy, and with higher risk preferences. These results are all in line with expectations and consistent with prior literature. Interestingly, however, I find the coefficient

⁷⁰ Chao and Swanson (2005) document that the ERM is generally less sensitive to the weak instrumental variable problem, since it is based on maximum likelihood estimation. Nevertheless, I report my first-stage results in Table B.2 in Appendix. The coefficients on the instrumented financial market participation variable positively related to the original financial market participation in all cases, indicating the validity of this instrument.

⁷¹ The coefficient of *FINANCIAL_MARKET_PARTICIPATION_IV_i* is 0.592 for the natural logarithm of annuitised net wealth, therefore, the increase in annuitised net wealth equals $\exp(0.592) - 1 = 0.81$.

on ‘Age’ to be negative with the replacement ratio channel and positive with the annuitised net wealth channel, both are statistically significant at the 1% levels. This contradictory finding is justifiable in terms of the income channel when using the replacement ratio as retirees’ income earning powers are diminishing over time. Therefore, there exists a negative relationship between income sufficiency and age. In terms of the wealth channel when using annuitised net wealth, it is more likely that older retirees have more annuitised net wealth on account of a shorter life expectancy compared to younger retirees. The results on employment status further confirm this conjecture. I find employed retirees are better off in terms of their replacement ratio, while unemployed retirees are better off in terms of annuitised net wealth. The unemployed retirees are likely to be older and have more net wealth so that they do not need to or have the incentive to continue working after retirement.

Table 3.2
Baseline Income Sufficiency Results

This table presents the regression results of post-retirement income sufficiency measured by retirees’ direct financial market participation, using an instrumented variable. The two measures are the regular retirement income replacement ratio and the natural logarithm of annuitised net wealth. The variable *Financial_Market_Participation* is a dummy variable that equals one if the retiree receives income or dividends from company shares, managed funds, and property trusts, and zero otherwise. The control variables include *Age*, which represents the age of the retiree; *Gender*, a dummy variable that equals one if the retiree is male, and zero otherwise; *Living_Area* is a dummy variable that equals one if the retiree lives in a major city, and zero otherwise; *Employment_Status* is equal to one if the retiree does not work, two if the retiree works less than 35 hours a week, and three if more than 35 hours a week; *Self-Rated_Health* is the retiree’s self-perception of health conditions, ranging from one to five, from poor to excellent; *Highest_Education* is the highest education level achieved by the retiree at the time of the interview, which equals one if it is 12 years or less, two if the retiree has a certificate or diploma, and three if the retiree has a university degree; *Financial_Literacy* is the correct number of answers for five standardized financial literacy questions regarding inflation, compounding, and diversification; *Living_Status* is a dummy variable that equals one if the retiree is living with a partner, and zero otherwise; *Risk_Preference* is the financial risk the retiree is potentially willing to take with spare money, ranging from one to four, representing no risks to substantial risks; *Regular_Gross_Retirement_Income* is the retiree’s regular weekly average before-tax retirement income, in thousands of dollars; and *Individual_Net_Wealth* is the individual retiree’s net wealth, in millions of dollars, which is overall assets minus debts. The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 3.2 Continued

	Replacement ratio	Annuitised net wealth
Financial_Market_Participation_IV	0.047*** (2.82)	0.592*** (15.32)
Age	-0.004*** (-4.18)	0.047*** (18.10)
Gender	0.019* (1.79)	-0.006 (-0.18)
Living_Area	0.004 (0.43)	0.173*** (5.66)
Employment_Status	0.156*** (13.67)	-0.055 (-1.39)
Self-Rated_Health	0.010* (1.87)	0.085*** (4.62)
Highest_Education	0.024*** (3.23)	0.123*** (6.36)
Financial_Literacy	-0.000 (-0.06)	0.083*** (5.77)
Living_Status	-0.052*** (-4.78)	-0.082** (-2.29)
Risk_Preference	0.058*** (5.50)	0.198*** (6.64)
Regular_Gross_Retirement_Income		0.112*** (4.00)
Individual_Net_Wealth	0.078*** (9.22)	
Constant	0.309*** (3.87)	6.079*** (24.55)
Observations	2,132	2,836

3.4.3 Further analysis

In this section, I perform further analysis to examine the direct financial market participation impacts on income sufficiency based on retirees' individual characteristics. Specifically, I repeat my baseline analysis in subsamples for various groups of retirees according to age,

gender, living status, living area, and pension eligibility. Results are presented in Table 3.3.⁷²

Panels A to E report the results for age, gender, living status, living area and age pension eligibility subsamples, respectively.

Table 3.3
Subsample Test Results

This table presents the regression results for age, gender, living status, living area, and age pension eligibility subsamples. I only present results in this table for the *Financial_Market_Participation_IV* variable. I include all the control variables (age, gender, living area, employment status, self-rated health, highest education, financial literacy, living status, risk preference, income, and wealth), but do not tabulate them. Panel A reports the age groups for younger retirees (65–73 years old) and older retirees (74 years and older). Panel B reports the male and female subsample test results. Panel C reports the results for the subsamples of retirees living with and without a partner, respectively. Panel D reports the test results for the subsamples of retirees living in major and other cities. Panel E reports the test results for the subsamples of Age Pension receivers and non-receivers, respectively. The *t*-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Subsample	Variable	Replacement ratio		Annuitised net wealth	
		Estimates	Observations	Estimates	Observations
Panel A: Age groups					
Younger retirees	<i>Financial_Market_Participation_IV</i>	0.021 (1.00)	1,409	0.537*** (10.12)	1,579
Older retirees	<i>Financial_Market_Participation_IV</i>	0.082*** (3.34)	723	0.639*** (11.24)	1,257
Panel B: Gender groups					
Male	<i>Financial_Market_Participation_IV</i>	0.051** (2.15)	1,103	0.587*** (10.77)	1,325
Female	<i>Financial_Market_Participation_IV</i>	0.045** (2.03)	1,029	0.601*** (11.09)	1,511

⁷² I only report the results from the main variables, all control variables are the same as in Table 3.2.

Table 3.3 Continued

Subsample	Variable	Replacement ratio		Annuitised net wealth	
		Estimates	Observations	Estimates	Observations
Panel C: Living status groups					
Living with a partner	Financial_Market_Participation_IV	0.036* (1.82)	1,484	0.525*** (12.97)	1,828
Not living with a partner	Financial_Market_Participation_IV	0.063** (2.29)	648	0.754*** (8.42)	1,008
Panel D: Living area groups					
Living in a major city	Financial_Market_Participation_IV	0.040* (1.85)	1,191	0.639*** (12.70)	1,589
Living in other cities	Financial_Market_Participation_IV	0.055** (2.23)	941	0.524*** (8.85)	1,247
Panel E: Age Pension eligibility groups					
Pension receivers	Financial_Market_Participation_IV	0.011 (0.63)	1,209	0.360*** (10.22)	1,752
Non-receivers	Financial_Market_Participation_IV	0.055* (1.83)	923	0.745*** (9.45)	1,084

Results for the age subsample are presented in Table 3.3 Panel A. My full sample is split into two subsamples, based on the median age, where the younger subsample includes retirees who are 65 to 73 years old, and the older subsample includes those aged 74 years and above. The average financial market participation rates are 27.73% and 30.07% for the younger and older subsamples, respectively. The coefficient on the ‘Financial_Market_Participation_IV’ for the older retiree group is 0.082 and statistically significant at the 1% level, indicating a strong positive impact on the post-retirement replacement ratio. This result is economically significant as well, as the replacement ratio for the older retirees who participate in the financial market is 8.2% higher than the older retirees who do not. For annuitised net wealth, I find both younger

and older retirees who participate in the financial market are significantly greater than those retirees who do not, since both coefficients are statistically significant at the 1% level. These results are consistent with my expectations that younger retirees only benefit from financial market participation through the long-term wealth channel as younger retirees may still receive income from wages and salaries. For older retirees, they benefit from the financial market participation through both the income and wealth channels. As retirees become older, the likelihood of having wage/salary income deteriorates, therefore, income from direct financial market investments supplements regular incomes (i.e., pension) and benefit their post-retirement financial wellbeing.

Panel B reports results for the gender subsample analysis. Women generally have a longer life expectancy, earn a lower income, and exhibit lower financial literacy (Williamson & Boehmer, 1997). Moreover, women tend to participate less in financial markets, since they are more risk averse than men (Säve-Söderbergh, 2012; Watson & McNaughton, 2007). Thus, females generally suffer more from income insufficiency after retirement than males. In my sample, 27.45% female participate in financial markets, in contrast to 30.41% male participation. My results in Panel B suggest that both male and female retirees' financial wellbeings are substantially enhanced through direct financial market participation since the coefficients on 'Financial_Market_Participation_IV' are positive and statistically significant at the 5% level. My results are not only statistically significant but also economically significant. The male retirees who participate in the financial market result a 5.1% higher replacement ratio compared

to those who do not participate, while the female financial market participants have a 4.5% higher replacement rate. This indicates that those male financial market participants enjoy a higher replacement ratio than those female participants. Given the fact that many female retirees earn a lower pre-retirement income (Ohsfeldt & Culler, 1986), any increase on post-retirement income is substantial for female retirees. On the other hand, my result confirms a strong increase in annuitised wealth for female retirees who directly participate in the financial market.

Living with a partner or not can influence individuals' wealth and consumption decisions, as well as the decision to participate in financial markets (Arano, K., Parker, C., & Terry, R., 2010; Li, 2014). Panel C presents results from the living status subsample. In this group, 61.07% of retirees live with a partner and have an average financial market participation rate of 31.90%. Retirees who live alone have a lower average financial market participation rate of 23.85%. My findings suggest that a participant retiree not living with a partner benefits more through the financial market participation in both income and wealth channels than a participant retiree living with a partner. My results demonstrate a stronger income sufficiency increase from the financial market participation for retirees living alone, as the coefficient for replacement ratio is 0.063 and annuitised net wealth is 0.754, and they are statistically significant at the 5% level.

There are financial pros and cons of living in a major city. People living in a major city will normally face higher living costs but may have easier and greater access to financial market

information. This could have a positive effect on financial market participation. Individuals' decisions could also be influenced through behavioral channels, such as regional risk preferences (Portela Maseda, Fernández-López, & Rey-Ares, 2020), peer effects through the workplace or neighborhood (Gerrans et al., 2018; Zhang et al., 2018), and trust and sociability (Georgarakos & Pasini, 2011), which are likely related to their geographical locations. Panel D reports the results for my living area subsample, I split my sample into those who live in a major or non-major city, respectively. The coefficients on the participation variable are positive and statistically significant. However, the magnitudes are different among different groups. I find that retirees living in non-major cities gain more from financial market participation through the income channel than those who live in a major city. On the other hand, retirees living in a major city benefit more from financial market participation through the wealth channel than those who live in non-major cities.

As the first pillar in the Australian retirement income system, the Age Pension plays a vital role in supporting retirees. However, not all retirees are eligible for public Age Pension in Australia. For example, a retiree must be an Australian resident and have lived in Australia for at least 10 years. Individuals must also pass income and asset tests to receive the public pension. The role of financial market participation could be more important for those who are not eligible, since they face a more significant income shortfall and must live on their lifetime accumulated wealth. Panel E presents results for the Age Pension eligibility subsample analysis. Of retirees in my sample, 63.3% receive the Age Pension and 36.7% do not. I find an average stock market participation rate of 19.20% among pension receivers, and 45.3% among non-

receivers. This highlights the stronger incentive for non-receivers to save and accumulate more wealth for their retirement security through investing in financial markets. My results in Panel E conclude the above findings that non-receivers significantly benefit from financial market participation through both the income and wealth channels. My results again confirm financial market participation as an effective means of compensating for the loss of the public pension and encourages individuals to take more responsibility for their own retirement.

3.5 Robustness tests

3.5.1 Alternative models

I use three alternative models to check the robustness of my baseline results. The first model is the standard OLS model, and the second is the standard OLS with a state fixed effect. Finally, I follow Adams et al. (2009) and use a three-stage procedure to account for endogeneity. Specifically, Adams et al. (2009) first estimate a binary response model (e.g., probit) of the endogenous covariate (i.e., financial market participation in my case) on the instrument (i.e., the financial market participation of a randomly selected retiree who lives in the same geographical area). The authors then compute the fitted probabilities from the first stage. Lastly, they estimate the effect of the endogenous covariate by using the fitted probabilities from the second stage as the instrument. This procedure differs from standard 2SLS, since an instrument variable regression is run in the last step, and not the standard OLS of the outcome variable on the fitted values from the previous step. This procedure also considers the binary nature of the

endogenous variable and does not require the binary response model of the first stage to be correctly specified. I present the results in Table 3.4. All coefficients are positive and statistically significant at the 1% levels. They are consistent with my baseline results and suggest my baseline results are robust.

Table 3.4
Alternative Models

This table presents three alternative models to conduct robustness tests for the post-retirement income sufficiency results, measured by retirees' direct financial market participation. I only present results in this table for the Financial_Market_Participation_IV variable. I include all the control variables (age, gender, living area, employment status, self-rated health, highest education, financial literacy, living status, risk preference, income, and wealth), but do not tabulate them. Panel A presents the OLS regression results, Panel B the results using state fixed effect, and Panel C the results from the three-step strategy following Adams et al. (2009). The *t*-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Variables	Replacement ratio	No. of Obs	Annuitised net wealth	No. of Obs
Panel A: OLS				
Financial_Market__ Participation_IV	0.055*** (4.79)	2,132	0.480*** (14.30)	2,836
Panel B: State fixed effect				
Financial_Market__ Participation_IV	0.059*** (6.97)	2,132	0.465*** (16.90)	2,836
Panel C: Three-step strategy				
Financial_Market__ Participation_IV	0.588*** (5.08)	2,132	3.960*** (15.68)	2,836

3.5.2 Alternative measures of retiree income sufficiency

Following Purcell (2012), my baseline analysis for the replacement ratio includes only regular gross retirement income. In this section, I also use an alternative approach to include any irregular income (e.g., bequests) in calculating the replacement ratio, to conduct a further

robustness check. Furthermore, I use an alternative measure for annuitised net wealth. I exclude projected public pension from the calculation and include only wealth generated from private sources. This approach allows us to focus on examining whether private savings are influenced by financial market participation, since the projected public pension should be largely irrelevant to direct financial market participation. I then replicate my baseline analysis and present the results in Table 3.5.⁷³ As expected, financial market participation significantly increases the annuitised net wealth, even more so when I only take account into wealth accumulated from private savings.⁷⁴

⁷³ The first-stage results are presented in the Appendix B.3. All my instruments are valid.

⁷⁴ In untabulated results (available upon request), the same conclusion holds for both of the alternative measures above, if I run OLS without using any instrumental variable.

Table 3.5**Alternative Measures for Income Sufficiency**

This table presents the regression results from alternative measures for post-retirement income sufficiency, using the retiree's direct financial market participation as an instrumented variable. The replacement ratio includes the irregular income in gross retirement income. Annuitised individual net wealth is the annuitised net wealth based on net wealth at the time of the interview, without the projected Age Pension. The *t*-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Replacement ratio	Annuitised net wealth
Financial_Market_Participation_IV	0.054*** (3.19)	1.124*** (16.81)
Age	-0.005*** (-4.88)	0.061*** (12.84)
Gender	0.020* (1.73)	-0.122** (-2.00)
Living_Area	-0.003 (-0.25)	0.238*** (4.29)
Employment_Status	0.154*** (13.43)	0.148*** (3.09)
Self-Rated_Health	0.014** (2.37)	0.190*** (6.00)
Highest_Education	0.026*** (3.41)	0.253*** (7.52)
Financial_Literacy	-0.001 (-0.23)	0.182*** (6.57)
Living_Status	-0.049*** (-4.41)	0.343*** (4.99)
Risk_Preference	0.058*** (5.39)	0.295*** (5.27)
Regular_Gross_Retirement_Income		0.141*** (3.95)
Individual_Net_Wealth	0.078*** (9.16)	
Constant	0.373*** (4.52)	2.679*** (5.88)
Observations	2,132	2,817

3.5.3 Subjective financial wellbeing

The replacement ratio and annuitised net wealth measure retirees' financial wellbeing objectively. Another strand of literature focuses on retirees' self-rated subjective financial wellbeing (Barrett & Kecmanovic, 2013; Shams, 2016). For example, using subjective

measures, Alan et al. (2008) find that Canadian retirees are more satisfied with their finances than they were before their retirement. Yen (2018) studies subjective retirement replacement rates and subjective feelings of income sufficiency in the United Kingdom. The author concludes that retirees who have defined contribution plans feel more insecure about their retirement during times of fluctuating financial markets. Xue, Gepp, O'Neill, Stern and Vanstone (2019) document that elderly Australians' subjective financial wellbeing is improved through the knowledge of financial literacy and non-essential consumption (e.g., alcohol, tobacco, gifts, and donations).

On the other hand, Bond and Lang (2014, 2019) suggest that subjective wellbeing measures might not be accurate, because individuals' subjective feelings are not directly comparable and their benchmarks could be different. Nevertheless, in my context, levels of subjective and objective financial wellbeing could be quite different for reasons such as lack of financial literacy or behavioral biases. Therefore, it is still interesting to investigate whether financial market participation improves individuals' financial wellbeing in a subjective dimension. I use two subjective measures from the survey. The first is the survey question that asks retirees to rate their level of satisfaction with their financial situation, with scores ranging from zero to 10, indicating total dissatisfaction to total satisfaction. The second measure is the survey question that asks participants to rate how well their current needs and financial responsibilities are met, using a scale from one to six, with one meaning very poor and six meaning prosperous. I then re-run my baseline model as in Section 4.2 and results are presented in Table 3.6. My results suggest that the financial market participation positively affects the two subjective post-

retirement financial wellbeing measures for Australian retirees, and results are statistically significant. This is consistent with my baseline results when using objective measures for the post-retirement financial wellbeing, again indicating that my baseline line results are robust.⁷⁵

Table 3.6
Subjective Financial Wellbeing Results

This table presents the regression results for two measures of subjective financial wellbeing. The first measure is the level of satisfaction with one's financial situation and the second measure is financial life satisfaction considering financial needs and responsibilities. All the control variables are the same as in my main analysis. The *t*-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Subjective financial wellbeing Measure 1	Subjective financial wellbeing Measure 2
Financial_Market_Participation_IV	0.231*** (3.32)	0.437*** (5.67)
Age	0.025*** (7.73)	0.019*** (5.52)
Gender	-0.112*** (-2.63)	-0.081* (-1.73)
Living_Area	-0.164*** (-4.04)	-0.122*** (-2.70)
Employment_Status	-0.201*** (-5.07)	-0.079* (-1.71)
Self-Rated_Health	0.213*** (9.21)	0.240*** (9.66)
Highest_Education	-0.001 (-0.03)	0.125*** (3.98)
Financial_Literacy	0.001 (0.03)	0.008 (0.43)
Living_Status	0.235*** (5.23)	0.386*** (7.75)
Risk_Preference	0.048 (1.22)	0.144*** (2.97)
Regular_Gross_Retirement_Income	0.153*** (4.87)	0.097** (2.34)
Individual_Net_Wealth	0.186*** (5.38)	0.404*** (9.09)
Observations	2,841	2,814

⁷⁵ The first-stage results are presented in the Appendix B.4. All my instruments are valid.

3.6 Conclusion

This paper uses data covering 3,527 retirees from Australia, to examine the relationship between the retirees' income sufficiency and the direct financial market participation. My results suggest a significant positive relationship between the two that financial market participation enhances retirees' short-term income replacement ratio and long-term wealth accumulation, which are described by the replacement ratio and annuitised net wealth, respectively. These measures are specifically designed to capture retirees' financial wellbeing, by taking account into the critical planning horizon (life expectancy) and various sources of income.

My further analysis reveals that retirees' characteristics play a role in improving the post-retirement financial wellbeing through financial market participation. Specifically, I find retirees who are older, male, living alone, living in a non-major city, or ineligible for public pension benefit more from financial market participation through the short-term income replacement channel. This could be because these retirees typically face a greater drop in post-retirement income or have higher short-term funding needs. In contrast, the older female retirees who are living alone, living in a major city, or are ineligible for public pension, accumulate greater long-term wealth from participating in financial markets. Importantly, my study accounts for endogeneity issue using instrumental variables. I also use various alternative models and measures of income sufficiency to confirm the robustness of my results.

This study documents a critical issue relating to post-retirement income sufficiency and direct financial market participation. My results conclude that direct financial market participation has a strong positive impact on the financial wellbeing for Australian retirees. This finding sheds extra light on the importance of financial market participation in helping individuals achieve a more secure retirement. It therefore has important policy implications and provides strong evidence for the Australian government's initiative to promote financial literacy.

CHAPTER FOUR

ESSAY THREE

RETIREMENT INCOME SUFFICIENCY COMPARISON IN AUSTRALIA AND NEW ZEALAND⁷⁶

This chapter decomposes retirees' income sufficiency differences between Australia and New Zealand. Using the 2018 household-level surveys in both countries, Australian retirees have a higher objective income sufficiency, shown in annuitised net wealth with and without government pensions. The subjective wellbeing results document that New Zealand retirees have a significantly higher average level of overall life satisfaction due to the contribution from unobserved variables, including macroeconomic differences between Australia and New Zealand and factors resulting from differences in the two countries' pension systems. However, there is no significant difference in financial situation satisfaction between the two countries. This paper provides important implications for both governments to improve retirees' objective income sufficiency in New Zealand and retirees' subjective life satisfaction in Australia.

⁷⁶ Access to the data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in this study are the work of the authors, not Statistics NZ.

