Behavioural effects of pension eligibility in New Zealand

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Abstract

This study examines the differential labour supply behaviour of pension eligibility in New Zealand, including New Zealand Superannuation (NZS) take-up rates, the composition and level of personal income, and individual employment rates. Administrative data from the Integrated Data Infrastructure (IDI) covering the period from five years before to five years after the pension age was used to examine cohorts born between 1940 and 1947. Using Ordinary Least Squares (OLS), maximum likelihood Probit regression, and hazard-based duration models, a variety of statistically significant labour supply effects were discovered.

First, a 96.4 percent of NZS take-up rate was found three months after turning 65 for the entire sample cohort that was restricted to individuals who were presumably eligible for this public pension at 65, and it continued to increase over time, reaching 98.7 percent at age 70. The NZS take-up rate gaps for various demographic groups narrow over time. Some take-up issues appear to exist with NZS, which appears to be concentrated among people of Māori, Pacifica, and Asian, as well as people who had continuously received main benefits between the ages of 60 and 64.

Second, a temporary boost of $253 in total income on average was found for the entire sample cohort at the 65th birthday month, due to the effect of receiving NZS. A permanent rise of $565 in total monthly income was discovered after being pension eligible, which was equivalent to a substantial 30.8 percent of the average income at the age of 64. Furthermore, we found that NZS was not entirely offset by a reduction in earned income at age 65. Instead, NZS generated a substantial boost to total income when compared to income prior to eligibility and lasted for nearly five years for the entire sample cohort. Only at age 69.44, was average income predicted to be at the same level as that received in the month immediately before becoming pension eligible.

Third, being pension eligible significantly lowered the employment rate by 3.38 percentage points for the entire sample cohort, which we suspect was due entirely to the pure income effect generated by NZS. For the sub-sample who transitioned from means-tested main benefits to the non-means-tested NZS with weaker work disincentives, there were significant positive relative gains in the labour supply. These effects varied based on the uptake of main benefits between the ages of 60 and 64, with people who had continuously received main benefits having a greater impact.

Disclaimer

Access to the data used in this study was provided by Stats NZ 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 author, not Stats NZ or individual data suppliers.

These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) which is carefully managed by Stats NZ. For more information about the IDI please visit https://www.stats.govt.nz/integrated-data/.

The results are based in part on tax data supplied by Inland Revenue to Stats NZ under the Tax Administration Act 1994 for statistical purposes. Any discussion of data limitations or weaknesses is in the context of using the IDI for statistical purposes, and is not related to the data's ability to support Inland Revenue's core operational requirements.

Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

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Table of Contents

List of Figures

List of Tables

List of Appendices

1 Introduction

1.1 Introduction

The overall purpose of this thesis is to use individual-level linked administrative data to provide a better understanding of the nature and behavioural effects of New Zealand's public retirement programme (Superannuation). Although New Zealand Superannuation (NZS) can be seen as a universal entitlement to a basic, non-means-tested benefit at age 65, is there empirical evidence of a 100 percent take-up among the eligible population? Do these take-up rates differ by subpopulations? What are the different changes in the composition and level of personal incomes when a person becomes pension eligible? What are the overall and differential labour supply changes of being pension eligible?

Public pensions are intended to ease the elderly's concerns about declining earning capacity and assist them in maintaining their standards of living in retirement (OECD, 2005). Governments play an important role in designing long-term retirement plans that will help the elderly. Thus, it is crucial to have a better understanding of pension take-up rates, pre- and post-retirement income changes, and labour supply behaviour around pension age. This has become even more crucial with a forecasted rise in future life expectancy, as well as an increase in the old-age labour force supply over the past decades.

According to the Organisation for Economic Co-operation and Development (OECD, 2019), on average in OECD countries, life expectancy for males aged 65 is expected to rise from 18.1 in 2015-20 to 22.5 in 2060-65. Females of the same age may expect to live an average of 21.3 years in 2015-20 and an average of 25.2 years in 2060-65. The growth rate in life expectancy in post-65 life is 19.8 percent for males and 15.4 percent for females. In New Zealand (NZ), the life expectancy of people aged 65 is forecasted to rise from 19.4 and 21.7 years in 2015-2020 to 23.5 and 25.4 years in 2060-2065, for males and females, respectively. The growth rate in life expectancy in post-65 life is 17.5 percent for males and 14.4 percent for females.

Between 1990 and 2020, the labour force participation rate (LFPR) for people aged 65 and over in average OECD countries rose from 10.4 to 15.5 percent, while the rate for NZ rose from 6.5 to 24.8 percent.[1] NZ saw a considerable rise of nearly fourfold in the

[1] Source: OECD (2021), Labour force participation rate (indicator). doi: 10.1787/8a801325-en.

old-age LFPR, while the average OECD country saw only a 49.0 percent rise. One explanation for this situation might be a lack of means-testing for New Zealand Superannuation (NZS). Another possible reason could be the absence of mandatory retirement age in NZ.[2]

To date, the non-take-up of pension benefits has not received sufficient attention in many countries. The take-up issues are commonly associated with means-tested social welfare programmes due to their complex income and asset tests (Cole, 1958; Hancock, Pudney, Barker, Hernandez, & Sutherland, 2004; Hemming, 1962; Hernanz, Malherbet, & Pellizzari, 2004; Van Oorschot, 1991). The non-take-up of pensions has similar reasons to the general social welfare benefits (Ginn & Arber, 2001; Steventon & Sanchez, 2008; Vlachantoni, Feng, Evandrou, & Falkingham, 2017). NZS plays a major role in funding the elders in their retirement life. It has very simple eligibility criteria compared to other complex pension systems, which only depends on age 65, partnership, and residency requirements.[3] In addition, it is publicly funded and not means-tested. It would be very easy to identify the eligible population and once an individual takes it up, there would be no other factors affecting their decisions. In such a case, it would be of great interest to discover whether the take-up issue exists, as it does in other pension systems. Moreover, identifying the key reasons for lower pension take-up is crucial. Because knowing why people don't take up pensions gives us a better understanding of the functioning of the pension policies and how a country could well design the social security system, such as the choice between universal and three-pillar pension schemes (Van Oorschot, 1991).

Low pension take-up rates would most likely lead to low retirement income, resulting in poverty in later life (Barr & Diamond, 2006; Van Oorschot, 1991). Some evidence has been provided for income inequality among subgroups under means-tested private and state pension benefits, such as race, gender, and educational attainments, particularly in the post-retirement period (Brown, 2016; Choi, 1997; Heisig, Lancee, & Radl, 2018; Pensions, 2014). However, limited evidence regarding pre- and post-retirement income changes in a publicly-funded and non-means-tested pension system is found. Thus, it is vital to understand the income changes before and after elders become pension eligible in NZ.

[2] The definition of means-testing can be found in Section 2.2.1.
[3] Source: Work and Income.

Labour supply behaviour around pension age is most often studied when pension systems are reformed, such as changes in pension eligible age, benefit levels, and means-testing rules. For instance, the causal effects under pension reforms are estimated by comparing the variations in pre- and post-reform labour supply consequences. When evaluating the labour supply behaviour induced by pension eligibility rules under an existing pension system, the biggest challenge is a lack of counterfactual outcomes. In other words, the labour supply effects in the absence of the existing pension system are unobservable. However, when eligibility is based on age, a comparison right before and after the age of eligibility for pension provides some evidence of the possible behavioural effects.

A number of international studies have examined the behavioural effects of pension eligibility since the 1980s, both with and without pension reforms (see Chapter 3 for details). However, in NZ, very limited attention has been paid to an understanding of the differential labour supply behaviour among the elderly and the economic consequences of being pension eligible. Substantial uncertainties over the labour supply effects remain.

Only a few domestic studies have evaluated the behavioural effects around pension age. The first category of these studies was the evaluation of the effects of raising the pension age from 60 to 65 which occurred between 1992 and 2001 on the labour supply (Hurnard, 2005; Kalb & Scutella, 2003; Maloney, 2000). The second category of these studies looked at the changes in labour supply of being pension eligible (Dixon & Hyslop, 2008; Khawaja & Boddington, 2009). The last category only measured the rise in the labour force of the elders (Khawaja & Boddington, 2009). Despite these studies, there are no thorough estimates of the NZS take-up rates, impact of eligibility on total income, or the differential labour supply effects of eligibility for various subpopulations, particularly for those with pre-65 benefit histories.

This study attempts to extend the previous literature, especially the work of Dixon and Hyslop (2008), by tracking the labour supply behaviour of the elderly five years before and after being pension eligible, including a thorough and detailed monthly analysis of NZS take-up rates, income, and employment rate changes for various subgroups. Specifically, the direction and magnitude of the change at pension age will be assessed. The potential drivers and their percentage attributed to the observed changes will be examined.

1.2 Thesis Aims

This study aims to fill some gaps in the current literature on pension take-up issues, pre- and post-retirement income changes, and overall and differential labour supply effects of pension eligibility in a non-means-tested universal pension system. This study will hopefully be of benefit to the research and public policy communities. First, this study will provide some evidence of take-up issues in a publicly-funded and non-means-tested pension system. Second, the findings will provide some new perspectives on the current pension scheme and explore some potential future implications, such as improving the administrative efficiency of granting NZS and minimizing administrative costs. Third, this study will offer a new perspective on the income changes before and after the elderly become pension eligible. Fourth, this study could offer a potential contribution to the international literature about the evidence on older workers' labour supply and retirement behaviour under a publicly-funded and non-means-tested policy environment.

The aims of this study are to examine the following questions:

1. Does everyone who is eligible for NZS receive it? What are the NZS take-up rate levels for different population subgroups?
2. What are the different changes in the composition and level of personal incomes when a person becomes pension eligible, especially for work income?
3. What are the overall and differential labour supply changes of being pension eligible, especially for those with a pre-65 benefit history?

1.3 Outline

Eight chapters are included in this study. Chapter 2 provides the background information on the NZ social welfare system, including working-age main benefits, NZS, and supplementary benefits. It also gives an overall review of the LFPR and income structure of those aged 55 and over. It also provides the theoretical framework for the analysis of this study.

Chapter 3 summarises and critiques the international and domestic literature on the social welfare take-up issues, pre- and post-retirement income changes, and behavioural effects of pension eligibility. The substantial international literature and the limited number of domestic studies in this area are surveyed.

Chapter 4 illustrates the datasets that will be used in Chapters 5, 6, and 7. It introduces the study outcomes and describes the selection and construction of the sample cohorts. Summary statistics from the sample, as well as the key variables, are presented. Finally, the advantages and limitations of the datasets used in this study are clarified.