4.1 Introduction

The world continues to experience an unprecedented increasing aging population trend, and those aged 65 years and above represented 9.3% in 2020. Furthermore, this number is forecast to reach 16% by 2050, according to the United Nations. One of the aging population's biggest challenges is the source of retirement income, and government pension systems play a vital role in determining aging people's retirement lives. The universal pension system (i.e. in New Zealand) guarantees retirees' minimum living standards, while the means-tested pension system (i.e. in Australia) secures a safe position for the low-income retiree group. Mercer Global Pension Index, which benchmarks 39 retirement systems using more than 50 indicators, shows that the retirement income system needs to comprise adequacy, sustainability, and integrity. Countries adjust their pension systems according to changing demographics, such as Australia maintaining a means-tested government Age Pension, while increasing their retirement age from 65 years to 67 years by 2023. However, New Zealand is maintaining its retirement age at 65 years, while NZ Superannuation (NZ super) is also a universal government pension.

Australia and New Zealand share many common characteristics due to their geographical location and historical connections as members of the British Commonwealth; however, they apply different pension systems. Australia and New Zealand ranked 4th and 10th among these 39 studied countries, achieving B overall Index Grades in the 2020 Mercer report. More specifically, this global pension index consists of three sub-indexes, including adequacy (40%), sustainability (35%), and integrity (25%). Adequacy focuses on benefits, system design,

savings, government support, homeownership, and growth assets; sustainability considers pension coverage, total assets, demographics, public expenditure, government debt, and economic growth; and integrity is mainly measured by regulation, governance, protection, communication, and operating costs. Even if Australia and New Zealand ranked top in the report, there would still be challenges for both pension systems, such as the ability to prevent poverty, the ratio to pre-retirement incomes, and the time retirees spend in receiving the government pensions. The differences in the government pension systems ultimately result in different retirement savings and welfare situations in individuals, and retirees prepare differently for their retirement.

There are no unified criteria to compare pension systems between countries. Australia and New Zealand have three pillars with different characteristics: targeted/universal government pensions as the first pillar, a mandatory/voluntary employer contribution as the second pillar, and voluntary retirement savings as the third pillar. New Zealand has a residency test for NZ superannuation with certain requirements, and Australia has income and asset tests as well as a residency test.⁷⁷ Australia and New Zealand have defined contribution plans as the second pillar, which are mandatory employer superannuation and voluntary KiwiSaver, respectively. Australian superannuation is a compulsory scheme with voluntary components, while New Zealand KiwiSaver is a voluntary pension scheme, with enrollment by default. The third pillar is voluntary savings, undertaken through similar vehicles among various countries, including

⁷⁷ See section 4.2.2 and Appendix Table C.1 for more details on the Australia and New Zealand pension system comparison.

voluntary pension schemes, insurances, financial market investments, and other retirement saving instruments. From the designs of the pension systems, Australia and New Zealand apply different strategies to prepare their retirees for retirement, and it is difficult to conclude which pension system is more beneficial for retirees to prepare for their retirement.

Therefore, I compare how retirees fare under different pension systems in Australia and New Zealand in my research. How do means-tested and universal pension systems affect retirees' saving decisions? Do demographic traits, individual financial positions, and varying macroeconomic differences result in different retirement income sufficiency between Australia and New Zealand? My research focuses on the mean income sufficiency differences between Australia and New Zealand and decomposes the gap from demographic traits, individual financial positions, and unobserved variables.

Using Household, Income and Labor Dynamics Australia (HILDA) and the Household Economic Survey (HES) New Zealand in 2018, I obtain 3,527 Australian retirees and 2,175 New Zealand retiree observations for the research. I decompose the mean difference in the objective annuitised net wealth (Haveman et al., 2007b) and subjective wellbeing (Bond & Lang, 2019) using Oaxaca-Blinder linear and non-linear decompositions by including different categories of variables. My control variables consist of demographic traits and individual financial positions. The mean value differences in the control variables provide explanations for the explained part of the overall difference, including demographic and individual financial

position characteristics. The unexplained difference is due to other factors not controlled in the regressions. Instrumental variables are used to deal with the endogeneity issue within each country so that the microeconomic level difference is mainly addressed. Therefore, the macroeconomic differences between Australia and New Zealand and factors resulting from differences in the two countries' pension systems largely contribute to the unobserved difference.

The results show that New Zealand retirees have better scores of demographic traits and better influences from unobserved variables, while Australian retirees have better individual financial positions on average. As a result, Australian retirees have better objective income sufficiency shown in two annuitised net wealth measurements, while New Zealand retirees fare better for life satisfaction. More specifically, Australian retirees would have had a higher level of overall annuitised net wealth if applied to the same demographics in New Zealand. For the three components making up the decomposition, the demographic traits contribute to a -0.118 percentage point (ppt) for the annuitised net wealth with government pensions and a -0.242 ppt difference for the annuitised net wealth without government pensions. This means that Australian retirees' average scores of demographic traits are lower than New Zealand retirees as this negative value is calculated as the average Australian value minus the average New Zealand value. The financial position factors contribute positively to Australia, at 0.258 ppt, accounting for the annuitised net wealth with government pensions and 0.772 ppt for annuitised net wealth without government pensions. This demonstrates that Australian retirees' average financial positions are better than New Zealand retirees. The unobserved variables contribute

negatively to Australia. Therefore, demographic traits and unobserved variables contribute positively to New Zealand retiree income sufficiency, and individual financial positions benefit Australian retirees. Moreover, the contribution from unobserved variables drives New Zealand to a higher level of life satisfaction than Australian retirees.

Furthermore, I also compare both annuitised net wealth with the national poverty lines and regional median incomes in each country to examine retirees' relative retirement lifestyles. The results indicate that Australian and New Zealand retirees' relative retirement lifestyles do not show significant differences, and that demographic traits, individual financial positions, and unobserved variables play the same roles as with the main results. Moreover, I also use different distributional decomposition methods to decompose the annuitised net wealth difference at 10%, and 90% levels and the Oaxaca recentred influence function (RIF) decomposition to check the robustness of the main results, which is explained in Section 4.4. The influences from demographic traits, individual financial positions, and unobserved variables remain, even if the overall differences between certain groups are no longer significant. Due to the difference in the means-tested and universal pension systems in Australia and New Zealand, I also carry out subsample tests among homeowners and non-homeowners to examine the influence of having a principal residence. The results show that Australian homeowner retirees have higher income sufficiency regardless of whether or not they have paid off the mortgage compared to New Zealand homeowners. At the same time, New Zealand non-homeowners have significantly higher income sufficiency than Australian non-homeowners. Moreover, New Zealand non-

homeowners also show better individual financial positions, confirming the significance of Australian housing property in their wealth accumulation.

The main contributions of this paper are as follows: 1. This study compares Australian and New Zealand retiree income sufficiency using different datasets in 2018 (HILDA in Australia and HES in New Zealand). Most research uses a harmonised dataset (in Europe and the U.S.) and qualitative analysis for two-country comparison. 2. This research focuses on both micro-level (demographic traits and financial positions) and macro-level (shown in unexplained factors) comparisons. However, to the best of my knowledge, no study to date has focused on both levels, and most research only emphasises one aspect. 3. This paper applies a novel method (Oaxaca-Blinder decomposition) to decompose the income sufficiency gap among demographic traits, individual financial positions, and unobserved variables. Moreover, objective annuitised net wealth and subjective wellbeing are considered. 4. Finally, this research shows important policy implications for both countries about the factors influencing retiree income sufficiency under different pension systems. This research illustrates the outcome differences that evolve through different pension systems, and governments need to use different strategies to improve their retirees' income sufficiency given their respective approaches.

The remainder of the paper is organised as follows. The next section briefly discusses the related literature and characteristics of the pension systems in both countries. Section 4.3

describes the data and presents the income sufficiency comparisons. Section 4.4 explains the decomposition method in detail, and Section 4.5 shows the decomposition results for the income sufficiency difference between Australia and New Zealand. Section 4.6 performs further analysis, including relative income sufficiency measurements, alternative methods, and homeownership subsample tests. Section 4.7 concludes and highlights the implications for both countries.

4.2 Literature review and background information

4.2.1 Literature review on cross country comparisons

Cross-country income and wealth comparisons are widely studied among different age groups in the U.S. and European countries due to similar economic situations and the harmonised survey questionnaires. Banks, Blundell, & Smith (2003) compare household finance differences in the U.S. and UK, and they document that median U.S. households accumulate more financial wealth than similar households in the UK. They find that less longevity risk and large housing price fluctuations in the UK may explain the lesser accumulation. Housing assets have been proved to play an important role in determining individual wealth, and Azpitarte (2011) also concludes that the housing wealth component drives the higher poverty rate in the UK compared to Spain. He compares the households' asset-poor compositions between Spain and the UK, and shows that the characteristics of the households in these two countries are very similar. However, the percentage of poverty in the UK is around twice that in Spain.

Christelis, Georgarakos and Haliassos (2013) study the household portfolio differences among those aged 50 years and above among the U.S. and some European countries. They find the allocation differences can be explained by institutional characteristics, which are the country-level differences. However, Sierminska and Doorley (2018) document that household characteristics determine those younger households' asset participation by studying financial and non-financial asset participation differences among European and North American countries. Moreover, Cowell, Karagiannaki and McKnight (2012) conclude that average wealth holdings are low in generous welfare countries and higher in those countries expecting individuals to engage in greater saving themselves. It is shown from the literature that the household characteristics largely influence wealth among young people, and the difference in the older generation is normally impacted by the institutional characteristics, which are macroeconomic factors. It can also be summarised that household and macroeconomic characteristics influence different age cohorts among countries, and the influences change with their lifecycles.

There are also cross-country comparisons between OECD countries among aging populations. However, the retiree group has unique characteristics as they have a threshold for income and savings, and they also have increased expenditure on health costs or other uncertainties. Sierminska, Brandolini and Smeeding (2007) using Oaxaca decomposition method compare retirees' financial situation between the U.S., Canada, the UK, Italy, Germany, Finland, and Sweden. They use the relative poverty line in each country, which is 50% of the population's median household income, as the benchmark, and the U.S. leads in the older income poverty

with a rate of 23%. A majority of households' net worth rises with the level of education except for Italy and Germany, and they have an entirely different level of homeownership at all levels of education for this cohort of elders. World War II's effects on the German housing stock and multigenerational households in Italy explain the interesting phenomenon between education and homeownership in the two countries. Bourguignon, Ferreira and Leite (2008) also document that the key income difference between Brazil and the U.S. lies in the distribution of education and non-labour income (mainly pensions) using a micro-econometric approach, and Brazil also has steeper schooling returns.

Smeeding (2003) compares the income maintenance among older people in the U.S., Australia, Canada, the UK, Spain, France, Luxembourg, Belgium, Denmark, Germany, and the Netherlands. His results show that the means-tested Age Pension would not benefit those high-income older individuals in Australia, which is the rationale behind the pension system design. Fasang (2012) studies the influence of social policies on German and British income inequality in retirement. The results reveal that there is no direct link between social policies and income inequality during retirement. Even if Britain is more differentiated and destandardised than Germany, similar levels of income inequality have been established before retirement while individuals were still in the labour market.

Given the different designs in pension systems among different countries and the uncertainties in retirees' post-retirement life, retirees prepare accordingly. Australia and New Zealand have

many similar characteristics, while they differ significantly in their pension systems. It is reasonable to assume that the different designs of pension systems will lead retirees to diverse financial planning behaviours, which is shown in retirees' different asset allocations among financial and non-financial assets. I compare the two countries' subjective and objective income sufficiency and decompose the differences into demographic traits, individual financial positions, and unobserved variables. More details will be discussed in section 4.3.2.

4.2.2 Australia and New Zealand background information and pension systems

In 2018, the share of the population that is 65 years and above reached 15.6% and 15.4% in Australia and New Zealand, respectively. The old-age dependency rate was 23.9 and 23.5 for every 100-working people in each country. The life expectancy at birth was 81.2 and 85.2 years for males and females, in Australia, and this number was 80.3 and 83.8 years, in New Zealand. Increasing life expectancy should mean the extension of each age period, not only the retirement stage. In theory, aging people should also work longer to postpone their retirement as an appropriate response. To maintain the pension system's sustainability, Australia has announced it will increase its retirement age to 67 years by July 2023, while the New Zealand retirement age remains at 65 years to maintain a minimum income for retiree individuals. Lyons, Grable and Joo (2018) compare the aging population financial security among thirteen OECD countries and ten non-OECD countries. The macroeconomic indicators show that public pension spending was 3.5% and 4.9% of Australian and New Zealand GDP, respectively. According to the Allianz report in 2020, no country among the 54 studied countries has a sound

balance between sustainability and adequacy in their respective pension systems as it is a trade-off choice. New Zealand does better in adequacy, and Australia does better in sustainability.⁷⁸

According to the OECD Statistics, the employment rate of older workers, those between 65-69 years, is 28.5% for Australia and 44.0% for New Zealand, showing a large aging employment rate in New Zealand. The effective labour market exit age is 65.3 and 64.3 years for males and females, in Australia and 69.8 and 66.4 years for males and females, respectively, in New Zealand. Working longer proves to be an appropriate solution to increase retirement income (Higo & Klassen, 2017). Australians have a longer life expectancy, with a younger retirement age on average. As a result, the expected years in retirement were 19.8 and 23.3 years in Australia and 15.6 and 20.5 years in New Zealand for males and females, again ranking top among global life expectancy according to the Allianz pension report 2020. This report also shows that the Australian public pension coverage rate is around 70%, and the New Zealand coverage rate is almost 100%. The results are not surprising as the NZ super is a universal pension. In Australia, the government pension is means-tested.

Australia and New Zealand are considered to operate three-pillar pension systems. However, the structures of the systems and the requirements for pension eligibility are different. They start with the government pension as the first pillar, Australia Age Pension and New Zealand

⁷⁸ Sustainability shows the ability for the pension system to cushion the impact of the demographic changes, which consists of 60% prediction and 40% finance. Adequacy manifests the adequate level that an individual can gain from the first pillar (50%) and other pension incomes (50%).

Superannuation. In New Zealand, residents qualify for NZ Super once they reach 65 years. The only criterion is that they must be citizens, permanent residents, or residence class visa holders with certain amount of time spent in New Zealand to pass the residency test. However, Australian retirees also need to pass asset and income tests as well as qualifying through residency tests. The senior Australians' tax offset may eliminate the tax liability, and Australian Age Pension receivers may be free from tax⁷⁹, even if NZ super and the Australia Age Pension are taxed at marginal rates. New Zealand retains the 65-year retirement age for the first pillar, while Australia has gradually increased the qualifying age to 66.5 years since July 1, 2021.

Moreover, Australia has a compulsory employer scheme as the second pillar, while New Zealand's KiwiSaver is voluntary. Australia employer superannuation and New Zealand KiwiSaver are a hybrid of Pillar 2 and 3, as employees are auto-enrolled and can choose to opt out. Australian compulsory employer superannuation requires employers to contribute for their employees, and the minimum contribution rate reached 10% since July 1, 2021, scheduled to increase to 12% by 2025. When Australian individuals reach 60 years, superannuation can be claimed in either annuity or lump sum form. However, New Zealand KiwiSaver is a combined contribution from employees and employers, and the default contribution rate from the employer is 3%. KiwiSaver is auto-enrolled, and from the design, it functions like compulsory employer superannuation. Employees participate in the plan by default, while they can choose to withdraw whenever they want to. Australian employee superannuation is taxable at a flat

⁷⁹ <https://www.ato.gov.au/Individuals/Income-and-deductions/Offsets-and-rebates/Seniors-and-pensioners-tax-offset/>

rate of 15%, with an annual cap of A\$27,500 since July 1, 2021. New Zealand KiwiSaver is taxable if the contribution is from employers and the contributions from employees are made from after-tax income.

The third pillar is the voluntary private superannuation funds and it refers to different types of retirement pensions or various types of savings, like defined contribution and defined benefit plans. In Australia, these are tax-preferred, while in New Zealand, these contributions are still taxable as the tax preferences were removed in the late 1980s (Guest, 2013). A more detailed comparison of each pillar is presented in Table C.1 in the Appendix.

Australia and New Zealand's aging demographic situations impose tremendous pressure on the pension systems. Dang et al. (2006) document that those countries with more support for older people may result in a higher level of poor elderly retirees. On the one hand, individuals under means-tested pensions may plan to save less as they want to qualify for the government pension in Australia. However, on the other hand, a universal government pension may also lead to insufficient savings, as retirees may rely on the government pension as their only source of retirement income in New Zealand. The tax arrangements for retirement savings seem to encourage Australian retirees to save more in retirement saving accounts than New Zealand retirees. Hence, whether the New Zealand or Australian retirement system is beneficial to retirees' income sufficiency is ambiguous in theory.

4.3 Data

4.3.1 Australia HILDA and New Zealand HES

To compare aging population income sufficiency in Australia and New Zealand, I use the 2018 household-level data from Household, Income and Labour Dynamic in Australia (HILDA) and Household Economic Survey (HES) in New Zealand. Both surveys include data from household and individual levels to investigate people's demographics, income, and wealth, using randomly selected samples from the whole population in each country. The data contains multiple sources of income, and there is also detailed information about household wealth, including financial and non-financial assets in 2018. Moreover, there is sufficient demographic information and similar questions regarding living areas, highest education, living status, and risk preference. Therefore, these two datasets are comprehensive and comparable enough to carry out my research.

HILDA is a national representative longitudinal study of Australian households surveying people's economic and personal wellbeing. The survey started in 2001, and it aims to track the samples over the course of their life. It is funded by the Australian government through the Department of Social Services and administered by the Melbourne Institute at the University of Melbourne. Individual income questions are surveyed every year, and the household wealth section is conducted every four years. In 2018, the survey covered income and wealth questions, providing all the necessary information for my research.

New Zealand HES data is cross-sectional, and randomly selects different households each year. The full HES runs every three years, including income, expenditure, and wealth, while HES (income) is carried out every year. The wealth data is collected every three years and I use the full HES from 2018, whose aim is to retain 8,000 households for the wealth module. HES data is part of Integrated Data Infrastructure (IDI) administered by Stats NZ, a government department, to collect information from people and organisations through censuses and surveys. HES collects the individual income and household wealth data in New Zealand to help the New Zealand government understand low-income families and develop ways to help them.

One major problem regarding the data of the two countries is comparability, and the definitions of the variables are presented in Table C.2 in the Appendix. Table 4.1 compares the income and wealth categories in each dataset. The income category includes government pension (first pillar), private retirement pension plans (second pillar), investment income (one source of the third pillar), and gross retirement income. The wealth category consists of bank account savings, pension funds, other financial assets, homeownership, other non-financial assets, credit card debt, mortgage, and other debts in each country.

Table 4.1
Comparison of Australia HILDA and New Zealand HES Income and Wealth Categories

Category	Australia	New Zealand
Panel A: Income Category		
Government Pensions	Australia Age Pension.	New Zealand Superannuation.
Private Pensions	Australia compulsory employer superannuation.	New Zealand private super schemes. (Government Superannuation Fund, National Provident Fund, KiwiSaver, NZ Mutual Fund, other NZ job-related superannuation schemes, other NZ private superannuation schemes that are not job-related).
Investment Income	Investment income or dividends from company shares, managed funds, and property trusts.	Investment income or dividends from company shares, managed funds, and unit trusts.
Gross Retirement Income	All incomes above plus wages and salaries, business income, and other regular income and transfers before tax.	All incomes above plus wages and salaries, and other regular income and transfers before tax.
Panel B: Wealth Category		
Bank Accounts	Bank account savings.	Bank account savings.
Pension Funds	Australian employer superannuation.	Defined benefit and defined contribution superannuation.
Other Financial Assets	Life insurance, cash investments, equity investments, trust funds.	Life insurance, investments and trusts.
Homeownership	Principal residence.	Principal residence.
Other Non-financial Assets	Vehicles, business assets and collections.	Consumer durables, motor vehicles, cash and non-cash assets, farm, and business equity.
Credit Card Debt	Credit card debt.	Credit card debt.
Mortgage	Mortgage for a principal residence.	Mortgage for a principal residence.
Other Debts	Student loans, other personal debts.	Consumer credit loans.

4.3.2 Retiree income sufficiency in Australia and New Zealand

Retirement income sources are limited, and retirement is a stage to decumulate wealth. Table 4.2 illustrates the absolute values from different income and wealth categories. These absolute values from the income category show that New Zealand retirees have a higher average government income from the first pillar, a lower average private pension from the second pillar, and a lower average gross retirement income than Australian retirees. I also include the

investment income from shares, funds and trusts for the third pillar as this source of income shows retirees' direct and active retirement income management.

A similar percentage of retirees in both countries have these wealth items in each wealth category except for the higher ratios for pension schemes, other financial assets, and homeownership in Australia. More than half of Australian retirees have private retirement pension schemes, while 19% of New Zealand retirees do. Moreover, Australian retirees also have a higher homeownership level of 81%, while this ratio is 60% in New Zealand. These differences are also the product of different pension systems in each country, as the Australian government pension has an asset test, which excludes the principal residence. In comparison, New Zealand retirees have a universal government pension.

Annuitised net wealth is a specialised way to calculate a retiree's income sufficiency (Haveman et al., 2007a; Haveman et al., 2007b). More specifically, I calculate two annuitised net wealth figures, with and without government pensions, representing pre-retirement and post-retirement wealth. The individual overall net wealth is the present value of the remaining government pension added to the individual net wealth at the interview in 2018. As the government pensions are adjusted for inflation annually in both countries, the remaining pensions can be proxied as the current pension multiplied by the remaining life expectancy. The remaining life expectancy is matched to life tables in each country by age and gender, and the discount rate is the inflation-adjusted T-bill rate in 2018. The overall net wealth is

annuitised based on this remaining life expectancy and discount rate. I also use another annuitised net wealth measurement excluding the government pensions, where only the net wealth is considered at the time of interview. This net wealth is annuitised based on the same remaining life expectancy and discount rate. Table 4.3 presents the absolute and relative annuitised net wealth comparisons shown in 2018 Australian dollars. Panel A in Table 4.3 shows that Australia's average overall annuitised net wealth is A\$73,845, and the average annuitised net wealth excluding pension is A\$61,819; these numbers in New Zealand are A\$61,014 and A\$43,780, respectively.

I further compare the two annuitised net wealth measures with two benchmarks; the national poverty lines, and regional median incomes; to check the relative lifestyles that the retirees maintain. According to the OECD, there is no standard level for the poverty line, and this research uses 50% of the median individual income of the total population before housing costs as the poverty line in both countries. In March 2018, the 50% median income poverty line before housing costs for a single person was A\$457 and A\$370 after housing costs, according to Australia Council in 2020. I apply A\$457 weekly income, making A\$23,764 annually as the poverty line since I consider the gross retirement income at the individual level.⁸⁰ In New Zealand, I use 50% median equivalent one-person household income before housing costs as the poverty line. In 2018, the median one-person household income in New Zealand was NZ\$39,900 annually, according to the Ministry of Social Development and the poverty line I

⁸⁰ I am aware that there are couples in my data, however, I am working on individual level and I deal with them as individuals. The annual poverty line is $A\$457 * 52 = A\$23,764$.

consider as NZ\$19,950. Table 4.3 Panel B shows New Zealand retirees have a higher relative average overall annuitised net wealth poverty line ratio of 3.3 (3.1 in Australia), while Australia has a higher average annuitised net wealth (without government pensions) poverty line ratio of 2.6 (2.37 in New Zealand).

Another benchmark is the regional median income. Australia uses state median incomes, and New Zealand applies regional median incomes.⁸¹ Australia shows higher relative ratios in both measurements, reaching 1.48 and 1.23, while these ratios are 1.41 and 1.01 in New Zealand for annuitised net wealth with and without government pensions. Absolute and relative comparisons show that Australia has an absolute higher income sufficiency and regional median income ratios. However, New Zealand retirees have higher national poverty line ratios. These numbers indicate that Australian retirees are saving more for their retirement while maintaining a better post-retirement living standard in general. However, New Zealand retirees are covered better in relation to the national poverty line on average.

Moreover, I also apply the self-rated life satisfaction and financial situation satisfaction to compare the retiree's subjective wellbeing in Australia and New Zealand. Bond and Lang

⁸¹ In the Australian states of New South Wales, Victoria, Queensland, South Australia, Western Australia, Tasmania, Northern Territory and the Australian Capital Territory, the total median incomes were A\$50,153, A\$49,266, A\$48,826, A\$48,354, A\$52,671, A\$45,546, A\$60,636, and A\$64,332, respectively. In New Zealand, the regional median incomes in Northland, Auckland, Waikato, Bay of Plenty, Gisborne/Hawkes Bay, Taranaki, Manawatu, Wellington, Tasman/Nelson/Marlborough/ West Coast, Canterbury, Otago, and Southland regions were NZ\$40,560, NZ\$54,080, NZ\$46,748, NZ\$39,884, NZ\$48,880, NZ\$42,744, NZ\$39,780, NZ\$58,240, NZ\$38,688, NZ\$44,876, NZ\$44,356, and NZ\$42,224, respectively.

(2019) document that the condition for subjective wellbeing is that all individuals report their happiness in the same way, and this assumption is rejected in almost all cases. Therefore, subjective measurement rankings may not be reliable. I use a dummy variable as the subjective measurement, including overall life satisfaction and financial situation satisfaction. Overall life satisfaction is assigned as 1 if, when retirees consider all parts of life, their life is better than average. Otherwise, their life satisfaction is 0 if retirees' life is worse than, or at, the average level. Those retirees who have more than enough income to cover their daily costs are assigned as 1, and those with less than, or just, enough income for their daily needs are considered to be 0. The summary statistics and the comparison results will be discussed in detail in section 4.5.

Table 4.2
Individual Financial Year Income and Wealth Comparisons for Aging Populations
in 2018 Australian Dollars

This table presents the median and mean values of different income and wealth sources in 2018 Australian dollars. The ratios below in brackets are average ratios, which are the average individual ratios of his/her income/wealth categories compared with the regular gross retirement income or net wealth. Received Observations and ratio show the percentage of retirees with the respective wealth or income categories.

Category	Australia			New Zealand		
	Median (Ratio)	Mean (Ratio)	Received Obs (Ratio)	Median (Ratio)	Mean (Ratio)	Received Obs (Ratio)
Panel A: Income Category						
Government Pensions	A\$17,774.00 (0.90)	A\$17,485.49 (0.75)	2,400 (0.68)	A\$16,938.75 (0.90)	A\$18,391.19 (0.74)	2,076 (0.95)
Private Pensions	A\$20,000.00 (0.49)	A\$28,154.67 (0.53)	1,322 (0.37)	A\$20,062.06 (0.46)	A\$23,009.72 (0.44)	162 (0.07)
Investment Income	A\$1,500.00 (0.06)	A\$ 10,527.10 (0.19)	849 (0.24)	A\$1,721.50 (0.05)	A\$12,286.69 (0.13)	282 (0.13)
Gross Retirement Income	A\$24,670.00	A\$43,265.83	3,527	A\$22,743.91	A\$36,900.10	2,175
Panel B: Wealth Category						
Bank Accounts	A\$19,289.00 (0.05)	A\$75,428.05 (0.16)	3,318 (0.94)	A\$9,262.00 (0.04)	A\$52,443.67 (0.11)	2,054 (0.94)
Pension Schemes	A\$162,306.50 (0.25)	A\$305,288.00 (0.29)	1,898 (0.54)	A\$37,001.29 (0.10)	A\$109,993.77 (0.20)	410 (0.19)
Other Financial Assets	A\$25,000.00 (0.04)	A\$189,079.60 (0.13)	1,424 (0.40)	A\$197,371.09 (0.24)	A\$241,085.96 (0.28)	172 (0.08)
Home-ownership	A\$600,000.00 (0.96)	A\$753,886.40 (1.08)	2,757 (0.81)	A\$236,178.45 (0.67)	A\$300,400.74 (0.64)	1,306 (0.60)
Other Non-Financial Assets	A\$12,000 (0.02)	A\$44,846.99 (0.12)	3,091 (0.88)	A\$47,467.24 (0.18)	A\$101,217.56 (0.30)	2,112 (0.97)
Credit Card Debt	A\$1,500.00 (0.005)	A\$3,062.15 (0.162)	371 (0.11)	A\$740.95 (0.001)	A\$1,447.10 (-0.007)	693 (0.32)
Mortgage	A\$124,000 (0.23)	A\$188,274.80 (0.45)	300 (0.08)	A\$32,592.16 (0.13)	A\$72,990.61 (-0.002)	176 (0.08)
Other Debts	A\$9,149.50 (0.02)	A\$42,173.89 (0.20)	422 (0.19)	A\$2,084 (0.01)	A\$11,699.85 (-0.10)	264 (0.12)
Individual Net Wealth	A\$504,021.00	A\$801,376.40	3,359	A\$305,225.91	A\$555,324.07	2,175

Table 4.3**Absolute and Relative Annuitised Net Wealth Comparisons**

This table presents two annuitised net wealth measurement comparisons in 2018 Australian dollars and the relative ratio comparisons. The overall annuitised net wealth is the overall net wealth annuitised based on the remaining life expectancy and inflation-adjusted T-bill rate in 2018. The overall net wealth is the present value of remaining government pensions added to the net wealth at the interview time. The relative ratios are shown in the annuitised net wealth compared with the national poverty lines and regional median incomes.

Category	Benchmark	Australia		New Zealand	
		Median	Mean	Median	Mean
Panel A: Absolute Annuitised Net Wealth					
Overall Annuitised Net Wealth		A\$49,002.04	A\$73,874.58	A\$39,411.71	A\$61,014.33
Annuitised Net Wealth (without government pensions)		A\$36,002.79	A\$61,818.51	A\$21,786.80	A\$43,780.08
Panel B: Relative Annuitised Net Wealth Ratios					
Overall Annuitised Net Wealth	National poverty line	2.06	3.11	2.13	3.30
	Regional median income	0.99	1.48	0.93	1.41
Annuitised Net Wealth (without government pensions)	National poverty line	1.52	2.60	1.18	2.37
	Regional median income	0.72	1.23	0.51	1.01

4.4 Methodology

Retiree objective income sufficiency is measured by annuitised net wealth with and without government pensions. Moreover, I also calculate the relative ratios to illustrate the retirement living standard that the annuitised net wealth can maintain in each country. The comparisons in Table 4.3 show that substantial differences in annuitised net wealth with and without government pensions exist between Australia and New Zealand. The gap between the two countries for the annuitised net wealth is widened when excluding the government pensions. An appropriate method called Blinder-Oaxaca decomposition further provides me with a

platform to decompose the influences from demographic traits, individual financial positions, and macroeconomic situations (Oaxaca, 1973; Sierminska & Doorley, 2018).

Oaxaca (1973) and Blinder (1973) first applied this decomposition method to male and female wage differences to determine the influences of personal characteristics (explained reasons) and discrimination factors (unexplained reasons). Oaxaca-Blinder is a statistical method explaining the difference in the means of a dependent variable between two groups. The difference between the two groups can be decomposed into the differences in the mean values of the independent variable within the group. The other part is the group differences in the effects of the unobserved variables, shown in the coefficients.

In my context, the differences in retiree income sufficiency may be caused by demographic traits, individual financial positions, or other unobserved variables (mainly macroeconomic situations). Therefore, I decompose the difference in income sufficiency measurements - the annuitised net wealth (with and without government pensions) - to capture the influences from demographic traits, individual financial positions, and unobserved variables. I also decompose subjective financial and life satisfaction to explain retiree income sufficiency from a subjective wellbeing perspective. Due to the characteristics of the dependent variables, linear and non-linear Oaxaca decompositions are applied, and I will discuss more details of the decomposition methods in the following section.

4.4.1 Standard Oaxaca-Blinder for linear regression models

The fundamental question that Oaxaca-Blinder is dealing with is that how much the mean outcome difference is:

$$R = E(Y_A) - E(Y_B) \quad (1)$$

In my equation, the A and B groups are Australia and New Zealand, and $E(Y)$ is the expected value of annuitised net wealth with and without government pensions. Therefore, R shows the group differences between the predictors.

Based on the linear model:

$$Y_l = X_l' \beta_l + \varepsilon_l, \quad E(\varepsilon_l) = 0, \quad l \in \{A, B\} \quad (2)$$

X is a vector containing the control variables (demographic traits and individual financial positions) and a constant, β , contains the slope parameters and the intercept, with ε being the error term. The mean outcome difference can be expressed as the difference in the linear prediction at the group-specific means of the regressors.

$$R = E(Y_A) - E(Y_B) = E(X_A)' \beta_A - E(X_B)' \beta_B \quad (3)$$

Since, $E(Y_l) = E(X_l' \beta_l + \varepsilon_l) = E(X_l' \beta_l) + E(\varepsilon_l) = E(X_l)' \beta_l$, under the assumption that

$E(\beta_l) = \beta_l$, and $E(\varepsilon_l) = 0$. Oaxaca (1973) aimed to investigate the wage difference between both genders caused by personal characteristics (such as different education levels) or discrimination between genders (unobserved factors). In the research, he assumed β^* is the nondiscriminatory coefficients vectors and the outcome can be changed into

$$R = [E(X_A) - E(X_B)]' \beta^* + [E(X_A)' (\beta_A - \beta^*) + E(X_B)' (\beta^* - \beta_B)] \quad (4)$$

Similarly, in my context, this β^* is the undifferentiated retiree wealth structure between Australia and New Zealand. Now, I have the two-fold decomposition. $R = Q + U$, where $Q = [E(X_A) - E(X_B)]' \beta^*$ is the explained part in the group difference in the control variables (“quality effect”), meaning this part can be explained by these variable differences (the mean values in demographic traits and individual financial positions) controlled in the regression. $U = [E(X_A)'(\beta_A - \beta^*) + E(X_B)'(\beta^* - \beta_B)]$ is the “unexplained” part, showing all potential effects of differences in unobserved variables. For β^* , there are different specifications in the literature.⁸² In my research, I aim to find the difference between wealth accumulation caused by individual characteristics and country-level differences, and I use $\hat{\beta}^* = \widehat{\beta}_{AUS}$ as the benchmark. The gap can be calculated as:

$$\hat{R} = [E(X_{AUS}) - E(X_{NZ})]' \widehat{\beta}_{AUS} + E(X_{NZ})' (\widehat{\beta}_{AUS} - \widehat{\beta}_{NZ}) \quad (5)$$

In this equation, $Q = [E(X_{AUS}) - E(X_{NZ})]' \widehat{\beta}_{AUS}$ is shown as explained partly by personal characteristics, if New Zealand retirees were faced with Australian situations. The Q part can be further decomposed into each control variable. $U = E(X_{NZ})' (\widehat{\beta}_{AUS} - \widehat{\beta}_{NZ})$ is the unexplained differences due to the different processes in wealth accumulation for retirement (or pension system influence) (Jann, 2008). This unexplained difference can largely be attributed to these two countries’ differences including culture, risk preference differences, pension systems, and other factors.

⁸² Reimers (1983) use the average coefficients over both groups as an estimator of the nondiscriminatory parameter, that is $\hat{\beta}^* = 0.5\widehat{\beta}_A + 0.5\widehat{\beta}_B$. Meanwhile Cotton (1988) suggests weighting the coefficients by the group size n_A and n_B , that is $\hat{\beta}^* = \frac{n_A}{n_A+n_B}\widehat{\beta}_A + \frac{n_B}{n_A+n_B}\widehat{\beta}_B$. Neumark (1988) uses a pooled model over both groups to obtain $\hat{\beta}^*$ and Elder et al. (2010) argue that the pooled OLS regression overstates the role of observables. There is no specific reason to assume that the coefficients of one or the other group are nondiscriminatory.

As I am aware of the possible endogeneity issues for the separate regression in each country, I also use the 2SLS with the instrumental variable with robust standard errors for both countries to examine the macroeconomic influence. In this way, I have primarily dealt with the possible endogeneity issue (mainly omitted variables) within each country, and the unexplained gap could be largely explained by the macroeconomic factors influencing the coefficients. Therefore, I can check the influence from the explained gap by all these individual-level characteristics and examine the unexplained gap from the country-level difference. This linear model is used for objective annuitised net wealth measurements.

4.4.2 Standard Oaxaca-Blinder for non-linear regression models

I use an extension of Oaxaca-Blinder decomposition for a non-linear regression with binary results for my retiree income sufficiency subjective measurement (Fairlie, 1999; Sinning et al., 2008). I estimate a probit model for income sufficiency satisfaction by financial market participation, as this is the variable for instrumental variable, m :

$$p_j(m) = F(X\beta) \quad (6)$$

Based on the linear regression, the final linear decomposition in (5) can be decomposed on conditional expectation in non-linear regression (Sinning, Hahn, & Bauer, 2008) to:

$$\begin{aligned} \bar{Y}_{AUS} - \bar{Y}_{NZ} = & \left[\left(E_{\hat{\beta}_{AUS}}(Y_{AUS}|X_{AUS}) - E_{\hat{\beta}_{AUS}}(Y_{NZ}|X_{NZ}) \right) \right] + \\ & \left[\left(E_{\hat{\beta}_{AUS}}(Y_{NZ}|X_{NZ}) - E_{\hat{\beta}_{NZ}}(Y_{NZ}|X_{NZ}) \right) \right] \quad (7) \end{aligned}$$

Equation (7) can be re-written as:

$$\hat{p}^{AUS}(m) - \hat{p}^{NZ}(m) = \left(\hat{p}^{AUS}(m) - \hat{p}_{NZ}^{AUS}(m) \right) + \left(\hat{p}_{NZ}^{AUS}(m) - \hat{p}^{NZ}(m) \right) \quad (8)$$

This is my method for subjective wellbeing measurements. Similarly, I also address the possible endogeneity issue within each country. Therefore, I use the probit model with instrumental variables for both countries and decompose the subjective wellbeing based on the two models.

4.4.3 Oaxaca recentered influence function decomposition

The recentered influence function (RIF) of the unconditional quantile is used to estimate the effect of the change in independent variables on the marginal quantiles of the dependent variable, as proposed by Firpo, Fortin and Lemieux (2009). It is a suitable method to check the impact of the small change in the distribution of independent variable X , on the β th quantile of the unconditional distribution of the dependent variable, Y . It is assumed that Y and X have a joint distribution on $F_{Y,X}(\cdot, \cdot): R \times \chi \rightarrow [0,1]$ and $\chi \in R^k$ and the unconditional distribution function of Y can be written as:

$$F_Y(y) = \int F_{Y|X}(y|X=x) \cdot dF_X(x) \quad (9)$$

G_Y represents the counterfactual distribution of Y, under the assumption that the conditional distribution $F_{Y|X}(\cdot)$ is unaffected by the small change of distribution of X. The directional derivative of v in the direction of the distribution G_Y is:

$$\lim_{t \rightarrow 0} \frac{v(F_{Y,t,G_Y}) - v(F_Y)}{t} = \frac{\partial v(F_{Y,t,G_Y})}{\partial t} \Big|_{t=0} = \int IF(y; v, F_Y) \cdot d(G_Y - F_Y)(y) \quad (10)$$

F_{Y,t,G_Y} is the mixing distribution showing that t is away from F_Y in the direction of the distribution G_Y . $F_{Y,t,G_Y} = (1 - t)F_Y + t \cdot G_Y = t \cdot (G_Y - F_Y) + F_Y$, where $0 \leq t \leq 1$.

Moreover, $IF(y; v, F_Y) = \frac{\partial v(F_{Y,t,\Delta y})}{\partial t} \Big|_{t=0}$, and Δy is the probability measure that puts mass 1 at the value of y , while $(F_{Y,t,G_Y}) = v(F_Y) + t \cdot \int IF(y; v, F_Y) \cdot d(G_Y - F_Y)(y) + r(t; v; G_Y, F_Y)$, and $r(t; v; G_Y, F_Y)$ is the remainder term. Firpo et al. (2009) define RIF where $G_Y = \Delta y$ and $t = 1$, and $\int IF(y; v, F_Y) \cdot d F_Y(y) = 0$. Finally,

$$RIF(y; v, F_Y) = v(F_Y) + \int IF(s; v, F_Y) \cdot d\Delta y(s) = v(F_Y) + IF(y; v, F_Y) \quad (11)$$

This method can be used to analyse the change of X distribution on the unconditional distribution of Y, applying it to some other distributions like different quantiles and the Gini inequality index. Standard Oaxaca-Blinder decomposition manages to decompose the mean value difference, and I apply RIF Oaxaca-Blinder to decompose the 10th and 90th quantiles for different wealth levels among retirees.

Moreover, Firpo, Fortin and Lemieux (2007) also proposed a two-stage method for wage difference decomposition using both the reweighting and RIF regressions. I also use this

method for my further analysis. In the first stage, a reweighting method decomposes the overall gap into a regression structure (retiree wealth accumulation) effect and a composition effect. Then, the second stage further decomposes each explanatory variable using RIF regressions, as shown above. I will explain more details on the first stage for the reweighting process. My interest is to decompose retiree's income sufficiency gap in Australia and New Zealand.

$$\Delta v = v_{AUS} - v_{NZ} = v(F_Y^{AUS}) - v(F_Y^{NZ}) \quad (12)$$

$$\Delta v = v\left(\int F_{Y|X}^{AUS}(Y|X)d F_X^{AUS}(X)\right) - v\left(\int F_{Y|X}^{NZ}(Y|X)d F_X^{NZ}(X)\right) \quad (13)$$

To further decompose for both composition (explained) and coefficient (unexplained) effects, a counterfactual statistics v_c is defined as:

$$v_c = v\left(\int F_{Y|X}^{NZ}(Y|X)d F_X^{AUS}(X)\right)$$

$$v_1 = E(RIF(y_i; v(F_Y^{AUS}))) = \overline{X^{AUS}}' \widehat{\beta}^{AUS}$$

$$v_0 = E(RIF(y_i; v(F_Y^{NZ}))) = \overline{X^{NZ}}' \widehat{\beta}^{NZ}$$

$$v_c = \overline{X^{AUS}}' \widehat{\beta}^{NZ}$$

To identify the counterfactual distribution for $v_c = v\left(\int F_{Y|X}^{NZ}(Y|X)d F_X^{AUS}(X)\right)$ based on observed data, this reweighting method was proposed (DiNardo, Fortin, & Lemieux, 1996) to deal with the possible incorrect identification issues (Barsky, Bound, Charles, & Lupton, 2002).

As the distribution of the outcomes and characteristics of the counterfactual distribution $F_{Y|X}^C$ cannot be observed directly, a factor $\omega(X)$ is multiplied by $dF_X^{NZ}(X)$ to represent $dF_X^{AUS}(X)$.

$$F_{Y|X}^C = \int F_{Y|X}^{NZ}(Y|X) dF_X^{AUS}(X) \cong \int F_{Y|X}^{NZ}(Y|X) dF_X^{NZ}(X) \omega(X) \quad (14)$$

According to Bayes rule, the reweighting factor is:

$$\begin{aligned} \omega(X) &= \frac{dF_X^{AUS}(X)}{dF_X^{NZ}(X)} = \frac{dF_{X|T}(X|T = AUS)}{dF_{X|T}(X|T = NZ)} = \frac{dF_{T|X}(T = AUS|X)}{dF_T(T = AUS)} \frac{dF_T(T = NZ)}{dF_{T|X}(T = NZ|X)} \\ &= \frac{1 - P}{P} \frac{P(T = AUS|X)}{1 - P(T = NZ|X)} \quad (15) \end{aligned}$$

where P is the portion of people in Australia and $P(T = AUS|X)$ is the conditional probability of someone with characteristics X as being part of Australia. In this way, $\omega(X)$ is estimated using a probit or logit model to estimate the conditional mean (Rios-Avila, 2020). After the weight is determined, RIF Oaxaca-Blinder can be used in the second stage for further decomposition. This method is used as a robustness check for my main results.

4.5 Results

Blinder Oaxaca is used to decompose the mean outcome differences between groups (Oaxaca & Ransom, 1994, 1999) and my research uses the same method to decompose retiree income sufficiency between Australia and New Zealand (Sierminska & Doorley, 2018). I aim to examine the influence of demographic traits (including age, gender, living area, employment

status, self-rated health, highest education, and partnership status), individual financial positions (including bank savings, homeownership, pension funds, mortgages, other debts, home contents insurance, financial market participation, income, and wealth), and unobserved variables including such things as macroeconomic differences between Australia and New Zealand and factors resulting from differences in the two countries' pension systems on the gap of the mean annuitised net wealth and subjective wellbeing between Australia and New Zealand. I run different regressions with a different group of control variables to analyse the respective influences.