Chapter 5 provides a thorough analysis of the NZS take-up rates for the entire sample cohort, as well as various subgroups. It examines whether the NZS take-up rates meet the government's goal of 100 percent of the eligible population receiving Superannuation (WEAG, 2018). It also explores the reasons that might cause the take-up rates to be lower for some subpopulations. Finally, some potential policy implications are provided.

Chapter 6 depicts the changes in mean monthly income for the sample cohort over a ten-year period. Particularly, it focuses on the four key features of the income change. These are pre- and post-65 time trends, and temporary and permanent effects of being pension eligible. Further, it discusses whether NZS is an immediate replacement or enhancement for lost work income when people reach pension age.

Chapter 7 looks at the changes in the employment rate for the study cohort five years before and after 65. It calculates the time trends in the employment rate for various subgroups. In addition, it emphasizes the possible permanent labour supply effects after being pension eligible.

Finally, Chapter 8 summarises the main findings of this study, as well as some possible policy implications. It also discusses the advantages and drawbacks of this study. Lastly, it concludes with some future research perspectives.

2 Background

2.1 Introduction

This chapter provides background information for the following chapters. Section 2.2 introduces the social welfare system in New Zealand (NZ), including pre-65 working-age main benefits, post-65 New Zealand Superannuation (NZS), and all-age supplementary benefits.[4] It highlights the trends in the older group of individuals receiving means-tested main benefits before reaching the pension eligibility age of 65. It also emphasizes the concerning trend in the government's growing NZS expenditures in previous decades. Section 2.3 gives a brief description of the pension supplement, Kiwisaver. Section 2.4 shows the aggregate labour supply behaviour of individuals aged 55 and over and highlights the rising trend of the Labour Force Participation Rate (LFPR) in the elderly population.[5] It also describes the average income change before and after the age of 65. Furthermore, it addresses the disparities in labour supply change between beneficiaries and non-beneficiaries upon reaching pension age.[6] Section 2.5 illustrates the theoretical frameworks for the retirement incentives and labour supply models that are relevant for this study. Finally, a brief conclusion is provided in Section 2.5.

2.2 Social Welfare System

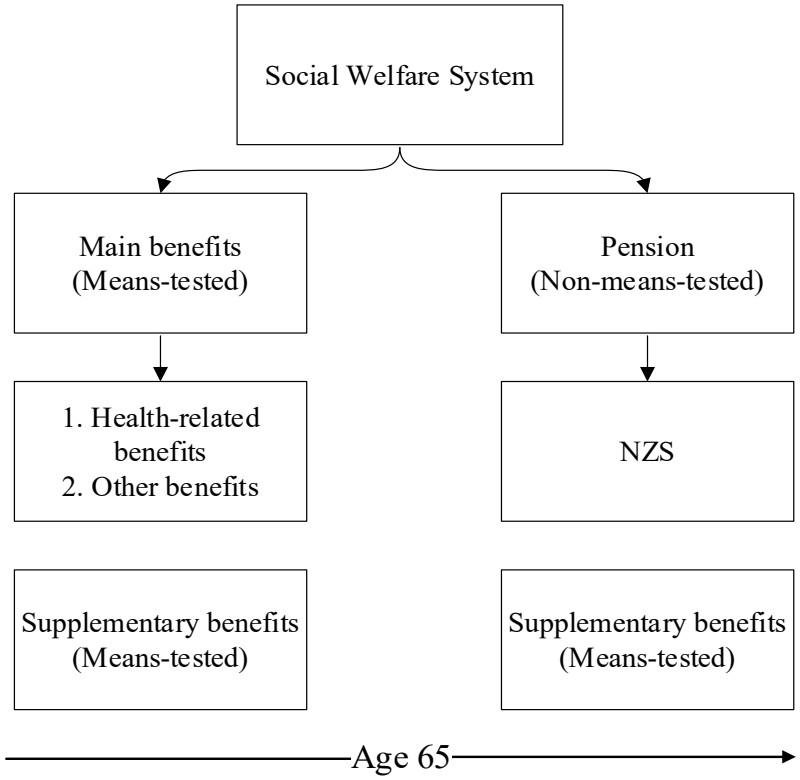
The NZ social welfare system is designed to protect people from poverty throughout their lifetime. It consists mainly of three parts: working-age main benefits, pension, and supplementary benefits.[7] Figure 2.1 depicts the framework of the social welfare system in NZ.

Working-age main benefits aim to help people aged 16 to 64 who are unable to meet the basic living costs due to circumstances such as unemployment, sickness, disability, and being a single parent. The pension system is designed to support people aged 65 and over. In contrast to most countries' three-pillar pension system (e.g., the United States, Australia), including public pension, occupational schemes, and private pension savings, the universal public pension of NZS plays a major role in funding the elders in their

[4] See Section 2.2.1 for the definition of main benefits and Section 2.2.3 for supplementary benefits. All-age here refers to age 16 and over.
[5] To be consistent with the age group mentioned in Section 2.2.1, the analysis of labour supply behaviour begins at the age of 55.
[6] Beneficiaries are those who received working-age main benefits before age 65.
[7] Source: Social Security Act 2018, New Zealand Superannuation and Retirement Income Act 2001, Work and Income, and Ministry of Social Development.