4.5.1 Summary statistics

Table 4.4 provides the summary statistics in Australia and New Zealand. The sample retiree average annuitised net wealth with government pensions and annuitised net wealth without government pensions is A\$52,052 and A\$29,733 in Australia, and NZ\$44,356 and NZ\$16,984 in New Zealand.⁸³ There are 83% of retirees with above-average life satisfaction and 74% with better than average financial situation satisfaction in Australia, and these two ratios are 88% and 71%, respectively, in New Zealand.

⁸³ These numbers are different from those in Table 4.3 as I use logarithm values for my regressions. Therefore, these mean values are logarithm averages and those in Table 4.3 are direct arithmetic mean values. Moreover, I use the Australian and New Zealand dollars for each country as the currency (exchange rate) difference can be shown in the unobserved differences as well.

In Australia, retirees' average age is 74.34 years, and 46% of them are males. The rate for retirees living in major cities reaches 57% of the samples, their average employment status is 1.18 out of 3 (from retired to working full-time), and their self-rated health is 2.94 out of 5 (from poor to excellent). The highest education is 1.68 out of 3, and 62% of retirees have a partner. Almost all retirees have bank account savings for individual financial positions, which is consistent with older people's high degree of risk averseness. The homeownership is 81%, and 9% of them have not paid off their mortgages. More than half of the retirees have pension funds (57%), and 20% of retirees have debts other than mortgages and credit card debt. Moreover, 88% of sample retirees have home contents insurance, and the direct financial market participation rate is 29%. The average regular gross retirement income is A\$43,270 annually, and the average net wealth is A\$850,000.

In the case of New Zealand, retirees' average age is 74 years, with 49% being males. Retirees living in the major cities account for 67% of retirees, with an average score of 1.34 out of 3 for employment status. Their average self-rated health is 3.42 out of 5; the average highest education is 1.75 out of 3, and 62% of them have a partner. Most demographic characteristics are similar to Australia, but New Zealand has a higher male rate, a higher portion of retirees living in the major cities, and a better self-rated health status score. Financially, 98% of retirees have bank accounts, but the homeownership is only 60%, far behind Australia. Among homeowners, 8% of them have not yet paid off their mortgages. Only 19% of the sample retirees have private pension funds, and 39% have debts other than mortgages and credit card debt. Retirees have a low risk tolerance, showing that 85% of the sample retirees have home

contents insurance, and 13% of the retirees participate in the financial market directly. The regular annual gross retirement income is NZ\$38,060, and the individual net wealth is NZ\$560,000.

Table 4.4
Summary Statistics in Australia and New Zealand

This table presents summary statistics of the overall 3,527 Australian and 2,175 New Zealand aging observations, whose age is 65 years and above. Overall_Annuitised_Net_Wealth and Annuitised_Net_Wealth (without government pensions) are the natural log format values. P1 and P99 show the values at 1 and 99 percentiles.

	N	Mean	Std. dev.	P1	P99
Panel A: Australia					
Overall_Annuitised_Net_Wealth	3,521	10.86	1.00	7.26	13.11
Annuitised_Net_Wealth (without government pensions)	3,491	10.30	1.73	3.95	13.12
Overall_Life_Satisfaction	3,351	0.83	0.38	0	1
Financial_Situation_Satisfaction	3,100	0.74	0.44	0	1
Demographic Traits					
Age	3,527	74.34	7.22	65	93
Gender	3,527	0.46	0.50	0	1
Living_Area	3,527	0.57	0.50	0	1
Employment_Status	3,524	1.18	0.51	1	3
Self_Rated_Health	3,084	2.94	0.94	1	5
Highest_Education	3,360	1.68	0.77	1	3
With_Partner	3,359	0.62	0.49	0	1
Individual Financial Positions					
Bank_Accounts	3,359	0.99	0.11	0	1
Homeownership	3,385	0.81	0.39	0	1
Pension_Funds	3,359	0.57	0.50	0	1
Mortgage	3,484	0.09	0.28	0	1
Other_Debts	3,355	0.20	0.40	0	1
Home_Contents_Insurance	3,511	0.88	0.32	0	1
Financial_Market_Participation	3,333	0.29	0.45	0	1
Regular_Gross_Retirement _Income (in 1,000)	3,527	43.27	71.66	0	288
Individual_Net_Wealth (in 1,000,000)	3,527	0.85	1.08	0.002	4.72
Panel B: New Zealand					
Overall_Annuitised_Net_Wealth	2,164	10.70	0.93	7.51	12.95
Annuitised_Net_Wealth (without government pensions)	2,134	9.74	1.82	3.49	12.90
Overall_Life_Satisfaction	1,849	0.88	0.33	0	1
Financial_Situation_Satisfaction	1,849	0.71	0.45	0	1
Demographic Traits					
Age	2,175	74.00	6.84	65	91
Gender	2,175	0.49	0.50	0	1
Living_Area	2,175	0.67	0.47	0	1
Employment_Status	2,167	1.34	0.69	1	3
Self-Rated_Health	2,147	3.42	1.08	1	5
Highest_Education	2,132	1.75	0.76	1	3
With_Partner	2,175	0.62	0.49	0	1
Individual Financial Positions					
Bank_Accounts	2,106	0.98	0.16	0	1
Homeownership	2,175	0.60	0.49	0	1
Pension_Funds	2,175	0.19	0.39	0	1
Mortgage	2,175	0.08	0.27	0	1
Other_Debts	2,175	0.39	0.49	0	1
Home_Contents_Insurance	1,849	0.85	0.35	0	1
Financial_Market_Participation	2,175	0.13	0.34	0	1
Gross_Retirement _Income (in 1,000)	2,175	38.06	35.92	0	227.41
Individual_Net_Wealth (in 1,000,000)	2,175	0.56	0.80	-0.002	5.48

4.5.2 Baseline result: objective income sufficiency results

Table 4.5 shows the decomposition results of the overall annuitised net wealth (with government pensions). Column 1 is the decomposition result of the overall annuitised net wealth with demographic traits, and Column 2 is the decomposition result with individual financial positions. Column 3 is the overall annuitised net wealth decomposition results with personal characteristics and individual financial positions, and the last column is the same as Column 3 with instrumental variables.

Column 1 shows the decomposition results of annuitised net wealth with government pensions between Australia and New Zealand with demographic traits, including age, gender, living area, employment status, self-rated health, highest education, and partnership status. The overall difference is significantly positive, at the 1% level, indicating that the Australian retirees have a relatively 14% higher mean overall annuitised net wealth.⁸⁴ The difference is the direct calculation from the Australian mean overall annuitised net wealth minus New Zealand mean values in my setting. Therefore, the positive value means the Australian sample mean value is higher than the New Zealand average. The -11.8 ppt counterfactual gap in the overall annuitised net wealth is due to the explained reasons shown in these personal characteristics, and it means these explained factors contribute -89%⁸⁵ of the overall annuitised net wealth gap. The mean Australian overall annuitised net wealth is higher, as the gap between the Australian and New Zealand averages is a positive value of 0.133. However, the mean values of demographic

⁸⁴ Overall annuitised net wealth is in log format, therefore, the gap in overall annuitised net wealth equals $\exp(0.133)-1=0.14$.

⁸⁵ $-0.118/0.133=-0.89$, which is the explained part of -0.118 divided by the overall difference of 0.133.

characteristics are better in New Zealand, as the explained part is -0.118, showing that the average value for Australia minus New Zealand is negative. In other words, Australian retirees would have higher annuitised net wealth if faced with the New Zealand retirees' demographic traits, keeping everything else consistent.

More specifically, self-rated health and living area are two major factors that contribute most to New Zealand retirees' overall annuitised net wealth, and the reasons can be explained from the mean values of each variable. Table 4.4 summary statistics show that New Zealand retirees enjoy a higher average self-rated health status of 3.42, and this value in Australia is 2.94. The reasons could be that New Zealand retirees are more optimistic about their health as this value is self-rated ratings and/or they have better health conditions. The living area can be explained in the same way, in that New Zealand retirees live in a higher proportion in the major cities at 67%, while this ratio in Australia is 57%. The major cities are identified by the level of accessibility to services. New Zealand retirees enjoy better average demographic traits, even if they have lower overall annuitised net wealth. New Zealand retirees also benefit better from the highest education gained than Australian retirees, at a 10% statistically significant level. Overall, New Zealand retirees have better demographic traits, mainly shown in health status, living area, and level of education.

Column 2 examines the influence of individual financial positions and decomposes the gap among these individual financial characteristics, including bank accounts, homeownership,

pension funds, mortgage, other debts, home contents insurance, income, wealth, and financial market participation. The results show that the overall annuitised net wealth difference is 7.8 ppt, and the 25.8 ppt counterfactual gap is due to individual financial positions. This indicates Australian average annuitised net wealth with government pensions is 8% ⁸⁶ higher than New Zealand average values. The financial factors contribute to 3.31⁸⁷ times the overall annuitised net wealth difference between the two countries, implying that the average overall annuitised net wealth gap would be wider if only for the individual financial positions. It also shows that Australian retirees have 29% ⁸⁸ higher overall annuitised net wealth compared with New Zealand retirees due to the individual financial positions, keeping all other situations constant.

Furthermore, the detailed decomposition in the explained part in Column 2 shows that homeownership and individual net wealth play a significant role in Australian retirees' retirement savings, and each factor stands for almost half of the overall annuitised net wealth gap. Australia has a higher rate of homeownership at 81%, among my retiree samples, while New Zealand's ratio is 60%, as shown in Table 4.4.⁸⁹ The pension systems between the two countries affect the incentives in this homeownership gap as Australia's means-tested Age Pension allows a generous exemption for the asset test for homeowner retirees, encouraging Australians to buy a principal residence. Moreover, according to the retirement income review

⁸⁶ $\text{Exp}(0.078)-1=0.08$.

⁸⁷ $0.258/0.078=3.31$.

⁸⁸ $\text{Exp}(0.258)-1=0.29$.

⁸⁹ According to the 2018 Census, the homeownership percentages for NZ retirees aged 65 years or above exceed 70%, which is higher than the data I use for this research. HES data shows a lower homeownership among retirees. Even if I follow the Census data, this retiree homeownership ratio is still lower than Australian retirees from HILDA survey.

final report in part 5 in 2021⁹⁰, it shows that financial incentives such as the capital gains tax concession applying to the home purchase decisions and other non-financial factors such as a sense of security, stability and belonging are influential drivers of investment in the principal residence as well.⁹¹ This higher homeownership improves retirees' overall individual assets and, in turn, Australian retirees have a higher level of individual net wealth. Australian retirees also have a better average situation of other debts and financial market participation, while New Zealand retirees are better in terms of pension funds.

Columns 3 and 4 decompose the gap on unobserved variables, as the different economic situations in each country can potentially determine retirees' financial planning behaviour. Both decompositions include all the demographic and individual financial factors. My focus is the unexplained part, whose influence is from the unobserved factors. In Column 3 Table 4.5, the overall difference is 8 ppt, indicating Australian retirees have higher overall annuitised net wealth than the New Zealand average value. The unexplained reason accounts for -22.5 ppt⁹², showing that unobserved influences both within and between each country contribute to -2.8193 times the overall annuitised net wealth difference. This means New Zealand retirees benefit from all those unexplained factors as this negative value is the result of the Australian average minus the New Zealand average. To eliminate the influence of the omitted variables

⁹⁰ https://treasury.gov.au/sites/default/files/2021-02/p2020-100554-ud-05_cohesion.pdf

⁹¹ The financial incentives could be applied to retirees in both countries, and the pension system differences play a key role in the retiree homeownership differences.

⁹² For those unobserved factors, the unexplained part becomes the focus and it is different from the control variables of Columns 1 and 2. The explained parts in Columns 3 and 4 are the combination effects from demographic traits and individual financial positions.

⁹³ $-0.225/0.080=-2.81$.

within each country, I use the instrumental variable to deal with the endogeneity issue and apply 2SLS to address the concern. Following Zhang et al. (2018) and Brown et al. (2008), the instrumental variable is the randomly selected retiree's financial market participation situation within the same regional area to represent this particular retiree's participation. The result in Column 4 shows that the value for the unexplained reason is negative and the value is -22.8 ppt, which means Australian retirees have 20%⁹⁴ less overall annuitised net wealth due to the unobserved reasons, including such things as macroeconomic differences between Australia and New Zealand and factors resulting from differences in two countries' pension systems, as the instrumental variables largely deal with the omitted variable issues within each country. Columns 3 and 4 show that the unobserved variables benefit New Zealand retirees' income sufficiency better.

In detail, the unobserved factors on age and homeownership are two major influences that help Australian retirees save more. As shown in C.3 and C.4 in the Appendix in the separate regressions, the coefficients in age and homeownership are significantly positive, and the influences are stronger in Australia. The different structures of the pension system between the two countries can largely explain the reasons. The factor that influences the overall annuitised net wealth mainly lies in the remaining life expectancy in New Zealand. The older retirees are, the more overall annuitised net wealth they might have with the same level of individual net wealth and short remaining life expectancies. However, this scenario becomes more

⁹⁴ $\text{Exp}(-0.228)-1=0.20$.

complicated in Australia due to the means-tested Age Pension. The older retirees are in Australia, the more assets they have decumulated. As a result, the same individual has a higher chance to qualify for the means-tested Age Pension due to their decreasing assets. In conclusion, the age in New Zealand only works through the remaining life expectancy, while the age can also potentially influence the qualification for the government pension in Australia. The architecture of the government pensions can further explain the influence on the homeownership following the same rationale as well. Homeowners have a higher level of assets under the asset test for the government pension accordingly in Australia, while there is no such test in New Zealand.⁹⁵ Homeownership not only increases an individual's net wealth but also reduces the government pension eligibility in Australia. The unobserved factors influencing living area, self-rated health and pension funds also significantly benefit Australian retirees.

Moreover, the unobserved macroeconomic factors influence the partnership status, bank account savings, gross retirement income and individual net wealth, which further help to improve New Zealand retirees' savings. New Zealand retirees qualify for the government pension regardless of how much they are currently earning and are only subject to the residency test. The extra pension received can help them achieve better retirement income sufficiency. In contrast, the higher income reduces Australian retirees' chances to receive the government pension. Having a partner also helps accumulate more wealth to lower the chance for retirees

⁹⁵ More details are shown in Appendix C.1.

to qualify for the government pension in Australia. As a result, partnership status, gross retirement income, and individual net wealth are hurdles for the government pension qualification in Australia.

Annuitised net wealth without the government pensions is a measurement for pre-retirement savings. Table 4.6 shows the decomposition results in Column 1 with demographic traits, Column 2 with individual financial positions, and Columns 3 and 4 with all the control variables. All the results are mainly consistent with the overall annuitised net wealth. Demographic traits and macroeconomic situations help New Zealand retirees to save, while individual financial positions benefit Australians more. However, it is interesting to note that the negative private pension funds in the overall annuitised net wealth give way to the positive values in the separate individual financial position decompositions. Appendix Table C.4 can help explain this result as the pension funds negatively influence the overall annuitised net wealth while having a positive influence on annuitised net wealth in Australia, showing that private pension funds and the government pension have a trade-off relation.

In conclusion, overall annuitised net wealth and annuitised net wealth without government pensions decomposition results indicate that the retiree income sufficiency gap would be wider if Australia applied similar demographic traits and had a similar macroeconomic situation to

New Zealand.⁹⁶ New Zealand has better average demographic traits and unobserved variables to benefit retirees. In contrast, the Australian better average individual financial positions contribute more to retirees' pre-retirement and post-retirement savings.

Table 4.5

Retiree Overall Annuitised Net Wealth Decomposition in Australia and New Zealand

This table presents the decomposition result over the mean value of overall annuitised net wealth and there are three groups of variables with four regressions. The first result only decomposes the overall annuitised net wealth shown in log format values over demographic traits including Age, which is the age of retirees; Gender, which equals to one if the retiree is a male, and zero otherwise; Living_Area, which equals to one if the retiree lives in a major city, and zero otherwise. Employment_Status, which equals to one if the retirees do not work, two if the retirees work part-time and three if they work full-time; Self_Rated_Health, which is the retirees' self-perception of health conditions, ranging from one to five, from poor to excellent; Highest_Education, which is the highest education level achieved by the retiree that equals one if it is 12 years or less, two if the retiree has a certificate or diploma, and three if the retiree has a university degree; With_Partner, which is a dummy variable that equals one if the retiree is living with a partner, and zero otherwise. The second result decomposes the overall annuitised net wealth difference over individual financial positions including Bank_Accounts, which is a dummy variable that equals to one if the retirees have savings in bank accounts, and zero otherwise; Homeownership which equals to one if the retirees have a principal residence and zero otherwise; Pension_Funds which is a dummy variable if the retirees have pension funds and zero otherwise; Mortgages which is a dummy variable if the retirees have mortgages left and zero otherwise; Home_Contents_Insurance which is a dummy variable if the retirees have contents insurance and zero otherwise; Financial_Market_Participation which is a dummy variable if the retirees have income or dividends from stock, funds and trusts; Gross_Retirement_Income which is the retiree's annual average before-tax retirement income, in thousands of dollars; and Individual_Net_Wealth is the individual retiree's net wealth, in millions of dollars, which is overall assets minus debts. The third results include all the variables in the first and second results and the last result using an instrumental variable for Financial_Market_Participation. The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

⁹⁶ The detailed factors of the macroeconomic situations are out of the scope of this research, as Oaxaca decomposition would only decompose the influence of those control variables. There is no variation for those macroeconomic factors within each country, so they cannot be included in the regressions within each country. However, the samples are retirees and the differences in the pension systems are the most important factors.

Table 4.5 Continued

Overall Annuitised Net Wealth				
	Demographic Traits	Individual Financial Positions	Overall Factors	Overall Factors with Instrumental Variable
Difference	0.133*** (4.98)	0.078** (2.86)	0.080** (2.89)	0.080** (2.89)
Explained	-0.118*** (-7.53)	0.258*** (10.98)	0.305*** (11.23)	0.308*** (11.32)
Unexplained	0.250*** (9.27)	-0.180*** (-6.42)	-0.225*** (-7.91)	-0.228*** (-8.02)
Explained				
Age	-0.0001 (-0.02)		-0.024* (-2.39)	-0.024* (-2.39)
Gender	-0.002 (-1.56)		-0.001 (-0.63)	-0.001 (-0.63)
Living_Area	-0.025*** (-5.37)		-0.010*** (-3.93)	-0.010*** (-3.92)
Employment_Status	-0.006 (-1.00)		0.007* (2.29)	0.007* (2.28)
Self_Rated_Health	-0.072*** (-7.15)		-0.020** (-3.16)	-0.020** (-3.13)
Highest_Education	-0.012* (-2.29)		-0.002 (-1.72)	-0.002 (-1.71)
With_Partner	-0.0002 (-0.31)		-0.005 (-1.78)	-0.005 (-1.78)
Bank_Accounts		-0.001 (-1.18)	-0.001 (-1.60)	-0.0001 (-1.59)
Homeownership		0.127*** (9.56)	0.143*** (10.40)	0.142*** (10.39)
Pension_Funds		-0.037*** (-3.60)	0.068*** (6.62)	0.067*** (6.55)
Mortgage		-0.003 (-1.76)	-0.002 (-1.66)	-0.002 (-1.65)
Other_Debts		0.025*** (3.92)	0.009 (1.60)	0.009 (1.52)
Home_Contents_Insurance		0.003 (1.60)	0.008* (2.31)	0.008* (2.31)
Gross_Retirement_Income		-0.002* (-2.10)	-0.001 (-0.76)	-0.001 (-0.81)
Individual_Net_Wealth		0.125*** (8.25)	0.120*** (8.30)	0.119*** (8.29)
Financial_Market_Participation		0.022*** (5.32)	0.016*** (4.51)	0.021*** (4.09)
Unexplained				
Age	0.138 (0.42)		0.938*** (3.25)	0.935*** (3.24)
Gender	-0.001 (-0.04)		0.018 (1.03)	0.018 (1.03)
Living_Area	0.159*** (4.87)		0.074*** (3.47)	0.074*** (3.47)
Employment_Status	-0.046 (-0.70)		-0.030 (-0.66)	-0.034 (-0.74)
Self_Rated_Health	0.163 (1.74)		0.167* (2.31)	0.166* (2.31)
Highest_Education	0.001 (0.01)		0.023 (0.56)	0.025 (0.62)

Table 4.5 Continued

Overall Annuitised Net Wealth				
	Demographic Traits	Individual Financial Positions	Overall Factors	Overall Factors with Instrumental Variable
With_Partner	-0.025 (-0.72)		-0.051* (-2.05)	-0.051* (-2.04)
Bank_Accounts		-0.352* (-2.22)	-0.348* (-2.34)	-0.348* (-2.35)
Homeownership		0.252*** (6.57)	0.298*** (8.27)	0.296*** (8.21)
Pension_Funds		-0.004 (-0.62)	0.019** (3.03)	0.019** (3.00)
Mortgage		0.003 (0.85)	0.005 (1.45)	0.005 (1.49)
Other_Debts		-0.013 (-0.72)	-0.015 (-0.82)	-0.013 (-0.73)
Home_Contents_Insurance		-0.253*** (-3.09)	-0.160 (-1.91)	-0.159 (-1.90)
Gross_Retirement_Income		-0.048** (-2.75)	-0.085*** (-4.15)	-0.082*** (-4.03)
Individual_Net_Wealth		-0.063*** (-3.08)	-0.090*** (-4.55)	-0.090*** (-4.55)
Financial_Market_Participation		0.001 (0.10)	0.001 (0.12)	-0.001 (-0.25)
Constant	-0.139 (-0.37)	0.297 (1.61)	-0.988*** (-2.78)	-0.987*** (-2.79)
Obs of Australia	3,078	3,191	2,958	2,958
Obs of NZ	2,115	1,788	1,768	1,768

**Table 4.6
Retiree Annuitised Net Wealth (without Government Pensions) Decomposition
in Australia and New Zealand**

This table presents the decomposition result over the mean value of annuitised net wealth and there are three groups of variables with four regressions. The first result only decomposes the annuitised net wealth shown in log format values over demographic traits including Age, which is the age of retirees; Gender, which equals to one if the retiree is a male, and zero otherwise; Living_Area, which equals to one if the retiree lives in a major city, and zero otherwise. Employment_Status, which equals to one if the retirees do not work, two if the retirees work part-time, and three if they work full-time; Self_Rated_Health, which is the retirees' self-perception of health conditions, ranging from one to five, from poor to excellent; Highest_Education, which is the highest education level achieved by the retiree that equals one if it is 12 years or less, two if the retiree has a certificate or diploma, and three if the retiree has a university degree; With_Partner, which is a dummy variable that equals one if the retiree is living with a partner, and zero otherwise. The second result decomposes the annuitised net wealth difference over individual financial positions including Bank_Accounts, which is a dummy variable that equals to one if the retirees have savings in bank accounts, and zero otherwise; Homeownership which equals to one if the retirees have a principal residence and zero otherwise; Pension_Funds which is a dummy variable if the retirees have pension funds and zero otherwise; Mortgages which is a dummy variable if the retirees have mortgages left and zero otherwise; Home_Contents_Insurance which is a dummy variable if the retirees have contents insurance and zero otherwise; Financial_Market_Participation which is a dummy variable if the retirees have income or dividends from stock, funds and trusts; Gross_Retirement_Income which is the retiree's annual before-tax retirement income, in thousands of dollars; and Individual_Net_Wealth is the individual retiree's net wealth, in millions of dollars, which is overall assets minus debts. The third results include all the variables in the first and second results, and the last result using an instrumental variable for Financial_Market_Participation. The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4.6 Continued

Annuitised Net Wealth without Government Pensions				
	Demographic Traits	Individual Financial Positions	Overall Factors	Overall Factors with Instrumental Variable
Difference	0.509*** (10.08)	0.349*** (6.87)	0.364** (7.10)	0.364*** (7.75)
Explained	-0.242*** (-9.29)	0.772*** (16.76)	0.790*** (15.48)	0.797*** (15.59)
Unexplained	0.751*** (15.63)	-0.423*** (-8.73)	-0.427*** (-8.91)	-0.434*** (-9.04)
Explained				
Age	-0.003 (-0.25)		-0.037* (-2.57)	-0.037* (-2.57)
Gender	-0.001 (-0.39)		-0.001 (-0.54)	-0.001 (-0.54)
Living_Area	-0.039*** (-4.84)		-0.017*** (-4.11)	-0.017*** (-4.09)
Employment_Status	-0.043*** (-4.82)		-0.015*** (-3.37)	-0.015*** (-3.40)
Self_Rated_Health	-0.145*** (-7.80)		-0.045*** (-4.47)	-0.044*** (-4.40)
Highest_Education	-0.021* (-2.14)		-0.005 (-1.89)	-0.005 (-1.89)
With_Partner	0.008 (1.23)		-0.004 (-1.65)	-0.004 (-1.66)
Bank_Accounts		0.001 (0.20)	0.001 (0.32)	0.001 (0.34)
Homeownership		0.402*** (11.83)	0.435*** (12.40)	0.433*** (12.41)
Pension_Funds		0.111*** (7.03)	0.247*** (13.82)	0.244*** (13.73)
Mortgage		-0.004 (-1.94)	-0.003 (-1.83)	-0.003 (-1.82)
Other_Debts		0.046*** (4.89)	0.028*** (3.32)	0.026*** (3.14)
Home_Contents_Insurance		0.017* (2.48)	0.029*** (3.45)	0.029*** (3.46)
Gross_Retirement_Income		-0.001 (-1.05)	-0.001 (-0.80)	-0.001 (-0.88)
Individual_Net_Wealth		0.156*** (8.03)	0.144*** (8.05)	0.141*** (8.03)
Financial_Market_Participation		0.045*** (6.70)	0.035*** (5.80)	0.049*** (5.68)
Unexplained				
Age	-1.552** (-2.68)		0.485 (1.16)	0.458 (1.10)
Gender	0.009 (0.18)		0.039 (1.33)	0.038 (1.33)
Living_Area	0.332*** (5.30)		0.117*** (2.94)	0.116*** (2.94)
Employment_Status	0.046 (0.49)		0.126 (1.78)	0.126 (1.77)
Self_Rated_Health	0.089 (0.52)		0.037 (0.34)	0.031 (0.29)
Highest_Education	-0.234* (-2.23)		-0.070 (-1.05)	-0.071 (-1.08)

Table 4.6 Continued

Annuitised Net Wealth without Government Pensions				
	Demographic Traits	Individual Financial Positions	Overall Factors	Overall Factors with Instrumental Variable
With_Partner	-0.089 (-1.30)		-0.185*** (-4.58)	-0.187*** (-4.60)
Bank_Accounts		-0.869* (-2.18)	-0.883* (-2.31)	-0.879* (-2.30)
Homeownership		0.744*** (10.09)	0.814*** (11.34)	0.808*** (11.34)
Pension_Funds		0.036** (3.06)	0.066*** (5.75)	0.065*** (5.68)
Mortgage		0.015* (2.29)	0.010 (1.59)	0.010 (1.69)
Other_Debts		-0.077** (-2.90)	-0.073*** (-2.90)	-0.069*** (-2.75)
Home_Contents_Insurance		-0.774*** (-5.55)	-0.465*** (-3.43)	-0.466*** (-3.45)
Gross_Retirement_Income		-0.018 (-0.58)	-0.052 (-1.39)	-0.051 (-1.37)
Individual_Net_Wealth		-0.230*** (-5.92)	-0.266*** (-6.88)	-0.272*** (-6.97)
Financial_Market_Participation		-0.002 (-0.17)	0.003 (0.38)	0.013 (0.89)
Constant	2.151*** (3.13)	0.753 (1.69)	-0.129 (-0.21)	-0.105 (-0.17)
Obs of Australia	3,052	3,161	2,932	2,932
Obs of NZ	2,091	1,771	1,752	1,752

4.5.3 Baseline result: subjective wellbeing results

Subjective wellbeing is another strand of retiree income sufficiency literature that focuses on retirees' self-rated happiness (Bonsang & Klein, 2012; Tibesigwa, Visser, & Hodkinson, 2016), and there are two aspects of subjective wellbeing: financial situation satisfaction, and life satisfaction. For financial situation satisfaction, those retirees who have more than enough income for their daily life spending are considered as 1, and those retirees with just enough or not enough income for daily costs are considered as 0. If retirees consider everything in life, those can just get along or are in a worse situation assigned as 0, and those can do better than average assigned as 1. In this way, both subjective wellbeing measurements are dummy

variables. On the one hand, I follow Bond and Lang (2019)'s no specific benchmark concern for subjective wellbeing comparable issue. On the other hand, non-linear Oaxaca-Blinder decomposition is used to deal with binary dependent variables.

I carry out the same procedure as for the objective measurement decompositions using non-linear regressions shown in section 4.4.2. Table 4.7 shows the financial situation satisfaction decomposition result, and Table 4.8 decomposes the life satisfaction with demographic traits in Column 1, individual financial positions in Column 2, and all the factors in Columns 3 and 4 in both tables. The financial situation satisfaction results in the first row of Table 4.7 show that Australia and New Zealand do not significantly differ in the satisfaction of how their income can meet their daily costs, even if the gap in objective annuitised net wealth is significant. However, demographic traits in Column 1, personal financial positions in Column 2, and unobserved variables in Columns 3 and 4 are statistically significant. The results are mainly consistent with the objective decomposition results that better demographic traits (mainly from self-rated health) and unobserved variables help New Zealand retirees improve their financial situation satisfaction, while individual financial positions (pension funds, other debts, and individual net wealth) benefit Australian retirees.

Table 4.8 shows the decomposition results of life satisfaction. Interestingly, New Zealand retirees have a significantly higher mean value of life satisfaction in Table 4.8. The first row shows that the Australian retiree average life satisfaction scores minus New Zealand average

life satisfaction is negative, and this is statistically significant at 1% level, which means New Zealand retirees have better life satisfaction on average. Demographic traits explain 61%⁹⁷ of the overall life satisfaction difference between Australian and New Zealand retirees in Column 1, and individual financial positions contribute to 1.21⁹⁸ times the overall difference for Australia in Column 2. In Columns 3 and 4, unobserved reasons help New Zealand retirees improve their life satisfaction, and the influence is almost twice the overall difference.

In conclusion, retirees do not show a significant difference in financial satisfaction in the two countries, but New Zealand retirees have relatively higher life satisfaction on average. Australian retirees gain more subjective wellbeing satisfaction from individual financial positions, and the demographic traits and unobserved variables benefit New Zealand retirees more. Furthermore, the unobserved variables raise New Zealand retirees' life satisfaction higher than Australian retirees.

⁹⁷ $-0.028/(-0.046)=0.61$.

⁹⁸ $0.070/(-0.058)= -1.21$. The negative sign means New Zealand has higher overall average life satisfaction. However, I use the positive value when I explain the contribution from Australia.

Table 4.7

Retiree Financial Situation Satisfaction Decomposition in Australia and New Zealand

This table presents the decomposition result over the mean value of financial situation satisfaction and there are three groups of variables with four regressions. The first result only decomposes the financial situation satisfaction over demographic traits including Age, which is the age of retirees; Gender, which equals to one if the retiree is a male, and zero otherwise; Living_Area, which equals to one if the retiree lives in a major city, and zero otherwise. Employment_Status, which equals to one if the retirees do not work, two if the retirees work part-time, and three if they work full-time; Self_Rated_Health, which is the retirees' self-perception of health conditions, ranging from one to five, from poor to excellent; Highest_Education, which is the highest education level achieved by the retiree that equals one if it is 12 years or less, two if the retiree has a certificate or diploma, and three if the retiree has a university degree; With_Partner, which is a dummy variable that equals one if the retiree is living with a partner, and zero otherwise. The second result decomposes the overall annuitised net wealth difference over personal financial positions including Bank_Accounts, which is a dummy variable that equals to one if the retirees have savings in bank accounts, and zero otherwise; Homeownership which equals to one if the retirees have a principal residence and zero otherwise; Pension_Funds which is a dummy variable if the retirees have pension funds and zero otherwise; Mortgages which is a dummy variable if the retirees have mortgages left and zero otherwise; Home_Contents_Insurance which is a dummy variable if the retirees have contents insurance and zero otherwise; Financial_Market_Participation which is a dummy variable if the retirees have income or dividends from stock, funds and trusts; Gross_Retirement_Income which is the retiree's regular weekly average before-tax retirement income, in thousands of dollars; and Individual_Net_Wealth is the individual retiree's net wealth, in millions of dollars, which is overall assets minus debts. The third results include all the variables in first and second results, and the last result using an instrumental variable for Financial_Market_Participation. The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Financial Situation Satisfaction				
	Demographic Traits	Financial Positions	Overall Factors	Overall Factors with IV
Difference	0.024 (1.81)	0.022 (1.54)	0.018 (1.26)	0.017 (1.17)
Explained	-0.046*** (-8.74)	0.109*** (9.82)	0.066*** (5.12)	0.069*** (5.23)
Unexplained	0.070*** (5.56)	-0.087*** (-5.66)	-0.048** (-3.03)	-0.052** (-3.18)
Explained				
Age	-0.003 (-1.83)		-0.027* (-2.28)	-0.003* (-2.27)
Gender	0.0002 (0.72)		0.0002 (0.67)	0.0002 (0.67)
Living_Area	0.0002 (0.19)		0.003** (2.67)	0.003** (2.69)
Employment_Status	-0.001 (-10.26)		0.003 (1.90)	0.003 (1.84)
Self_Rated_Health	-0.043*** (-10.26)		-0.024*** (-7.76)	-0.023*** (-7.68)
Highest_Education	-0.003* (-2.16)		-0.0004 (-0.95)	-0.0004 (-0.91)
With_Partner	0.003 (1.71)		0.002 (1.67)	0.002 (1.67)
Bank_Accounts		0.001 (1.31)	0.0004 (0.98)	0.0004 (1.01)
Homeownership		0.008* (2.05)	0.001 (0.16)	0.0001 (0.02)
Pension_Funds		0.020** (3.13)	0.017** (2.71)	0.016** (2.60)

Table 4.7 *Continued*

Financial Situation Satisfaction				
	Demographic Traits	Financial Positions	Overall Factors	Overall Factors with IV
Mortgage		-0.001 (-1.43)	-0.001 (-1.46)	-0.001 (-1.15)
Other_Debts		0.025*** (6.79)	0.019*** (5.68)	0.019*** (5.65)
Home_Contents_Insurance		0.004** (2.90)	0.002* (2.08)	0.002* (2.06)
Gross_Retirement_Income		0.009** (3.01)	0.009** (2.92)	0.009** (2.90)
Individual_Net_Wealth		0.036*** (2.90)	0.033*** (5.06)	0.032*** (5.00)
Financial_Market_Participation		0.009** (2.94)	0.005 (1.89)	0.009* (2.51)
Unexplained				
Age	-0.135 (-1.02)		0.041 (0.19)	0.027 (0.13)
Gender	-0.004 (-0.41)		-0.002 (-0.13)	-0.002 (-0.14)
Living_Area	-0.0112 (-0.75)		-0.043 (-1.50)	-0.043 (-1.56)
Employment_Status	-0.088** (-3.01)		-0.157 (-1.95)	-0.152* (-2.03)
Self_Rated_Health	0.118*** (3.30)		0.175 (1.95)	0.167* (2.01)
Highest_Education	-0.002 (-0.08)		-0.042 (-0.91)	-0.041 (-0.91)
With_Partner	0.020 (1.43)		0.037 (1.27)	0.036 (1.28)
Bank_Accounts		-0.015 (-0.16)	-0.022 (-0.18)	-0.018 (-0.15)
Homeownership		0.010 (0.46)	-0.016 (-0.53)	-0.020 (-0.64)
Pension_Funds		0.011 (1.72)	0.012 (1.38)	0.011 (1.32)
Mortgage		0.002 (0.54)	0.004 (0.86)	0.004 (0.94)
Other_Debts		-0.045*** (-3.35)	-0.050* (-2.13)	-0.046* (-2.18)
Home_Contents_Insurance		-0.024 (-0.70)	-0.022 (-0.47)	-0.022 (-0.48)
Gross_Retirement_Income		-0.014 (-0.45)	0.034 (0.57)	0.033 (0.58)
Individual_Net_Wealth		-0.005 (-0.19)	0.015 (0.39)	0.012 (0.32)
Financial_Market_Participation		-0.001 (-0.07)	-0.001 (-0.16)	0.003 (0.26)
Constant	0.173 (1.11)	-0.007 (-0.07)	-0.011 (-0.04)	-0.0002 (-0.00)
Obs of Australia	3,048	2,982	2,933	2,933
Obs of NZ	1,827	1,789	1,769	1,769

Table 4.8

Retiree Life Satisfaction Decomposition in Australia and New Zealand

This table presents the decomposition result over the mean value of life satisfaction and there are three groups of variables with four regressions. The first result only decomposes the life satisfaction over demographic traits including Age, which is the age of retirees; Gender, which equals to one if the retiree is a male, and zero otherwise; Living_Area, which equals to one if the retiree lives in a major city, and zero otherwise. Employment_Status, which equals to one if the retirees do not work, two if the retirees work part-time, and three if they work full-time; Self_Rated_Health, which is the retirees' self-perception of health conditions, ranging from one to five, from poor to excellent; Highest_Education, which is the highest education level achieved by the retiree at the time of the interview that equals one if it is 12 years or less, two if the retiree has a certificate or diploma, and three if the retiree has a university degree; With_Partner, which is a dummy variable that equals one if the retiree is living with a partner, and zero otherwise. The second result decomposes the life satisfaction difference over personal financial positions including Bank_Accounts, which is a dummy variable that equals to one if the retirees have savings in bank accounts, and zero otherwise; Homeownership which equals to one if the retirees have a principal residence and zero otherwise; Pension_Funds which is a dummy variable if the retirees have pension funds and zero otherwise; Mortgages which is a dummy variable if the retirees have mortgages left and zero otherwise; Home_Contents_Insurance which is a dummy variable if the retirees have contents insurance and zero otherwise; Financial_Market_Participation which is a dummy variable if the retirees have income or dividends from stock, funds and trusts; Gross_Retirement_Income which is the retiree's regular weekly average before-tax retirement income, in thousands of dollars; and Individual_Net_Wealth is the individual retiree's net wealth, in millions of dollars, which is overall assets minus debts. The third results include all the variables in first and second results and the last result using an instrumental variable for Financial_Market_Participation. The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Life Satisfaction				
	Demographic Traits	Financial Positions	Overall Factors	Overall Factors with IV
Difference	-0.046*** (-4.50)	-0.058*** (-5.65)	-0.052*** (-5.00)	-0.052*** (-5.04)
Explained	-0.028*** (-7.07)	0.070*** (8.35)	0.046*** (4.59)	0.048*** (4.73)
Unexplained	-0.018 (-1.83)	-0.128*** (-9.45)	-0.097*** (-6.90)	-0.100*** (-6.97)
Explained				
Age	-0.002 (-1.73)		-0.002* (-2.18)	-0.002* (-2.16)
Gender	0.0001 (0.60)		0.0001 (0.53)	0.0001 (0.54)
Living_Area	0.001 (1.26)		0.003* (2.10)	0.003* (2.12)
Employment_Status	-0.0003 (-0.19)		0.002 (1.24)	0.002 (1.20)
Self_Rated_Health	-0.028*** (-8.48)		-0.020*** (-6.11)	-0.020*** (-6.06)
Highest_Education	-0.001 (-1.44)		0.0003 (0.77)	0.0004 (0.82)
With_Partner	0.002 (1.75)		0.001 (1.63)	0.001 (1.63)
Bank_Accounts		0.001 (1.62)	0.001 (1.36)	0.001 (1.37)
Homeownership		0.007* (2.06)	0.002 (0.63)	0.002 (0.50)
Pension_Funds		0.019** (2.98)	0.020** (2.87)	0.019** (2.78)

Table 4.8 *Continued*

Life Satisfaction				
	Demographic Traits	Financial Positions	Overall Factors	Overall Factors with IV
Mortgage		-0.001 (-1.59)	-0.001 (-1.52)	-0.001 (-1.51)
Other_Debts		0.021*** (6.23)	0.018*** (5.46)	0.018*** (5.39)
Home_Contents_Insurance		0.002* (2.30)	0.003* (2.53)	0.003* (2.53)
Gross_Retirement_Income		0.004* (2.46)	0.005* (2.51)	0.005* (2.48)
Individual_Net_Wealth		0.012** (2.60)	0.011* (2.30)	0.011* (2.13)
Financial_Market_Participation		0.004 (1.57)	0.002 (0.91)	0.006 (1.66)
Unexplained				
Age	0.029 (0.33)		0.120 (0.81)	0.106 (0.72)
Gender	0.002 (0.23)		0.0003 (0.03)	-0.000004 (-0.00)
Living_Area	0.005 (0.47)		0.005 (0.26)	0.005 (0.26)
Employment_Status	-0.072*** (-3.38)		-0.181*** (-5.16)	-0.178*** (-5.06)
Self_Rated_Health	0.005 (0.17)		-0.030 (-0.70)	-0.033 (-0.77)
Highest_Education	0.030 (1.62)		0.004 (0.12)	0.001 (0.03)
With_Partner	-0.002 (-0.26)		-0.011 (-0.72)	-0.012 (-0.78)
Bank_Accounts		0.096 (1.06)	0.126 (1.43)	0.126 (1.43)
Homeownership		0.007 (0.35)	-0.003 (-0.17)	-0.004 (-0.23)
Pension_Funds		0.014* (2.19)	0.016** (2.64)	0.015* (2.56)
Mortgage		-0.0004 (-0.12)	0.002 (0.64)	0.002 (0.74)
Other_Debts		-0.045*** (-3.84)	-0.034** (-3.07)	-0.034** (-3.05)
Home_Contents_Insurance		0.004 (0.11)	0.040 (1.31)	0.039 (1.26)
Gross_Retirement_Income		0.023 (1.10)	0.067** (3.15)	0.065** (3.05)
Individual_Net_Wealth		0.029 (1.65)	0.019 (1.09)	0.016 (0.88)
Financial_Market_Participation		0.004 (0.65)	0.001 (0.28)	0.008 (1.24)
Constant	-0.133 (-0.13)	-0.257** (-2.67)	-0.238 (-1.25)	-0.221 (-1.17)
Obs of Australia	3,081	3,192	2,961	2,961
Obs of NZ	1,827	1,789	1,769	1,769

4.6 Further analysis

4.6.1 Alternative annuitised net wealth measurements

I use two benchmarks to show the relative retiree income sufficiency to examine the level of post-retirement life that can be maintained. Table 4.9 shows the two annuitised net wealth measurements compared with the national poverty lines, and Table 4.10 illustrates the regional median incomes comparison results.

Table 4.9 Panel A is the decomposition result of the ratio of annuitised net wealth with government pensions to the national poverty line, and Panel B is the result of the ratio of annuitised net wealth without government pensions to the national poverty line. The results show that there is no statistically significant difference between New Zealand and Australia on both annuitised net wealth compared with the national poverty lines with different personal characteristics in general. The demographic traits, individual financial positions, and unobserved variables also contribute in the same manner as for the main results. New Zealand has better demographic traits and unobserved variables, while Australian retirees have better individual financial positions on average. These results imply that Australian and New Zealand retirees have similar income sufficiency coverage for the national poverty lines on average.