retirement life with a primarily privately-funded KiwiSaver programme as a supplement. Occupational pension existed for a very short time in history (Overbye, 1996), which fell over years (OECD, 2019). In addition, income from occupational pension could not be distinguished from earnings in the Integrated Data Infrastructure (IDI). Private pension was very limited and had a poor historical record and very low coverage rate (Thomson, 1996). NZS, on the other hand, is more generous. All these reasons lead New Zealanders to rely more on NZS. In comparison to other complex pension systems, NZS, a universal public pension scheme, has very simple eligibility criteria, which is based solely on the age of 65, partnership, and residency requirements. As an alternative to NZS, the Veterans Pension (VP) is paid to war veterans. The rates for VP are the same as NZS, but VP recipients have additional benefits such as a war pensioner's funeral grant and a lump sum payment on death. Both NZS and VP are available to individuals aged 65 and over. Kiwisaver was just implemented in 2007, which had little impact on our sample cohort. In addition, the IDI does not have Kiwisaver information. Additional supplementary benefits are available to people on a main benefit, NZS, and VP, to provide additional assistance for specific needs, such as accommodation, temporary additional help, disability, and some unexpected costs.

Figure 2.1 Social welfare system structure



Source: Author's derivation according to Social Security Act 2018, New Zealand Superannuation and Retirement Income Act 2001, Work and Income, and Ministry of Social Development

Over the last few decades, NZ's social welfare system has undergone significant changes, especially for people aged 55 and over. Two major trends have occurred. The first was an increase in the proportion of the working-age population receiving main benefits. The second was a rise in the number of people eligible for NZS and the corresponding change in NZS expenditure.

2.2.1 Working-age Main Benefits

The working-age main benefit scheme dates back to 1938, when the first Social Security Act introduced the Unemployment Benefit (UB), Widow's Benefit (WB), Emergency Benefit (EB), and two types of health-related benefits: Sickness Benefit (SB) and Invalid's Benefit (IB). The Domestic Purposes Benefit (DPB) for single parents was introduced in 1973.[8] Youth payment (YP) and Youth Parent Payment (YPP) were introduced in 2012. Table 2.1 shows the main benefit types before the social welfare system reform in 2013.

Table 2.1 Pre-reform main benefit types

Year	Benefit Type	Definition
1938	UB	Unemployed and searching for jobs, or who are in a part-time job looking for more work
	WB	Women with children whose partner has died
	EB	Cannot support themselves and don't qualify for other benefits
	SB	Temporarily unable to work due to illness or accident
	IB	Permanently and severely limited in their ability to work due to a medical condition, injury, disability, or complete blindness[9]
1973	DPB	Single parents Full-time caregivers for a sick person Women without dependent children under certain circumstances
2012	YP	Aged 16 or 17 who can't live with their parents or guardian and aren't supported by them or anyone else
	YPP	Young parents between the ages of 16 and 19

Source: Ministry of Social Development

[8] DPB was introduced following the recommendations of the Royal Commission of Inquiry into Social Security.

[9] Permanent is defined as 'expected to continue for at least two years'. Severely is defined as 'not being able to regularly work for 15 hours or more per week in open employment'.

On 15 July 2013, the social welfare system for working-age main benefits was reformed. As part of this reform, the Ministry of Social Development (MSD) reclassified the main benefit types and some new obligations were introduced. Three new benefits (Table 2.2), Jobseeker Support (JS), Sole Parent Support (SPS), and Supported Living Payment (SLP), replaced most of the previous benefits, including UB, WB, SB, IB, and DPB.[10] Other main benefits remained the same. Two types of JS exist: Jobseeker Support – Work Ready (JS-WR) and Jobseeker Support – Health Conditions or Disability (JS-HCD). Though both JS-HCD and SLP provide assistance to people with disabilities, JS-HCD focuses on those who have more temporary or relatively minor disabilities, while SLP focuses on those who have more permanent or severe disabilities.

Table 2.2 Post-reform main benefit types

Year	Benefit Type	Definition
2013	JS	JS-WR: unemployed and searching for jobs, or who are in a part-time job looking for more work
		JS-HCD: able to work but have some health limitations or disabilities
	SPS	Single parents without financial support and with children under the age of 14
	SLP	Permanently and severely limited in their ability to work due to a medical condition, injury, disability, or complete blindness Full-time caregivers for a sick person

Source: Ministry of Social Development

Normally, the main benefits are provided to individuals aged from 16 to 64. However, under certain conditions, such as failing to meet the residency criteria when reaching pension age, individuals aged 65 and over might be eligible to receive main benefits, which generally have lower weekly payments compared to NZS.

Individuals must have usually resided in NZ for at least two years after becoming NZ citizens or permanent residents to be eligible for the working-age main benefits. The payment rates (Table 2.3) vary depending on the types of benefits, the person's age, marital status, and whether they have dependent children. The rates are means-tested. Means-testing is often depicted as a negative-income-tax (NIT) -type programme, which means that the full benefit amount is available if other income is below some threshold (income disregard). Under the means-testing programme, the benefit is reduced by a

[10] Refer to Table 2.3 for further information.

specific amount for every dollar in additional income over this disregard (e.g., 50 cents on the dollar), until the breakeven point is reached. At the breakeven point, the benefit received drops to zero. Means-testing provides a disincentive for the beneficiary to work because it lowers the effective wage rate and increases non-labour income. These work disincentives are known respectively as substitution and income effects. In other words, in order to maximize utility, individuals generally might prefer to work less or not work at all in the presence of a NIT programme.

Since 1960, the proportion of the working-age population receiving main benefits has risen dramatically. The number of people receiving main benefits was only about 26,079 at the end of March 1960, accounting for 1.9 percent of the working-age population.[11] This number was 309,995 at the end of March 2020, accounting for 10.3 percent of the working-age population.[12] Of all the beneficiaries, 49 percent received JS, 30 percent received SLP, 20 percent received SPS, and 1 percent received other main benefits. Of people who received JS, 59 percent received JS-WR and 41 percent had temporary health limitations or disabilities under JS-HCD. Of those receiving SLP, 91 percent had their work capacity permanently and seriously restricted, while only 9 percent were caregivers.

If we only consider the beneficiaries who are just below pension age, the proportion in receipt of a main benefit relative to the population is even higher. Figure 2.2 depicts the trends in the share of main benefits among people aged 55 to 64. Over the previous two decades, the rate rose from 16.4 percent in 1998 to 17.9 percent in 2001. It then dropped to 11.3 percent in 2008. After 2008, the rate fluctuated around 11 percent till 2020. This shows how common it would be for a person who reaches pension age to be a beneficiary. The rise in main benefit receipt during the 1990s and subsequent reduction in the 2000s may be largely related to the Transitional Retirement Benefit for those just below the pension age during the phased increase in NZS-eligibility age.

[11] The number of beneficiaries is from The Statistic Report, June 2008, MSD. As the earliest population estimation can only date back to 1991 in Statistics New Zealand, the working-age population estimation in 1960 is from OECD (2021), Population (indicator). doi: 10.1787/d434f82b-en.
[12] The rest main benefits information is from Benefit Fact Sheets, March 2020, MSD.

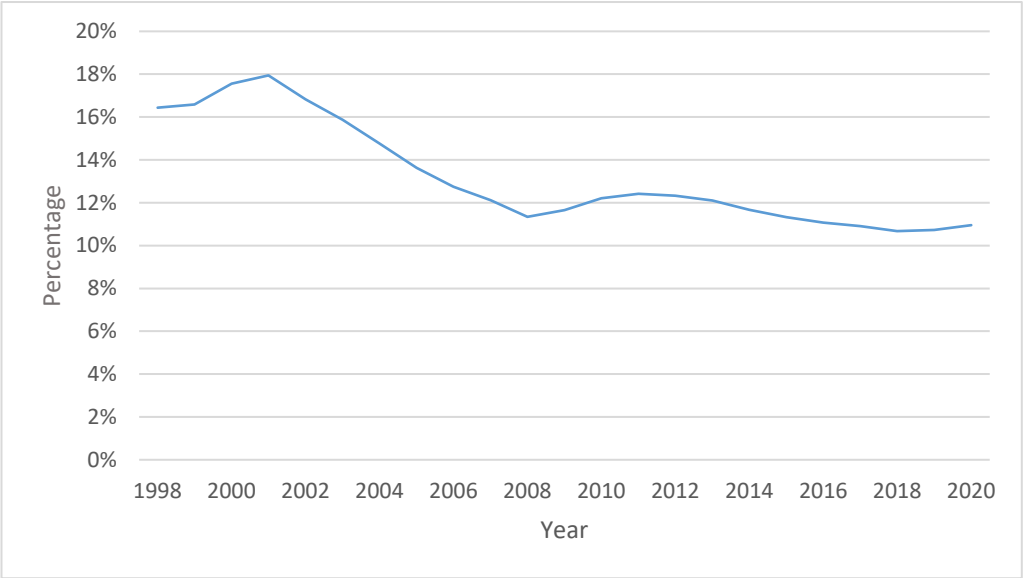
Table 2.3 Means-tested main benefits, nominal gross weekly rates, $, 1 April of each year

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020[1]	2021
JS[2]													
Single, 18-19 at home	145.05	147.90	150.01	152.67	153.60	155.72	156.51	156.51	158.23	160.39	163.11	196.07	202.13
Single, 18-19 away from home or 20-24	181.31	184.87	187.52	190.84	192.00	194.65	195.64	195.64	197.80	200.49	203.88	238.10	245.47
Single, 25+	217.59	221.85	225.03	229.01	230.40	233.59	234.78	234.78	237.37	240.60	244.67	281.08	290.49
Couple (each)	181.31	184.87	187.52	190.84	192.00	194.65	195.64	195.64	197.80	200.49	203.88	224.13	231.07
Sole parent with children	316.22	322.98	326.82	333.01	335.18	340.13	341.98	372.28	376.64	382.07	388.90	431.91	445.98
SPS[3]	316.22	322.98	326.82	333.01	335.18	340.13	341.98	372.28	376.64	382.07	388.90	431.91	445.98
SLP[4]													
Single, 16-17	220.09	224.40	227.61	231.64	233.05	236.27	237.47	237.47	240.09	243.35	247.46	284.20	293.70
Single, 18+	272.26	278.16	282.28	287.69	289.58	293.90	295.51	295.51	299.02	303.40	308.91	349.45	360.97
Couple (each)	226.64	231.09	234.39	238.54	239.99	243.30	244.54	244.54	247.23	250.59	254.83	277.29	286.57
Sole parent with children	366.75	374.51	378.00	385.10	387.58	393.24	395.36	425.67	430.61	436.78	444.55	489.28	505.13

Source: Work and Income and Ministry of Social Development

Notes: 1. The over 3 percent rise in main benefit rates on 1 April 2020 was from the indexation to the increased wage rates instead of the Consumer Price Index. 2. UB, WB (with no children or youngest children older than 14) and DPB (single parents with no children or children older than 14 and women without children) were revised to JS on 15 July 2013. 3. WB (with children under 14) and DPB (single parents with children under 14) were revised to SPS on 15 July 2013. 4. IB and DPB (full-time caregivers) were revised to SLP on 15 July 2013.