I also apply the regional median incomes, with more variations, as the benchmark to carry out the same decompositions. These median regional incomes provide us with an optional benchmark, and the ratios can also be a proxy for the retiree replacement ratio, which shows

the level of pre-retirement income that the retirement income can cover. Table 4.10 shows the decomposition results of the ratios of annuitised net wealth to the regional median incomes, and Panels A and B show the decomposition results of the annuitised net wealth with and without government pensions, respectively. Panel A shows that Australian and New Zealand retirees do not have a statistically significant difference in their overall annuitised net wealth compared with the regional median incomes; however, the different individual characteristics show the same significant results as the main results. Panel B shows a significantly higher average annuitised net wealth without government pensions to the regional median incomes in Australia than in New Zealand, at a 1% statistically significant level. The explained and unexplained parts are consistent with the main results that New Zealand retirees have better demographic traits and unobserved variables, while Australian retirees have better individual financial positions. In conclusion, Australian and New Zealand retirees can maintain similar levels of post-retirement lifestyle with their post-retirement wealth, shown in overall annuitised net wealth (with government pensions). Furthermore, Australian retirees maintain a better level of retirement life compared with New Zealand retirees if they exclude the government pensions from their annuitised net wealth, showing a higher level of pre-retirement savings among Australian retirees.

Table 4.9
Retiree Relative Income Sufficiency Decomposition in Australia and New Zealand
(Compared with the National Poverty Line)

This table presents the relative retiree income sufficiency decomposition results and the (overall) annuitised net wealth is compared with their national poverty line. I only present the overall decomposition results, and I control all the variables as those in the main result. Panel A reports the results of the overall annuitised net wealth compared with the national poverty line and Panel B reports the results of the annuitised net wealth without the government pensions compared with the national poverty line.

Relative Retiree Income Sufficiency (benchmark: the national poverty line)				
	Demographic Traits	Individual Financial Positions	Overall Factors	Overall Factors with IV
Panel A: Overall Annuitised Net Wealth				
Difference	-0.086 (-0.61)	-0.193 (-1.28)	-0.208 (-1.36)	-0.208 (-1.35)
Explained	-0.371*** (-6.45)	0.303*** (3.30)	0.653*** (6.56)	0.655*** (6.57)
Unexplained	0.285 (1.92)	-0.496*** (-4.30)	-0.861*** (-7.85)	-0.863*** (-7.85)
Obs of Australia	3,083	3,196	2,963	2,963
Obs of NZ	2,124	1,792	1,772	1,772
Panel B: Annuitised Net Wealth without Government Pensions				
Difference	0.353* (2.50)	0.254 (1.67)	0.249 (1.61)	0.249 (1.61)
Explained	-0.429*** (-7.33)	0.463*** (4.87)	0.748*** (7.33)	0.755*** (7.39)
Unexplained	0.782*** (5.23)	-0.209 (-1.83)	-0.499*** (-4.59)	-0.506*** (-4.64)
Obs of Australia	3,083	3,196	2,963	2,963
Obs of NZ	2,124	1,792	1,772	1,772

Table 4.10
Retiree Relative Income Sufficiency Decomposition in Australia and New Zealand
(Compared with the Regional Median Incomes)

This table presents the relative retiree income sufficiency decomposition results and the (overall) annuitised net wealth compared with the regional median incomes. I only present the overall decomposition results, and I control all the variables as for those in the main result. Panel A reports the results of the overall annuitised net wealth compared with the regional median incomes and Panel B reports the results of the annuitised net wealth without the government pensions compared with the regional median incomes.

Relative Retiree Income Sufficiency (benchmark: the regional median incomes)				
	Demographic Traits	Individual Financial Positions	Overall Factors	Overall Factors with IV
Panel A: Overall Annuitised Net Wealth Comparison				
Difference	0.119 (1.86)	0.064 (0.91)	0.058 (0.81)	0.058 (0.81)
Explained	-0.171*** (-6.30)	0.148*** (3.39)	0.322*** (6.79)	0.322*** (6.79)
Unexplained	0.290*** (4.25)	-0.084 (-1.52)	-0.264*** (-5.05)	-0.265*** (-5.04)
Obs of Australia	3,083	3,192	2,963	2,963
Obs of NZ	2,124	1,792	1,772	1,772
Panel B: Annuitised Net Wealth without Government Pensions Comparison				
Difference	0.283*** (4.38)	0.233*** (3.31)	0.232*** (3.23)	0.232*** (3.23)
Explained	-0.199*** (-7.22)	0.224*** (4.97)	0.367*** (7.54)	0.370*** (7.59)
Unexplained	0.482*** (6.98)	0.009 (0.17)	-0.135** (-2.60)	-0.138** (-2.65)
Obs of Australia	3,083	3,196	2,963	2,963
Obs of NZ	2,124	1,792	1,772	1,772

4.6.2 Alternative distributional decomposition methods

In Australia, only retirees in the lower financial situation can receive the government pension, so retirees in different quantiles of the wealth level may show different comparison results between both countries. Table 4.11 shows the decomposition results of those retirees in the bottom 10% of the wealth level, and Table 4.12 illustrates the results of the top 10% between

both countries. Following Firpo et al. (2009), the unconditional quantile regression is used to estimate the impact of the change in the distribution of the independent variables on the marginal quantiles or other functions of the dependent variable, applying recentred influence function (RIF). The influence function shows the influence of an individual observation on distributional statistics. Tables 4.11 and 4.12 show that the income sufficiency gap between Australia and New Zealand and the influences from demographic traits, individual financial positions, and unobserved variables are consistent with the main results.⁹⁹

Table 4.11 Panel A shows that the bottom 10% wealth group retirees in both countries do not have any significant difference in their overall annuitised net wealth; however, Panel B shows Australian retirees enjoy a higher annuitised net wealth without government pensions than New Zealand retirees at the 1% significance level. The results indicate that Australian and New Zealand retirees have similar post-retirement savings, while Australian retirees have significantly higher pre-retirement savings in the bottom 10% wealth group.

Table 4.12 shows the decomposition results for the top 10% wealth group retirees, and Panels A and B demonstrate that retirees in Australia have significantly higher annuitised net wealth than New Zealand retirees. These results indicate that wealthy Australian retirees have higher income sufficiency than New Zealand wealthy retirees in pre-retirement and post-retirement

⁹⁹ RIF cannot deal with 2SLS regressions. Therefore, for the last overall factors, the unobserved factors both refer to the omitted factors within each country and between countries. However, the main results in Tables 4.5 and 4.6 show that the influences from the omitted variables within each country (difference between Columns 3 and 4) are limited.

savings. Demographic traits, individual financial positions, and unobserved variables maintain the same influence as in the main results. Consistently, demographic traits and unobserved variables benefit New Zealand retirees more, while individual financial positions help Australians better for retirees in the bottom 10% and top 10% wealth levels.

I also use a two-stage method to decompose the differences between the retirees in both countries (Firpo, Fortin, & Lemieux, 2018) to check my main findings, as discussed in section 4.4.3. In the first stage, distributional changes are divided into a wage structure effect and a composition effect using a reweighting method. For the second stage, these components are decomposed into each respective covariate using RIF regression. This method allows a much more flexible wage-setting model and extends the decomposition to any distributional measure beyond the mean value. I apply this method to reweight the factors to estimate my model in Table 4.13. All the results are consistent with the main results. Australian retirees have a better annuitised net wealth in Panel A and Panel B, and they benefit more from the individual financial positions. In contrast, New Zealand retirees have positive influences from both demographic characteristics and unobserved variables. These results confirm that the main results are robust, and the main findings are consistent.

Table 4.11**Other Distributional Decomposition Methods (Bottom 10%)**

This table presents the retiree income sufficiency decomposition results using RIF (recentred influence function) decomposition. I only present the overall decomposition results, and I control all the variables as those in the main result. Panel A reports the results of the overall annuitised net wealth and Panel B reports the results of the annuitised net wealth without the government pensions.

(Overall) Annuitised Net Wealth			
	Demographic Traits	Individual Financial Positions	Overall Factors
Panel A: Overall Annuitised Net Wealth			
Difference	0.018 (0.68)	-0.052 (-1.93)	-0.052 (-1.92)
Explained	-0.043** (-2.72)	0.253*** (10.54)	0.307*** (10.18)
Unexplained	0.061* (2.12)	-0.304*** (-8.32)	-0.360*** (-8.83)
Obs of Australia	3,078	3,191	2,958
Obs of NZ	2,116	1,788	1,768
Panel B: Annuitised Net Wealth without Government Pensions			
Difference	1.037*** (5.31)	0.545** (2.66)	0.611** (2.87)
Explained	-0.647*** (-5.63)	3.467*** (14.33)	3.712*** (13.49)
Unexplained	1.684*** (8.84)	-2.922*** (-10.67)	-3.101*** (-10.48)
Obs of Australia	3,052	3,161	2,932
Obs of NZ	2,091	1,771	1,752

Table 4.12**Other Distributional Decomposition Methods (Top 10%)**

This table presents the retiree income sufficiency decomposition results using RIF (recentred influence function) decomposition. I only present the overall decomposition results, and I control all the variables as those in the main result. Panel A reports the results of the overall annuitised net wealth and Panel B reports the results of the annuitised net wealth without the government pensions.

(Overall) Annuitised Net Wealth			
	Demographic Traits	Financial Positions	Overall Factors
Panel A: Overall Annuitised Net Wealth			
Difference	0.201*** (4.62)	0.176*** (3.98)	0.167*** (3.70)
Explained	-0.138*** (-6.00)	0.073* (2.00)	0.161*** (3.74)
Unexplained	0.339*** (6.94)	0.104** (2.83)	0.007 (0.17)
Obs of Australia	3,078	3,191	2,958
Obs of NZ	2,116	1,788	1,768
Panel B: Annuitised Net Wealth without Government Pensions			
Difference	0.340*** (6.78)	0.314*** (6.07)	0.309*** (5.89)
Explained	-0.155*** (-6.24)	0.084* (2.09)	0.174*** (3.73)
Unexplained	0.495*** (8.88)	0.230* (5.47)	0.134** (2.98)
Obs of Australia	3,052	3,161	2,932
Obs of NZ	2,091	1,771	1,752

Table 4.13**Recentred Influence Function Decomposition**

This table presents the retiree income sufficiency decomposition results using reweighting RIF (recentred influence function) decomposition. I only present the overall decomposition results, and I control all the variables as those in the main result. Panel A reports the results of the overall annuitised net wealth and Panel B reports the results of the annuitised net wealth without the government pensions.

(Overall) Annuitised Net Wealth			
	Demographic Traits	Financial Positions	Overall Factors
Panel A: Overall Annuitised Net Wealth			
Difference	0.133*** (4.99)	0.078** (2.85)	0.080** (2.89)
Explained	-0.099*** (-8.95)	0.349*** (17.31)	0.360*** (10.69)
Unexplained	0.232*** (7.67)	-0.271*** (-7.00)	-0.280*** (-5.95)
Obs of Australia	3,078	3,191	2,958
Obs of NZ	2,116	1,788	1,768
Panel B: Annuitised Net Wealth without Government Pensions			
Difference	0.509*** (10.09)	0.349*** (6.88)	0.364*** (7.11)
Explained	-0.198*** (-10.19)	0.994*** (21.77)	0.966*** (12.52)
Unexplained	0.707*** (12.71)	-0.645*** (-8.28)	-0.602*** (-6.05)
Obs of Australia	3,052	3,161	2,932
Obs of NZ	2,091	1,771	1,752

4.6.3 Homeownership

Principal residence plays an important role in retirees' wealth accumulation, and the Australian pension system seems to encourage individuals to purchase their principal residence, as the principal residence is excluded from the asset test for the government Age Pension. I divide the whole group into non-homeowners and homeowners and carry out the same regressions in Tables 4.14 and 4.15, as the main regressions. Among the homeowners, I further divide them into those without and those with outstanding mortgages, and the results are shown in Tables 4.16 and 4.17.

Table 4.14 shows the decomposition results of the non-homeowner group, and the results illustrate that the non-homeowners in Australia have a lower mean annuitised net wealth with and without government pensions than in New Zealand. Demographic traits, individual financial positions, and unobserved variables all benefit retirees in New Zealand. These results indicate that principal residence is the main driver for Australian retirees' higher income sufficiency. Australian non-homeowner retirees are in a disadvantaged financial situation compared with New Zealand retirees in pre-retirement and post-retirement savings.

Table 4.15 shows the results of the homeowner group in both countries, and Australian homeowner retirees have a higher mean value of annuitised net wealth with and without government pensions than New Zealand retirees, at a statistically significant 1% level. New Zealand retirees enjoy better average demographic traits, and Australian retirees benefit more

from individual financial positions. Unobserved variables play different roles in the two groups' annuitised net wealth. The negative influence on Australian homeowners for overall annuitised net wealth is changed into a positive influence on the annuitised net wealth without government pensions. The different results of unobserved variables in both measurements indicate that the unobserved variables help New Zealand homeowners to improve their post-retirement savings and help Australian homeowners to improve their pre-retirement savings.

Furthermore, I divide these homeowners into those without and those with outstanding mortgages in Tables 4.16 and 4.17. The results in both tables show that Australian retirees have a higher annuitised net wealth in both measurements regardless of mortgage situation. These results again indicate the importance of homeownership in wealth accumulation for Australian retirees. The contributions from demographic traits and individual financial situations are consistent with the main results. However, the unobserved variables have mixed influences on both measurements. Table 4.16 Panel A shows that the unobserved variables benefit New Zealand retirees in their annuitised net wealth with government pensions, and Panel B shows that the unobserved variables benefit Australian retirees in their annuitised net wealth without government pensions for mortgage-free homeowners. In contrast, Table 4.17 Panel A demonstrates that both countries have similar results of unobserved variables and Panel B shows that the unobserved variables help Australian homeowner retirees with outstanding mortgages save more before retirement than New Zealand retirees in the same situation.

The overall homeownership subsample tests emphasise the importance of the homeownership in Australia, and it plays a vital role in retirees' wealth accumulation. Unobserved variables play mixed roles in both annuitised net wealth measurements between different groups. The different pension systems take fundamental responsibility for retirees' wealth accumulation process to a large extent.

Table 4.14
Retiree Income Sufficiency Decomposition among Non-homeowners
in Australia and New Zealand

This table presents the retiree income sufficiency decomposition results among non-homeowners. I only present the overall decomposition results, and I control all the variables as in the main result. Panel A reports the results of the overall annuitised net wealth and Panel B reports the results of the annuitised net wealth without the government pensions.

(Overall) Annuitised Net Wealth among Non-homeowners				
	Demographic Traits	Financial Positions	Overall Factors	Overall Factors with IV
Panel A: Overall Annuitised Net Wealth among Non-homeowners				
Difference	-0.578*** (-8.12)	-0.613*** (-8.65)	-0.643*** (-8.63)	-0.643*** (-8.69)
Explained	-0.093 (-1.81)	-0.458*** (-5.01)	-0.368*** (-3.56)	-0.368*** (-3.61)
Unexplained	-0.486*** (-6.09)	-0.155 (-1.58)	-0.275* (-2.50)	-0.275* (-2.53)
Obs of Australia	522	596	516	516
Obs of NZ	828	657	646	646
Panel B: Annuitised Net Wealth without Government Pensions among Non-homeowners				
Difference	-1.147*** (-8.38)	-1.321*** (-9.77)	-1.382*** (-9.77)	-1.382*** (-9.81)
Explained	-0.646*** (-6.66)	-0.739** (-3.12)	-0.718** (-3.01)	-0.719*** (-3.05)
Unexplained	-0.501*** (-3.62)	-0.583* (2.38)	-0.664* (-2.86)	-0.663** (-2.90)
Obs of Australia	496	566	490	490
Obs of NZ	806	642	632	632

Table 4.15
Retiree Income Sufficiency Decomposition among Homeowners
in Australia and New Zealand

This table presents the retiree income sufficiency decomposition results among homeowners. I only present the overall decomposition results, and I control all the variables as in the main result. Panel A reports the results of the overall annuitised net wealth and Panel B reports the results of the annuitised net wealth without the government pensions.

(Overall) Annuitised Net Wealth among Homeowners				
	Demographic Traits	Financial Positions	Overall Factors	Overall Factors with IV
Panel A: Overall Annuitised Net Wealth among Homeowners				
Difference	0.167*** (7.18)	0.149*** (6.26)	0.144*** (5.97)	0.144*** (5.97)
Explained	-0.116*** (-7.22)	0.173*** (8.95)	0.184*** (8.19)	0.186*** (8.27)
Unexplained	0.283*** (13.01)	-0.243 (-1.22)	-0.041** (-2.65)	-0.043** (-2.77)
Obs of Australia	2,465	2,595	2,442	2,442
Obs of Australia	1,288	1,131	1,122	1,122
Panel B: Annuitised Net Wealth among Homeowners				
Difference	0.431*** (13.69)	0.417*** (12.80)	0.408*** (12.40)	0.408*** (12.40)
Explained	-0.167*** (-8.51)	0.316*** (12.82)	0.293*** (10.32)	0.299*** (10.50)
Unexplained	0.598*** (20.84)	0.101*** (3.61)	0.115*** (5.28)	0.109*** (4.98)
Obs of Australia	2,465	2,595	2,442	2,442
Obs of NZ	1,285	1,129	1,120	1,120

Table 4.16
Retiree Income Sufficiency Decomposition among Homeowners without a Mortgage
in Australia and New Zealand

This table presents the retiree income sufficiency decomposition results among homeowners with mortgages left. I only present the overall decomposition results, and I control all the variables as in the main result. Panel A reports the results of the overall annuitised net wealth and Panel B reports the results of the annuitised net wealth without the government pensions.

(Overall) Annuitised Net Wealth among Homeowners without a Mortgage				
	Demographic Traits	Financial Positions	Overall Factors	Overall Factors with IV
Panel A: Overall Annuitised Net Wealth				
Difference	0.150*** (6.19)	0.139*** (5.64)	0.136*** (5.45)	0.136*** (5.46)
Explained	-0.133*** (-7.80)	0.167*** (8.50)	0.181*** (7.79)	0.182*** (7.85)
Unexplained	0.282*** (15.21)	-0.028 (-1.32)	-0.045** (-2.82)	-0.046** (-2.91)
Obs of Australia	2,206	2,327	2,194	2,194
Obs of NZ	1,137	1,018	1,011	1,011
Panel B: Annuitised Net Wealth				
Difference	0.382*** (11.97)	0.375*** (11.46)	0.370*** (11.18)	0.370*** (11.18)
Explained	-0.186*** (-8.92)	0.304*** (12.13)	0.286*** (9.79)	0.292*** (9.95)
Unexplained	0.568*** (19.50)	0.071* (2.47)	0.084*** (3.82)	0.078*** (3.55)
Obs of Australia	2,206	2,327	2,194	2,194
Obs of NZ	1,137	1,018	1,011	1,011

Table 4.17
Retiree Income Sufficiency Decomposition among Homeowners with a Mortgage
in Australia and New Zealand

This table presents the retiree income sufficiency decomposition results among homeowners without mortgages left. I only present the overall decomposition results, and I control all the variables as in the main result. Panel A reports the results of the overall annuitised net wealth and Panel B reports the results of the annuitised net wealth without the government pensions.

(Overall) Annuitised Net Wealth				
	Demographic Traits	Financial Positions	Overall Factors	Overall Factors with IV
Panel A: Overall Annuitised Net Wealth				
Difference	0.240*** (3.84)	0.250*** (3.81)	0.225*** (3.35)	0.225*** (3.38)
Explained	-0.072 (-1.67)	0.276*** (3.75)	0.211*** (2.74)	0.215*** (2.83)
Unexplained	0.312*** (4.75)	-0.026 (-0.39)	0.013 (0.20)	0.010 (0.16)
Obs of Australia	248	268	248	248
Obs of NZ	151	113	111	111
Panel B: Annuitised Net Wealth without Government Pensions				
Difference	0.754*** (7.88)	0.826*** (7.65)	0.787*** (7.17)	0.787*** (7.34)
Explained	-0.043 (-0.75)	0.577*** (5.68)	0.493*** (4.75)	0.496*** (4.86)
Unexplained	0.796*** (8.44)	0.249* (6.17)	0.294*** (2.86)	0.291** (2.95)
Obs of Australia	248	268	248	248
Obs of NZ	148	111	109	109

4.7 Conclusion

This research covers 3,527 Australian retirees and 2,175 New Zealand retiree observations, focusing on individual retiree income sufficiency comparisons in 2018. By applying the Oaxaca-Blinder decomposition in my context, the main results show that Australian retirees have higher objective income sufficiency shown in both annuitised net wealth measurements. In detail, New Zealand retirees benefit more from demographic traits and unobserved variables, while Australian retirees save more from their individual financial positions on average. Interestingly, New Zealand and Australian retirees do not have a significant difference in subjective financial situation satisfaction, while New Zealand retirees enjoy a higher level of overall life satisfaction. Demographic traits, individual financial positions, and unobserved variables play the same role in retiree objective and subjective income sufficiency measurements.

Furthermore, by comparing the annuitised net wealth measurements with the national poverty line and regional median incomes, New Zealand and Australian retirees enjoy a similar level of retirement lifestyle in general, even if the absolute values are significantly different. This result indicates that Australian retirees have higher absolute annuitised net wealth values, while retirees enjoy a similar relative lifestyle in both countries. The results among homeowners and non-homeowners show the significant influence from the homeownership in Australia. Australian retirees switch to a disadvantaged retirement financial position among those who are non-homeowners, indicating that homeownership is the main drive for higher Australian retirees' income sufficiency.

This study documents important implications for both countries. The Australian government should pay more attention to individual demographic traits, like improving individual retirees' health status for higher subjective life satisfaction. In comparison, the New Zealand government should encourage retirees to achieve better financial positions, such as increasing the level of homeownership for a higher objective annuitised net wealth. KiwiSaver seems to be a good solution to improve homeownership in New Zealand as KiwiSaver funds can be used for the first home. Moreover, the unobserved variables positively impact New Zealand retiree life satisfaction, and the benefit coverage from the universal pension system makes a huge contribution. However, the means-tested age pension in Australia results in a higher homeownership ratio.