Figure 2.2 Trends in share of main benefits among 55-64 years olds



Source: Ministry of Social Development, Benefit Fact Sheets (2003-2020) and Statistics New Zealand, Population Estimates.
Notes: The calculation is based on annual-March data, except for 1998, which is annual-December data.

2.2.2 New Zealand Superannuation

The history of public pensions in NZ began more than a hundred years ago. In 1898, the Old Age Pension was established as one of the first public pensions anywhere in the world. It was then regularly changed over the subsequent decades.[13] Several major changes occurred, which had a significant impact on people's retirement decision making.

Between 1940 and 1974, the public pension was a two-step age pension, means-tested from age 60 to 64 and universal from age 65. In 1975, the public pension scheme was changed to compulsory contributory superannuation, requiring all employers and employees to contribute at specific rates to retirement funding. In the following year, the short-lived compulsory contributory superannuation was repealed. In 1977, the government introduced the taxable universal National Superannuation from age 60. It was then followed by the imposition of a National Superannuation surcharge of 25 cents for every dollar on the superannuitant's other taxable income in excess of $100 a week in 1984. In 1990, the name was changed to Guaranteed Retirement Income and the previous residential criteria of requiring a person to reside in NZ for ten years since 16 was tightened. In 1991, the name was changed back to National Superannuation. Beginning in April 1992, with a scheduled incremental rise in the age of eligibility of 3 months for

[13] Source: 1. PensionBriefing 05/2008, The Retirement Policy and Research Centre, University of Auckland. 2. Periodic Report Group 2003, Ministry of Social Development.

every 6 months in calendar time, the state pension eligibility age was gradually raised from 60 to 65 with this ending in 2001. In 1993, the pension name was changed to "New Zealand Superannuation". The Transitional Retirement Benefit was introduced in 1994 to support those affected by the rise in pension age from 60 to 65. In 1998, the tax surcharge introduced in 1984 was abolished. Later that year, the net amount of NZS paid to a couple (both qualified) was reduced from 65 percent to 60 percent of the net average weekly wage. It was restored to 65 percent in 2000 and raised to 66 percent in 2005.

Currently, NZS is granted to individuals aged 65 and over. It is a universal payment to all individuals based solely on residency criteria and partnership status, and imposes no means-testing whatsoever for other income or assets.[14] To meet the residency criteria, an individual must be a NZ citizen or a permanent resident and have resided in NZ at least 10 years after the age of 20 and 5 years after the age of 50. Individuals who are qualified for NZS can include their non-qualified partners in their NZS payments at a slightly lower rate than if they were both qualified (see Table 2.4). Their combined income is means-tested in this situation, with a current reduction rate of 70 cents for every dollar of NZS if their combined income is more than $160 per week. In addition, after 9 November 2020, individuals who previously excluded their non-qualified partners from NZS payments were not able to re-include them. Instead, their partners could apply for a benefit. The NZS rates are adjusted in line with the combination of the Consumer Price Index (CPI) and wage rates (St John & Ashton, 1993).[15]

The receipt of NZS is not an automatic process but rather relies on eligible New Zealanders applying for this benefit prior to or after reaching pension age. Individuals can apply for NZS 12 weeks before their 65th birthday. No earlier submission is permitted, and any late submission will affect the timing of the receipt NZS. Moreover, any missing payment will not be backdated if someone has a late submission. The application process is time consuming. First, individuals need to complete a 24-page application form, providing details about themselves and their partners. Second, they need to collect all supporting materials, and transmit them to the MSD as part of the application process. Finally, MSD will determine whether or not a face-to-face meeting is needed prior to the payment. Applicants now will often be contacted by email about any incomplete

[14] Partnership is defined as two people of opposite or same sex living together in a genuine and stable relationship in any of the following situations: a legal marriage, a civil union, or a de facto relationship.
[15] Section 15 of New Zealand Superannuation and Retirement Income Act 2001 indicates that the annual rates of NZS will be adjusted by CPI.

information in their applications. Applicants are subsequently notified if their applications have been successful.

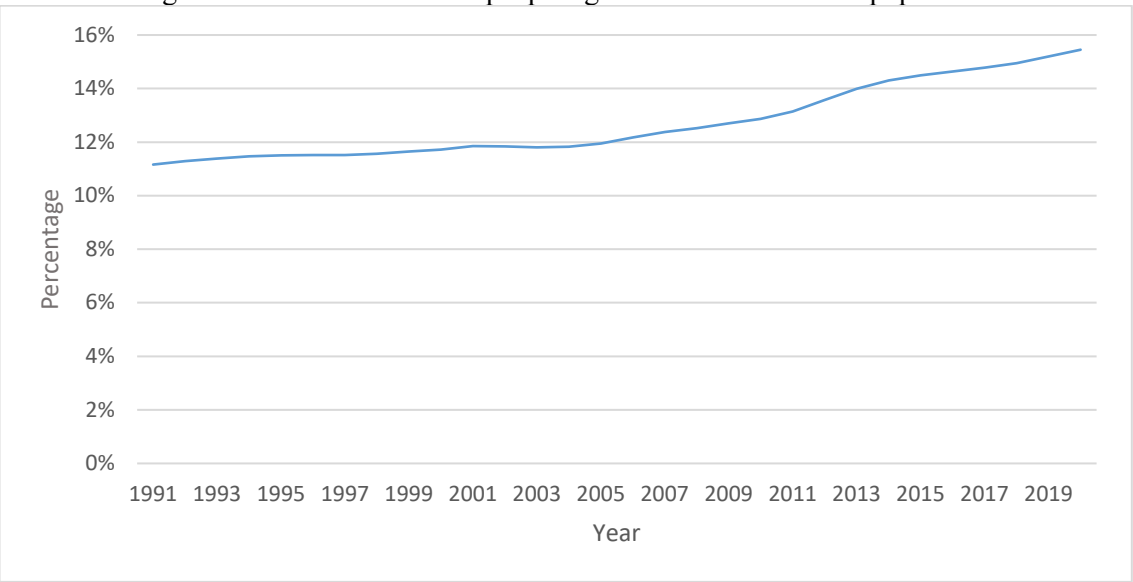
Table 2.4 Non-means-tested NZS, nominal gross weekly rates, $, 1 April of each year

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Single, living alone	364.50	373.56	389.14	400.07	410.32	421.76	431.10	443.43	450.10	463.04	475.42	490.73	506.64
Single, sharing	334.28	342.58	357.40	367.45	377.05	387.58	396.17	407.53	413.60	425.55	437.14	451.29	466.03
Couple, both qualify (each)	273.63	280.62	294.08	302.40	310.34	319.23	326.30	335.74	340.80	350.76	360.42	372.27	384.46
Couple, only one qualify but include unqualified partner (each)	259.86	265.86	278.31	286.29	293.73	302.27	309.04	318.10	322.78	332.34	341.43	352.63	364.32

Source: Work and Income and Ministry of Social Development

Figure 2.3 shows the trends in share of people aged 65 and over as a fraction of the total population since 1991. It indicates that the percentage of people aged 65 and over has risen from 11.1 percent in 1991 to 15.5 percent in 2020.

Figure 2.3 Trends in share of people aged 65 and over to total population



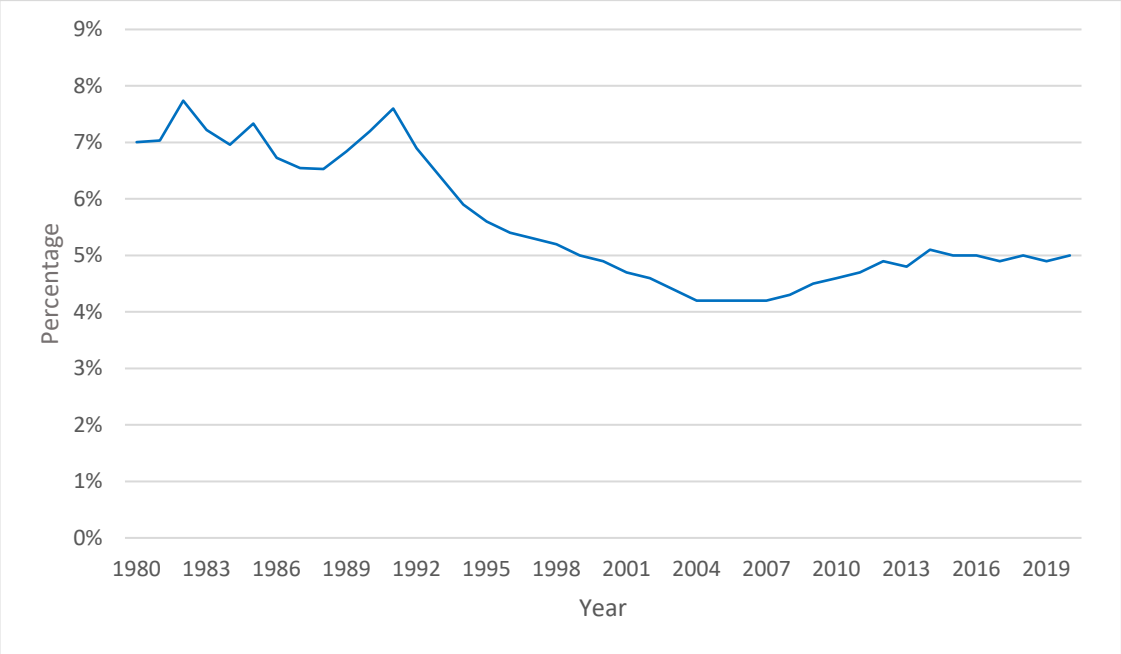
Source: Statistics New Zealand, *Infoshare*
Notes: The earliest data for population estimates is available since 1991.