CHAPTER FIVE

CONCLUSION

This chapter provides findings, conclusions, and policy implications for the whole thesis, and it comprises three essays. This chapter concludes by describing the limitations of the thesis and some possible recommendations.

5.1 Major findings and policy implications

5.1.1 Essay One: Retirement income sufficiency and financial market participation in New Zealand

This essay shows that New Zealand retirees' financial wellbeing is improved by direct financial market participation measured in the objective annuitised net wealth and subjective financial situation satisfaction approaches. The influence on overall life satisfaction is not significant. More specifically, retiree participants enjoy 40% more overall annuitised net wealth and 1.8 times more annuitised net wealth without government pensions. Moreover, those participants have a higher chance of making their income and needs meet, measured in subjective financial situation satisfaction. However, participants and non-participants have little difference in overall life satisfaction. My results prove a positive financial market participation influence on retirees' financial wellbeing in New Zealand.

Subsample tests examine the impact of financial market participation among retirees with different characteristics and, at the same time, they can check the robustness of the main results. It is shown that younger males with a partner living in a major urban city and not working retirees benefit more from financial market participation than their counterparts in both annuitised net wealth measurements. In particular, male participants have a significantly higher annuitised net wealth, and there are no significant influences among females. Retirees with partners also enjoy significant improvement from financial market participation, while it has no influence among those retirees without partners. However, subjective financial wellbeing subsample tests are largely consistent, and retirees with different characteristics enjoy better

financial wellbeing from financial market participation. Interestingly, working retiree participants have no difference in financial situation satisfaction from non-working retiree participants.

Furthermore, different methods are used to check the robustness of the objective income sufficiency and alternative survey questions for the subjective financial situation satisfaction. Standard OLS, region fixed effect, 2-stage Least Squares, and 3-stage strategy (Adams et al., 2009) are used to check the main results. The results are consistent with the baseline result that the direct financial market retiree participants enjoy a higher annuitised net wealth. The main financial wellbeing question is how the income meets their needs, and the alternative question is regarding how much dispensable money retirees can spend. The result is also consistent with the main subjective wellbeing result that direct financial market retiree participants have a higher chance to have a higher level of financial wellbeing satisfaction.

There is an important implication from these results that the New Zealand government should encourage individual retirees to improve their financial literacy (Van Rooij et al., 2011) in order to participate in the financial market for better financial wellbeing. Retirees should also realise the importance of taking charge of their financial satisfaction in retirement and efficiently getting involved in the financial market to ensure a better retirement life. Essay one shows that retiree direct financial market participation can improve retirees' post-retirement financial wellbeing in New Zealand with the universal pension system.

5.1.2 Essay Two: The impact of direct financial market participation on retirement income sufficiency in Australia

This research shows that financial market retiree participants have a 4.7% higher replacement ratio and 81% higher annuitised net wealth than non-participants in Australia. The results confirm that financial market participation can improve retirees' income sufficiency in both income and wealth channels. Furthermore, the whole samples are divided into different age, gender, partnership status, living area, and age pension eligibility groups, and the same regressions are conducted as for the main regressions for the samples. Subsample test results are largely consistent with the main results, and different groups benefit from different channels. For example, younger retirees (those younger than 74 years) and pension receivers only benefit from the wealth channel (shown in annuitised net wealth). At the same time, those older retirees and non-pension receivers benefit from both channels. Retirees who are male and living in non-major cities benefit more from the income channel (shown in the replacement ratio), while those who are female and living in major cities enjoy more from the wealth channel. Moreover, those retirees living alone benefit from both income and wealth channels.

Furthermore, the standard OLS with fixed effect and three-step strategy (Adams et al., 2009) is used for the robustness checks, and all the results are significant at a 1% significance level. Alternative measures for income sufficiency are also applied. The regular gross retirement income is replaced with the overall gross retirement income, including the irregular income. The remaining government pensions are also excluded from the annuitised net wealth measures. In other words, the net wealth at the interview is annuitised based on the remaining life

expectancy and discount rate. All the results are consistent with the main results, showing the main results are robust. It is documented in the literature that subjective wellbeing may not be reliable (Bond & Lang, 2019). Therefore, two alternative subjective questions are used as the robustness checks to examine the possible influence of financial market participation on retiree financial wellbeing. Two questions regarding the level of financial situation satisfaction (one's overall financial situation ratings, and the financial life satisfaction considering financial needs and responsibilities) are applied. The results show that direct financial market participation can improve retirees' subjective financial situation satisfaction, and the subjective financial wellbeing results again confirm the main results.

This research shows that retirees' direct financial market participation can improve retirees' income sufficiency from wealth and income channels in Australia. There is an effective policy implication for the government that they should encourage retirees to participate in the financial market for higher income sufficiency. Retirees should improve their financial literacy to participate in the financial market for a better retirement financial situation. The Australian government should devote more resources to retirees' financial education to encourage a higher financial market participation rate while reducing the burden on the government of pension expenditure.

5.1.3 Essay Three: Retirement income sufficiency comparison in Australia and New Zealand

This essay shows that Australian retirees have a higher annuitised net wealth and New Zealand retirees have better overall life satisfaction. There is no significant difference in the financial situation satisfaction. To put it in another way, Australian retirees are wealthier, and New Zealand retirees are happier. Moreover, retirees in both countries have similar satisfaction towards their financial situations. Specifically, Australian retirees benefit more from their individual financial position, especially higher homeownership, and New Zealand retirees have better demographic traits like better health status and unobserved variables.

Some other relative income sufficiency measures are also used to check the robustness of the main result. The annuitised net wealth is compared with the national poverty line (50% of the median single household income) and regional median incomes in each country to measure the retirement lifestyle that retirees' can maintain. The relative measurement results are largely the same as the main result: Australian retirees benefit more from individual financial positions, and New Zealand retirees benefit more from demographic traits and unobserved variables. Different distributional decomposition methods are applied to examine the gap between the top 10% and bottom 10% wealth groups. The results show that among the top 10% wealth group, Australian retirees have a higher level of annuitised net wealth, but there is no significant difference among the bottom 10% wealth group. The influences from demographic traits, individual financial positions, and unobserved variables are consistent with the main results. Moreover, the different influences among homeowners and non-owners are examined.

Interestingly, New Zealand retirees have a higher level of annuitised net wealth among non-homeowners, and Australian retirees have a higher level of income sufficiency among homeowners regardless of mortgage situation, showing the significant influence from Australian homeownership.

This research delivers significant implications for both governments that Australian retirees have a higher annuitised net wealth and New Zealand retirees have better overall life satisfaction. The New Zealand government should put more effort into improving retirees' annuitised net wealth, especially encouraging individuals' homeownership for better wealth accumulation. In contrast, the Australian government should emphasise life satisfaction to improve retirees' health status for happier retirement life. Australian and New Zealand retirees can have an enjoyable life by improving their respective aspects.

5.2 Limitations and recommendations

There are limitations in this thesis due to the data availability issue. Cross-sectional data is used for the first essay as no recent panel income data is available in New Zealand. The Survey of Family Income and Employment is the only longitudinal income data from 2002 to 2010, but the data are outdated for this study. Endogeneity issues are common problems for cross-sectional data, and an instrumental variable is applied to deal with this problem. Also, the extended regressions are used as independent and instrumental variables are binary.

While financial markets give positive risk-adjusted returns in the long-run and have been performing well in recent times, periods of substantial volatility and negative returns in financial markets could lead to significantly different results. If longitudinal data are available in the future, this research will be more comprehensive, and the cohort effect will be further addressed. Objective and subjective measurements have been applied for the research, and more measurements can be explored, such as the income replacement ratio and other constructions for subjective wellbeing.

The second essay measures Australian retiree income sufficiency from both wealth and income channels. For the income channel, the measurement for income replacement ratio is the gross retirement income to the gross pre-retirement income. There are different measures for pre-retirement income, like one-year before retirement, five-year average income before retirement, and more years of average income before retirement. There are advantages and disadvantages to using each measure, and I apply the pre-retirement industry average income by region as retirees' pre-retirement incomes. This pre-retirement income is a proxy rather than the real amount of the pre-retirement income; however, the real pre-retirement income remains a debate in the literature. There is no best solution to this value, and I use a new proxy for pre-retirement income. More reasonable and exact approaches should be explored or tried for retirees' pre-retirement income measurement. The annuitised net wealth is the present value of the overall retirement wealth. I use the current age pension to represent the future values; however, this value might change due to the individual financial status and macroeconomic situation.

Therefore, possible age pensions to gross retirement income ratios should be explored and studied for the government Age Pension.

Lastly, in the third essay, the same datasets as for the first two essays are used; as a result, the endogeneity issue and limited information remain an argument for cross-sectional data. Therefore, the instrumental variables are used to address all these issues. Furthermore, the comparability of the datasets for the cross-country study has been largely dealt with by matching the respective questions in the questionnaires in each country. Due to the lack of harmonised datasets, I have tried my best to standardise the two datasets from different countries; however, there are still differences in the same variables in both countries.

Moreover, the Oaxaca method decomposes the gap into explained and unexplained parts, and the explained part can be explained from the control variables. I control all the important demographic traits and individual financial characteristics from the literature, but this method fails to decompose the unobserved macroeconomic factors in detail. As Oaxaca is designed to work with the coefficients in separate regressions, there is no variation for macroeconomic factors within each country. Other approaches or proxies should be explored in the future to decompose the unexplained elements.

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APPENDIX A

ESSAY ONE

RETIREMENT INCOME SUFFICIENCY AND FINANCIAL MARKET PARTICIPATION IN NEW ZEALAND

Table A.1

New Zealand Household Economic Survey Variable Definitions

This table presents the descriptions of each variable and related questions in the 2018 HES New Zealand survey. The sample comprises aged 65 years and above, and there are 2,175 observations overall.

Variables	Description	Observations
Overall Annuitised Net Wealth	The present value of the remaining years of New Zealand government pensions (including NZ superannuation, veterans pension, war disablement pension, surviving spouse pension and other types of New Zealand government pension) are added to individual net wealth in 2018. The final value is the individual's overall net wealth and this value is annuitised based on the remaining life expectancy (according to gender and region) and the discount rate (inflation-adjusted T-bill rate in 2018). The natural logarithm of overall annuitised net wealth is the final value for this variable.	2,163
Annuitised Net Wealth (without government pensions)	This value is the logarithm of annuitised net wealth without government pensions. The annuitised net wealth is the overall net wealth (at the interview time) annuitised based on the remaining life expectancy and the discount rate.	2,136

Table A.1 *Continued*

Variables	Description	Observations
Overall Life Satisfaction	Survey question: I'm now going to ask you a very general question about your life. This includes all areas of your life, not just what we have talked about so far. Very dissatisfied=1, dissatisfied=2, neither satisfied nor dissatisfied=3, satisfied=4, very satisfied=5. For this question, only one person from each household answered the question and I duplicated the answers for other members in the same household.	1,848
Financial Situation Satisfaction	Survey question: I would like you to think about how well (you and your partners combined) total income meets your everyday needs for such things as accommodation, food, clothing, and other necessities. Not enough=1, only just enough=2, enough=3 and more than enough=4. For this question, only one person from each household answered the question and I duplicated the answers for other members in the same household as well.	1,848
Financial Market Participation	Dummy variable, direct financial market participation=1, otherwise =0. Income from New Zealand company dividends, unit trust and managed funds.	2,175
Age	Individuals were 65 years or above in 2017-2018 survey period.	2,175
Gender	Dummy variable, male=1, female=0.	2,175
Living Area	Living in major urban areas = 1, living elsewhere = 0 depending on the accessibility to services, according to the urban area classification in New Zealand.	2,175
Employment Status	Not working=1, working less than 30 hours =2, working more than 30 hours=3.	2,166
Highest Education	The highest education level has been achieved by 2017-2018 interview. Secondary school or below=1, certificate or diploma=2, university degree=3	2,133
Self-Rated Health	Self-assessed health status poor = 1, fair = 2, good = 3, very good = 4, or excellent = 5.	2,148
Partnership Status	Dummy variable, have a partner=1, otherwise=0.	2,175
Risk Preference	Do you have home contents insurance? Yes =1, no =0. For this question, still only one person from each household answered the question and I duplicated the answers for other members in the same household as well.	1,848

Table A.1 *Continued*

Variables	Description	Observations
Individual Net Wealth	Individual net wealth= Individual asset- individual liabilities	2,175
Gross Retirement Income	Total annual personal income from regular and recurring sources, including income from current and previous employment, investment income (rental properties, interests, dividends), all types of government transfer and other regular and recurring income (private superannuation payment, spousal and child support payments etc.) before taxes in the 2017/2018 survey.	2,175
Spending Range	About how much money, on average, do you have each week for spending on things for yourself without consulting anyone else? None=1, under \$10=2, \$10-\$25=3, \$26-\$50=4, more than \$50=5. This question was still only one answer from each household, and I duplicated the answers for other members in the same household as well.	1,815

Table A.2**First-Stage Results for the Baseline Objective Retirement Income Sufficiency Measures**

This table reports the first-stage relation between the Financial_Market_Participation and Financial_Market_Participation_IV, which is the randomly selected retiree's financial market participation situation for the baseline objective retirement income sufficiency measures. All the control variables are the same as the baseline results in Table 2.2. The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Stage 1 Results for	Stage 1 Results for
	Overall Annuitised Net Wealth	Annuitised Net Wealth (without government pensions)
	Financial_Market_Participation	Financial_Market_Participation
Financial_Market_Participation_IV	2.849*** (21.80)	2.850*** (21.96)
Age	-0.003 (-0.35)	-0.004 (-0.48)
Gender	0.075 (0.63)	0.090 (0.76)
Living_Area	0.030 (0.24)	0.023 (0.19)
Employment_Status	-0.115 (-1.06)	-0.119 (-1.12)
Self-Rated_Health	0.131* (2.20)	0.127* (2.14)
Highest_Education	0.180* (2.22)	0.167* (2.08)
Partnership_Status	0.419** (3.47)	0.382** (3.26)
Risk_Averseness	0.833** (2.99)	0.724*** (2.64)
Regular_Gross_Retirement_Income	0.004** (2.89)	0.004** (2.80)
Individual_Net_Wealth	0.021 (0.68)	0.028 (0.85)
Constant	-3.672*** (-4.52)	-3.385*** (-4.03)
Observations	1,821	1,806

Table A.3**First-Stage Results for the Subjective Financial Wellbeing Measures**

This table reports the first-stage relation between the Financial_Market_Participation and Financial_Market_Participation_IV, which is the randomly selected retiree's financial market participation situation for the subjective financial wellbeing measures. All the control variables are the same as the baseline results in Table 2.3. The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Stage 1 Results for Overall Life Satisfaction	Stage 1 Results for Financial Situation Satisfaction
	Financial_Market_Participation	Financial_Market_Participation
Financial_Market_ Participation_IV	2.856*** (21.68)	2.862*** (21.78)
Age	-0.000 (-0.01)	-0.001 (-0.12)
Gender	0.089 (0.74)	0.090 (0.75)
Living_Area	0.025 (0.20)	0.029 (0.23)
Employment_Status	-0.099 (-0.94)	-0.106 (-0.99)
Self-Rated_Health	0.128* (2.16)	0.130* (2.18)
Highest_Education	0.168* (2.10)	0.166* (2.07)
Partnership_Status	0.391** (3.34)	0.396*** (3.39)
Regular_Gross_ Retirement_Income	0.003** (2.63)	0.004** (2.67)
Individual_Net_ Wealth	0.045 (1.33)	0.044 (1.31)
Risk_Averseness	0.901** (3.01)	0.886** (2.93)
Constant	-3.894*** (-4.68)	-3.813*** (-4.57)
Observations	1,827	1,827

APPENDIX B

ESSAY TWO

THE IMPACT OF DIRECT FINANCIAL MARKET PARTICIPATION ON RETIREMENT INCOME SUFFICIENCY IN AUSTRALIA

Table B.1
Australia HILDA Variable Definitions

This table presents the descriptions of each variable and related questions in the 2018 HILDA survey. The sample comprises retirees aged 65 years and above, and 3,527 observations overall.

Variable	Description	Observations
Regular Retirement Income Replacement Ratio	Regular Retirement Income Replacement Ratio = Weekly Regular Gross Retirement Income/Weekly Pre-retirement Average Income by Industry and Gender.	2,477
Weekly Pre-retirement Average Income	Weekly Pre-retirement Average Income by industry and gender before taxes in May 2018 according to ANZSIC 2006 from the Australian Bureau of Statistics. Retirees' pre-retirement industries are obtained from the 2001 to 2018 surveys. Pre-retirement industry and gender are combined to match average gender earnings in each industry in Australia in May 2018.	2,477
Annuitised Net Wealth	The present value of the remaining years of the Age Pension is added to individual net wealth in June 2018. The final value is the individual's overall net wealth and this value is annuitised based on the remaining life expectancy and the discount rate (inflation-adjusted T-bill rate in 2018). The natural logarithm of the annuitised net wealth is the final value for this variable.	3,521

Table B.1 *Continued*

Variable	Description	Observations
Financial Market Participation	Dummy variable, direct financial market participation = 1, non-participation = 0. Survey question: During the last financial year (from July 1, 2017, to June 30, 2018), did you receive any income or dividends from these types of investments? (Investment type: company shares, managed funds, property trusts.)	3,333
Subjective Financial Wellbeing (measure 1)	Retirees' self-rated level of satisfaction toward their financial situation, ranging from 0 (totally dissatisfied) to 10 (totally satisfied).	3,351
Subjective Financial Wellbeing (measure 2)	Survey question: Given your current needs and financial responsibilities, would you say that you and your family are very poor = 1, poor = 2, just getting along = 3, reasonably comfortable = 4, very comfortable = 5, or prosperous = 6.	3,100
Age	Individuals were 65 years or older on June 30, 2018.	3,527
Gender	Dummy variable, male = 1, female = 0.	3,527
Living Area	Living in a major city = 1, living elsewhere = 0. Classified according to the 2001 Australian Statistical Geographical Classification.	3,527
Employment Status	Not working = 1, working less than 35 hours per week = 2, working more than 35 hours per week = 3.	3,524
Self-rated Health	Survey question: In general, would you say your health is poor = 1, fair = 2, good = 3, very good = 4, or excellent = 5.	3,084
Highest Education	The highest education level achieved by 2018, with year 12 or below = 1, certificate or diploma = 2, and university degree = 3.	3,360

Table B.1 *Continued*

Variable	Description	Observations
Financial Literacy	<p>The number of correct answers for five typical financial literacy questions regarding inflation, compounding, and diversification, ranging from 0 to 5 in the 2016 financial literacy section. These five questions are the following:</p> <ol style="list-style-type: none"> 1. An investment with a high return is likely to be high risk. (True or false?) 2. Buying shares in a single company usually provides a safer return than buying shares in a number of different companies. (True or false?) 3. Suppose you put A\$100 into a no-fee savings account with a guaranteed interest rate of 2% per year. You don't make any further payments into this account and you don't withdraw any money. How much would be in the account at the end of the first year, once the interest payment is made? 4. Imagine now that the interest rate on your savings account was 1% per year and inflation was 2% per year. After one year, would you be able to buy more than today, exactly the same as today, or less than today with the money in this account? 5. Suppose that by the year 2020 your income has doubled, but the prices of all of the things you buy have also doubled. In 2020, will you be able to buy more than today, exactly the same as today, or less than today with your income? 	3,193
Living Status	<p>Dummy variable, living with a partner = 1, otherwise = 0. This variable is from the following three survey questions:</p> <ol style="list-style-type: none"> 1. Which of these best describes your current marital status? And by "married," we mean in a registered marriage. [1] Married (in a registered marriage), [2] separated, but not divorced, [3] divorced, [4] widowed, [5] never married but living with someone in a relationship, [6] never married and not living with someone in a relationship. If the answer is 1, the next question is asked. If the answer is 2, 3, or 4, the third question is asked. 2. Which of the following best describes your current living circumstances? [1] Married and living with spouse, [2] married, but spouse is in an institution (e.g. nursing home, goal), [3] married, but living with spouse less than half the time owing to work/other commitments. 3. Are you currently living with someone in a relationship? [1] Yes [2] No <p>If the answer for the first question is 1 and the second question is 1 or 3, the value for "living status" is assigned as 1. If the first question is 5, this value is assigned as 1 as well. If the answer in the first question is 2, 3, or 4 and the answer for the third question is 1, this value is assigned as 1. All the remaining answers are assigned as 0.</p>	3,359

Table B.1 *Continued*

Variable	Description	Observations
Risk Averseness	<p>A value of 1 to 4 is assigned, depending on two questions in the survey, where no risk = 1, average risk = 2, above-average risk = 3, and substantial risk = 4. These two survey questions are as follows.</p> <p>1. Which of the following statements comes closest to describing the amount of financial risk that you are willing to take with your spare cash, that is, cash used for savings or investment? [1] I take substantial financial risks, expecting to earn substantial returns, [2] I take above-average financial risks, expecting to earn above-average returns, [3] I take average financial risks, expecting to earn average returns, [4] I am not willing to take any financial risk, or [5] I never have any spare cash. If the answer is 5 or missing for the first question, then the answer to the next question is the final answer.</p> <p>2. Assume you had some spare cash that could be used for savings or investment. Which of the following statements comes closest to describing the amount of financial risk that you would be willing to take with this money? [1] I take substantial financial risks, expecting to earn substantial returns, [2] I take above-average financial risks, expecting to earn above-average returns, [3] I take average financial risks, expecting to earn average returns, or [4] I am not willing to take any financial risks.</p>	3,038
Individual Net Wealth	<p>Individual net wealth = Household net wealth/number of people sharing the household wealth. Household net wealth = Total household assets – total household debts. Total household assets: balances on joint, individual, and children’s bank accounts and the value of superannuation, business assets, cash and equity investments, collectibles, home assets and other property assets, life insurance, trust funds, and vehicles. Total household debts: student loans, joint credit cards, individual credit cards, other personal debt, business debt, home debt, other property debt, and overdue household bills. The number of family members sharing the wealth is slightly different from living status. For the number of people sharing the household’s net wealth, those in a registered marriage are treated as two members, regardless of whether they live together. For other situations, living with a partner means two members, and living alone means one member.</p>	3,527
Weekly Regular Gross Retirement Income	<p>Weekly regular gross retirement income includes wages and salary, business income, investment income, private pension, private transfer, and Australian public transfers before taxes in the 2018 survey. Weekly regular gross retirement income = Financial year regular gross income/52 weeks.</p>	3,527
Age Pension Eligibility	<p>Dummy variable, age pension receiver = 1, non-age pension receiver = 0.</p>	3,332

Table B.2**First-Stage Results for the Baseline Retirement Income Sufficiency Measures**

This table reports the first-stage relation between the Financial_Market_Participation and the Financial_Market_Participation_IV (randomly selected retirees' financial market participation situation) for the main results in Table 3.2. All the control variables are the same as in the baseline analysis. The *t*-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Stage 1 results for the replacement ratio	Stage 1 results for annuitised net wealth
	Financial_Market_ Participation	Financial_Market_ Participation
Financial_Market_Participation_IV	2.123*** (28.31)	2.180*** (33.53)
Age	0.009 (1.35)	0.006 (1.20)
Gender	-0.111 (-1.39)	-0.118* (-1.72)
Living_Area	-0.136* (-1.79)	-0.001 (-0.02)
Employment_Status	-0.061 (-0.86)	-0.059 (-0.82)
Self-Rated_Health	-0.022 (-0.55)	0.042 (1.19)
Highest_Education	-0.022 (-0.45)	0.007 (0.16)
Financial_Literacy	0.059 (1.61)	0.056* (1.93)
Living_Status	0.066 (0.81)	0.109 (1.57)
Risk_Averseness	0.158** (2.39)	0.249*** (4.39)
Regular_Gross_Retirement_Income		0.073* (1.91)
Individual_Net_Wealth	0.298*** (4.87)	
Constant	-2.477*** (-4.14)	-2.538*** (-5.43)
Observations	2,132	2,836

Table B.3**First-Stage Results for the Alternative Measures for Income Sufficiency**

This table reports the first-stage relation between the Financial_Market_Participation and the Financial_Market_Participation_IV (randomly selected retirees' financial market participation situation) for the alternative measures in Table 3.5. All the control variables are the same as in the main analysis. The *t*-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Stage 1 results for the replacement ratio	Stage 1 results for annuitised net wealth
	Financial_Market_ Participation	Financial_Market_ Participation
Financial_Market_Participation_IV	2.122*** (28.29)	2.174*** (33.40)
Age	0.009 (1.35)	0.006 (1.08)
Gender	-0.111 (-1.40)	-0.115* (-1.69)
Living_Area	-0.137* (-1.80)	0.002 (0.02)
Employment_Status	-0.062 (-0.86)	-0.062 (-0.87)
Self-Rated_Health	-0.022 (-0.54)	0.041 (1.15)
Highest_Education	-0.022 (-0.45)	0.004 (0.09)
Financial_Literacy	0.058 (1.60)	0.055* (1.91)
Living_Status	0.066 (0.81)	0.102 (1.48)
Risk_Averseness	0.159** (2.41)	0.247*** (4.36)
Regular_Gross_Retirement_Income		0.074* (1.94)
Individual_Net_Wealth	0.298*** (4.83)	
Constant	-2.477*** (-4.14)	-2.465*** (-5.30)
Observations	2,132	2,817

Table B.4**First-Stage Results for the Subjective Financial Wellbeing Measures**

This table reports the first-stage relation between FINANCIAL_MARKET_PARTICIPATION and FINANCIAL_MARKET_PARTICIPATION_IV for the subjective financial wellbeing measures in Table 3.6. Measure 1 is the retiree's level of satisfaction toward his or her financial situation, and measure 2 is the retiree's self-rated financial situation satisfaction considering financial needs and responsibilities. All the control variables are the same as in the main analysis. The *t*-statistics are in parentheses. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Stage 1 results for subjective financial wellbeing Measure 1 Financial_Market_ Participation	Stage 1 results for subjective financial wellbeing Measure 2 Financial_Market_ Participation
Financial_Market_Participation_IV	2.107*** (31.65)	2.113*** (31.16)
Age	0.007 (1.39)	0.008 (1.54)
Gender	-0.091 (-1.28)	-0.102 (-1.44)
Living_Area	-0.066 (-0.99)	-0.055 (-0.82)
Employment_Status	-0.075 (-1.08)	-0.088 (-1.27)
Self-Rated_Health	0.032 (0.89)	0.029 (0.79)
Highest_Education	-0.042 (-0.95)	-0.041 (-0.93)
Financial_Literacy	0.049* (1.69)	0.060** (2.06)
Living_Status	0.152** (2.13)	0.164** (2.29)
Risk_Averseness	0.192*** (3.22)	0.186*** (3.15)
Regular_Gross_Retirement_Income	0.013 (0.48)	0.014 (0.53)
Individual_Net_Wealth	0.274*** (5.04)	0.277*** (4.82)
Constant	-2.551*** (-5.32)	-2.653*** (-5.46)
Observations	2,841	2,814

APPENDIX C

ESSAY THREE

RETIREMENT INCOME SUFFICIENCY COMPARISON BETWEEN AUSTRALIA AND NEW ZEALAND

Table C.1
Australia and New Zealand Pension System Comparisons

Pension system	Australia	New Zealand
Pillar 1	<p><u>Australia Age Pension</u> <u>Eligibility:</u></p> <ol style="list-style-type: none"> <u>Age:</u> 66.5 years since July 1, 2021, and will increase to 67 by 2023. <u>Residency rules:</u> on the day you claim Age Pension generally, you must be an Australian resident and in Australia (be a resident for at least ten years and be no break in the residence for at least five years). <u>Asset test (asset threshold):</u> <u>(1) To get a full pension,</u> For a single retiree, homeowners A\$268,000 and non-homeowners A\$482,500; For a couple combined, a couple separated due to illness combined, and a couple one partner eligible combined, A\$401,500 for homeowners and A\$616,000 for non-homeowners. 	<p><u>New Zealand Superannuation</u> <u>Eligibility:</u></p> <ol style="list-style-type: none"> <u>Age:</u> 65 years or over (no increase planned) <u>Residency rules:</u> you must be a New Zealand citizen, a permanent resident, or hold a residence class visa; you are an ordinary resident in New Zealand, the Cook Island, Niue or Tokelau when you apply; you have lived in New Zealand for at least ten years since your turned 20; you have lived in New Zealand the Cook Island, Niue or Tokelau (or a combination of these) for at least five years since your turned 50 (but it is increasing to a 20-year requirement by July 2042, with 5 years of that time after the age of 50.

Table C.1 Continued

Pension system	Australia	New Zealand
Pillar 1	<p><u>(2) To get a part pension.</u> For a couple, one partner eligible, combined and a couple, combined, A\$880,500 for homeowners and A\$1,095,000 for non-homeowners; For a couple, separated due to illness, combined, A\$1,037,000 for homeowners and A\$1,251,500 for non-homeowners; For a single retiree, A\$585,750 for homeowners and A\$800,250 for non-homeowners.</p> <p><u>(3) To get a transitional pension.</u> For a single retiree, homeowners A\$533,500 and non-homeowners A\$748,000; For a couple combined and a couple, one partner eligible combined, A\$830,000 for homeowners and A\$1,044,500 for non-homeowners; For a couple, separated due to illness, combined, A\$932,500 for homeowners and A\$1,147,000 for non-homeowners.</p> <p>d. <u>Income test:</u></p> <p>(1) For a single person, up to A\$178 per fortnight and Age Pension will reduce by 50 cents for each dollar over A\$178.</p> <p>(2) For a couple living together or separate due to illness, combined, up to A\$316 per fortnight and Age Pension will reduce by 50 cents for each dollar over A\$316</p> <p><u>Payment:</u></p> <p>(1) Maximum normal basic rate, for a single A\$868.30 and couple combined, A\$1,309.00 and couple apart due to ill health A\$868.30 per fortnight.</p> <p>(2) Maximum transitional rates, for a single A\$782.20 and couple combined, A\$1,263.60 and couple apart due to ill health A\$782.20 per fortnight.</p> <p><u>Tax:</u> taxable but liability may be eliminated by tax offset for seniors.</p>	<p><u>Payment:</u></p> <p>(1) Living alone or with a dependent child, NZ\$ 1,013.28 and living with some else either 18 years or older or visiting and staying for more than 13 weeks, NZ\$ 932.06 for a fortnight before tax.</p> <p>(2) Either both of the couple or only one meets the criteria for NZ super, NZ\$ 768.92 for each person for a fortnight before tax.</p> <p><u>Tax:</u> taxable at a marginal rate.</p>

Table C.1 Continued

Pension system	Australia	New Zealand
Pillar 2	<p><u>Australia employee superannuation</u></p> <p><u>Contribution:</u> The current contribution rate is 10% since July 1, 2021, and the rate will increase each year incrementally until 12% by 2025.</p> <p><u>Tax:</u> Super contributions are taxed at 15% under the threshold of A\$ 25,000, and the excess contributions are taxed at a marginal rate. Super earnings are taxed at a notional rate of 15%, but the actual rate is around 8% due to imputation credits and capital gains.</p> <p><u>Super withdrawals:</u> At the age of 60, tax free.</p> <p><u>Decumulation:</u> Lump sums and account-based pensions (allocated pensions or phased withdrawals).</p>	<p><u>New Zealand KiwiSaver</u></p> <p><u>Contribution:</u> The employer contribution rate is 3% minimum, and the employee contribution rate is 3% by default. But the employees can choose 4%,6%,8%, or 10%, and they can even choose to opt out.</p> <p><u>Tax:</u> KiwiSaver contributions are after-tax payments, and the employees pay the tax by the income marginal rate. Super fund earnings are generally taxed at 28%.</p> <p><u>Super withdrawals:</u> At the age of 65, tax free.</p> <p><u>Decumulation:</u> Lump sums or regular amounts with no minimum withdrawals.</p>
Pillar 3	<p><u>Private superannuation funds:</u> Individuals can contribute to their employee superannuation to make an extra contribution for their voluntary savings.</p>	<p><u>Private superannuation funds:</u> KiwiSaver (Pillar 2) is a hybrid of Pillar 2 and 3 as employees can choose the contribution rate.</p>

Table C.2
Australia HILDA and New Zealand HES Variable Definitions

This table presents the descriptions of each variable and related questions in the 2018 Australia HILDA and New Zealand HES surveys. The sample comprises retirees aged 65 years and above.

Variables	Description
Overall Annuitised Net Wealth	The present value of the remaining years of government pensions is added to individual net wealth in 2018. The final value is the individual's overall net wealth, and this value is annuitised based on the remaining life expectancy (according to gender and region in each country) and the discount rate (inflation-adjusted T-bill rate in 2018 in the respective country). The natural log format of overall annuitised net wealth is the final value for this variable.
Annuitised Net Wealth (without government pensions)	This value is the log format of annuitised net wealth without government pensions. The annuitised net wealth is the net wealth (at the interview time) annuitised based on the remaining life expectancy and the discount rate as in the overall annuitised net wealth.
Financial Situation Satisfaction	For the income and daily cost, the sufficiency of the income. Less than or just enough=0, more than enough=1 For this question in New Zealand, only one person from each household answered the question, and I duplicated the answers for other members in the same household. In Australia, it is a direct answer from everyone in each household.
Overall life Satisfaction	Considering all parts of life (not limited to the questions asked in the survey), worse than or just average=0, better than average=1.
Demographic traits	
Age	Individuals were 65 years or above in 2017-2018 survey period in New Zealand, and those were aged 65 years or above on June 30, 2018 in Australia.
Gender	Dummy variable, male=1, female=0.
Living Area	Living in major urban areas = 1, living elsewhere = 0 depending on the accessibility to services, according to the relative classifications in each country.
Employment Status	Not working=1, working part-time =2, working full time=3. In Australia, retiree works less than 35 hours, considered part-time, while in New Zealand, the time is 30 hours.
Self-Rated Health	Self-assessed health status poor = 1, fair = 2, good = 3, very good = 4, or excellent = 5.
Highest Education	The highest education level has been achieved by 2017-2018 interview. Secondary school or below=1, certificate or diploma=2, university degree=3

Table C.2 Continued

Variables	Description
With Partner	Dummy variable, have a partner=1, otherwise=0.
Individual Financial Positions	
Bank Accounts	Dummy variable, with bank account savings=1, otherwise=0.
Homeownership	Dummy variable, with principal residence=1, otherwise=0.
Pension Funds	Dummy variable, with pension funds=1, otherwise=0.
Mortgage	Dummy variable, with mortgage left=1, otherwise=0.
Other Debts	Dummy variable, with other debts except for mortgage=1, otherwise=0.
Home Contents Insurance	Dummy variable, with home contents insurance=1, otherwise=0.
Financial Market Participation	Dummy variable, with direct financial market participation=1, otherwise =0. Income from company shares, trust and managed funds.
Gross Retirement Income	Total annual personal income from regular and recurring sources, including income from current and previous employment, investment income (rental properties, interests, dividends), all types of government transfer and other regular and recurring income (private superannuation payment, spousal and child support payments etc.) before taxes in the 2017/2018 survey in New Zealand and in 2018 period in Australia.
Individual Net Wealth	Individual net wealth= Individual assets - individual liabilities at interview time in 2018.

Table C.3**OLS Results of Single Country Regression for Objective Income Sufficiency with All Factors**

This table presents the OLS regression results in each country over the overall annuitised net wealth and annuitised net wealth. The dependent variables are overall annuitised net wealth and annuitised net wealth both shown in log format. The control variables include Age, which is the age of retirees; Gender, which equals to one if the retiree is a male, and zero otherwise; Living_Area, which equals to one if the retiree living in a major city, and zero otherwise. Employment_Status, which equals to one if the retirees do not work, two if the retirees work part-time and three if work full-time; Self_Rated_Health, which is the retirees' self-perception of health conditions, ranging from one to five, from poor to excellent; Highest_Educaiton, which is the highest education level achieved by the retiree that equals one if it is 12 years or less, two if the retiree has a certificate or diploma, and three if the retiree has a university degree; With_Partner, which is a dummy variable that equals one if the retiree has a partner, and zero otherwise; Bank_Accounts, which is a dummy variable that equals to one if the retirees have the savings in the bank accounts, and zero otherwise; Homeownership which equals to one if the retirees have a principal residence and zero otherwise; Pension_Funds which is a dummy variable if the retirees have pension funds and zero otherwise; Mortgage which is a dummy variable if the retirees have mortgages left and zero otherwise; Other_Debts which is a dummy variable if retirees have other debts rather than mortgages and zero otherwise; Home_Contents_Insurance which is a dummy variable if the retirees have the insurance and zero otherwise; Financial_Market_Participation which is a dummy variable if the retirees have the income or dividend from stock, funds and trusts; Gross_Retirement_Income which is the retiree's regular annual before-tax retirement income, in thousands of dollars; and Individual_Net_Wealth is the individual retiree's net wealth, in millions of dollars, which is overall assets minus debts. The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Overall	Overall	Annuitised Net	Annuitised Net
	Annuitised Net	Annuitised Net	Wealth	Wealth
	Australia	New Zealand	Australia	New Zealand
Age	0.048*** (24.98)	0.036*** (10.51)	0.069*** (21.91)	0.063*** (13.56)
Gender	0.109*** (4.85)	0.071* (2.40)	0.121*** (3.36)	0.039 (0.78)
Living_Area	0.108*** (4.98)	-0.004 (-0.18)	0.179*** (5.27)	0.002 (0.05)
Employment_Status	-0.066* (-2.46)	-0.042 (-1.83)	0.133*** (4.00)	0.036 (0.84)
Self-Rated_Health	0.041*** (3.22)	-0.007 (-0.44)	0.090*** (4.66)	0.080*** (3.27)
Highest_Education	0.039** (3.15)	0.026 (1.33)	0.114*** (5.61)	0.154*** (4.86)
With_Partner	-0.185*** (-6.90)	-0.101** (-3.27)	-0.132*** (-3.32)	0.169*** (3.25)
Bank_Accounts	-0.152* (-2.39)	0.203 (1.47)	0.098 (0.32)	0.998*** (4.04)
Homeownership	0.747*** (15.24)	0.277*** (10.02)	2.246*** (24.12)	0.973*** (16.68)
Pension_Funds	0.163*** (6.76)	0.056* (2.27)	0.592** (15.28)	0.221*** (4.62)
Mortgage	-0.125*** (-4.25)	-0.193*** (-5.37)	-0.183*** (-4.26)	-0.321*** (-4.26)
Other_Debts	-0.053 (-1.61)	-0.015 (-0.44)	-0.154*** (-3.44)	0.038 (0.79)

Table C.3 Continued

	Overall	Overall	Annuitised Net	Annuitised Net
	Annuitised Net	Annuitised Net	Wealth	Wealth
	Australia	New Zealand	Australia	New Zealand
Home_Contents_	0.194**	0.381***	0.740***	1.281***
Insurance	(2.86)	(5.35)	(6.92)	(11.06)
Financial_Market_	0.096***	0.092***	0.209***	0.184***
Participation	(4.76)	(3.81)	(6.36)	(3.25)
Gross_Retirement	-0.0001	0.002***	-0.0002	0.001
Income	(-0.78)	(4.09)	(-0.82)	(1.26)
Individual_Net_	0.506***	0.661***	0.601***	1.056***
Wealth	(21.32)	(27.63)	(17.75)	(19.26)
Constant	6.029***	7.016***	0.956*	1.085*
	(30.53)	(23.80)	(2.30)	(2.39)
R-squared	0.66	0.57	0.73	0.66
Observations	2,958	1,768	2,932	1,752

Table C.4**2SLS Results of Single Country Regression for Objective Income Sufficiency with All Factors**

This table presents the 2SLS regression results result using an instrumental variable for Financial_Market_Participation in each country over the overall annuitised net wealth and annuitised net wealth. The dependent variables are overall annuitised net wealth and annuitised net wealth both shown in log format. The control variables include Age, which is the age of retirees; Gender, which equals to one if the retiree is a male, and zero otherwise; Living_Area, which equals to one if the retiree living in a major city, and zero otherwise. Employment_Status, which equals to one if the retirees do not work, two if the retirees work part-time and three if work full-time; Self_Rated_Health, which is the retirees' self-perception of health conditions, ranging from one to five, from poor to excellent; Highest_Educaiton, which is the highest education level achieved by the retiree at the time of the interview that equals one if it is 12 years or less, two if the retiree has a certificate or diploma, and three if the retiree has a university degree; With_Partner, which is a dummy variable that equals one if the retiree has a partner, and zero otherwise; Bank_Accounts, which is a dummy variable that equals to one if the retirees have the savings in the bank accounts, and zero otherwise; Homeownership which equals to one if the retirees have a principal residence and zero otherwise; Pension_Funds which is a dummy variable if the retirees have pension funds and zero otherwise; Mortgage which is a dummy variable if the retirees have mortgages left and zero otherwise; Other_Debts which is a dummy variable if retirees have other debts rather than mortgages and zero otherwise; Home_Contents_Insurance which is a dummy variable if the retirees have the insurance and zero otherwise; Financial_Market_Participation which is a dummy variable if the retirees have the income or dividend from stock, funds and trusts; Gross_Retirement_Income which is the retiree's regular annual income before-tax retirement income, in thousands of dollars; and Individual_Net_Wealth is the individual retiree's net wealth, in millions of dollars, which is overall assets minus debts. The t-statistics are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table C.4 *Continued*

	Overall annuitised net wealth		Annuitised net wealth	
	Australia	New Zealand	Australia	New Zealand
Age	0.048*** (24.90)	0.035*** (10.47)	0.069*** (21.67)	0.063*** (13.59)
Gender	0.109*** (4.84)	0.071* (2.38)	0.120*** (3.33)	0.039 (0.78)
Living_Area	0.108*** (4.96)	-0.004 (-0.18)	0.178*** (5.23)	0.002 (0.05)
Employment_Status	-0.065* (-2.45)	-0.039 (-0.18)	0.134*** (4.03)	0.038 (0.86)
Self-Rated_Health	0.040** (3.19)	-0.008 (-0.47)	0.089*** (4.56)	0.080** (3.24)
Highest_Education	0.039** (3.11)	0.024 (1.23)	0.113*** (5.56)	0.153*** (4.86)
With_Partner	-0.186*** (-6.93)	-0.103*** (-3.33)	-0.135*** (-3.39)	0.168** (3.20)
Bank_Accounts	-0.151* (-2.36)	0.203 (1.48)	0.103 (0.34)	0.998*** (4.04)
Homeownership	0.744*** (15.16)	0.278*** (10.03)	2.237*** (24.08)	0.974*** (16.79)
Pension_Funds	0.161*** (6.67)	0.056* (2.25)	0.585*** (15.13)	0.221*** (4.61)
Mortgage	-0.122*** (-4.14)	-0.192*** (-5.31)	-0.174*** (-4.05)	-0.321*** (-4.26)
Other_Debts	-0.050 (-1.52)	-0.016 (-0.49)	-0.146*** (-3.22)	0.038 (0.77)
Home_Contents_Insurance	0.193** (2.85)	0.379*** (5.34)	0.739*** (6.91)	1.280*** (11.11)
Financial_Market_Participation_IV	0.125*** (4.27)	0.136*** (4.30)	0.295*** (6.19)	0.201* (2.11)
Gross_Retirement_Income	-0.0001 (-0.82)	0.002*** (3.94)	-0.0002 (-0.90)	0.001 (1.21)
Individual_Net_Wealth	0.502*** (21.00)	0.657*** (27.43)	0.590*** (17.45)	1.055*** (18.89)
Constant	6.038*** (30.58)	7.025*** (23.82)	0.984*** (2.36)	1.089* (2.40)
R-squared	0.66	0.59	0.73	0.66
Observations	2,958	1,768	2,932	1,752