NZS is funded from general taxation on a pay-as-you-go basis. The government uses current tax revenues to pay for the current pension expenditures. From 1980 to 1991, NZ's percentage of GDP spent on pensions (ranging from 6.5 to 7.6 percent) was consistently higher than the OECD average (ranging from 5.7 to 6.5 percent).[16] It reached the highest of 7.6 percent in 1991 (Figure 2.4). To retain public financial sustainability in the face of rising pension costs, the government raised the pension age from 60 to 65 in a gradual process that lasted from 1992 to 2001. After the pension age reform, the percentage of GDP spent on pensions fell by 3.4 percentage points till 2007. This offered evidence that raising the pension age did reduce the government's financial burden. An upward trend in public pensions as a percentage of GDP began in 2008, which largely resulted from the rapidly aging population. After 2014, the trend remained relatively flat until 2020, which could be attributed to an increase in LFPRs among older age cohorts offsetting the rise in GDP. In comparison to 1992, the fiscal burden on NZS seems to have decreased over this period. However, taking into account the rising LFPRs of older age cohorts, especially those aged 65 and over (21 percent in 2014 and continuing to rise, see Figure 2.5 in Section 2.4), their contribution to GDP helped to hold the rate flat.

[16] Source: OECD (2021), Pension spending (indicator). doi: 10.1787/a041f4ef-en.

Without the large labour force participation of the older age cohorts, there may have been a sharp rise in the trend since 2014, which will result in a rise in fiscal pressure. Thus, a better understanding of individuals' labour supply behaviour around pension age is critical because it can provide new insights to the NZ Government on how to maintain fiscal sustainability.

Figure 2.4 Trends in share of NZS expenditure as a percentage of GDP



Source: Information of 1980 to 1998 is from OECD (2021), Pension spending (indicator). doi: 10.1787/a041f4ef-en. Information of 2019 and 2020 is from Financial Statements of the Government of New Zealand, June 2020, The Treasury.

In contrast to the means-tested main benefits discussed in Section 2.2.1, NZS is not means-tested. It essentially has an unlimited income disregard, which is just a lump sum amount paid to all individuals regardless of other income received. This is in terms of gross NZS, not net NZS. The net NZS does depend on other income received because it forms part of the individual's taxable income. Unlike a NIT-type structure, there is no change in effective wage rates. Where means-testing creates work disincentives by both lowering the effective wage rate as well as raising non-labour income, NZS does not create any work disincentive (except to the extent that higher non-work income might reduce the marginal utility of income). In other words, the labour supply change caused by NZS at pension age should be less than that caused by a means-tested structure.

At the same time, employers are not allowed to specify a mandatory retirement age in employment contracts under the Human Rights Act 1993. This also encourages individuals to continue working after being pension eligible. Thus, it became critical to

examine the labour supply impact of NZS and the Human Rights Act 1993, where NZS has a negative impact on people's labour supply while the Human Rights Act 1993 has a positive effect. This, however, cannot be investigated due to data limitations.

2.2.3 Supplementary Benefits

Supplementary benefits are intended to assist low-income individuals with specific needs such as housing, childcare, heating, disability, and one-off or unexpected costs. They are all means-tested, with some also being asset-tested. Supplementary benefits, in contrast to taxable main benefits and NZS, are not taxable. They are available to low-income people aged 16 and over. The residency criteria for supplementary benefits are the same as those for the main benefits (see Section 2.2.1).

The Accommodation Supplement (AS), Disability Allowance (DA), Temporary Additional Support (TAS), and Special Needs Grants (SNGs) are the major supplementary benefits. AS is a weekly entitlement paid to low-income individuals (who do not live in public housing) for rent, board, and mortgage payments. It is means-tested as well as asset-tested. The rates (Table 2.5) vary depending on where a person lives. From 2009 to 2017, the rates remained unchanged and were adjusted in 2018. At the end of March 2018, there were 279,283 people receiving AS, of which 67 percent also received main benefits, 14 percent received NZS or Veteran's Pension, and 19 percent were non-beneficiaries.[17] It shows how common it is for a main benefit recipient to claim AS at the same time. DA is a weekly payment designed to help people who face ongoing expenses as a result of a health condition or disability. The number of people receiving DA at the end of March 2018 was 232,243, with approximately 55 percent also receiving NZS. People who were on health-related main benefits, are also likely to receive DA at the same time. TAS and SNGs are the last options for those in need of assistance with basic living expenses or emergency costs. The rates of TAS are determined by each person's situation and can be paid for a maximum of 13 weeks. At the end of March 2018, 63,067 individuals received TAS. SNGs are often one-off payments directly paid to the suppliers. At the end of March 2018, 186,119 SNGs were granted. Due to the high cost of accommodation, the majority of people got TAS and AS at the same time.

[17] All information of supplementary benefits is from The Income Support System, Welfare Expert Advisory Group (WEAG).
The most updated information is March 2018.

The statistics above indicate that it is more likely for a person to claim both main benefits and supplementary benefits at the same time rather than NZS and supplementary benefits. This may be due to the fact that main benefits and supplementary benefits have similar eligibility criteria.

Table 2.5 Accommodation Supplement (AS) and Disability Allowance (DA), nominal gross weekly rates, $, 1 April of each year

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
AS													
	Area 1												
Single	145	145	145	145	145	145	145	145	145	165	165	165	165
Couple	160	160	160	160	160	160	160	160	160	235	235	235	235
Couple with kids	225	225	225	225	225	225	225	225	225	305	305	305	305
	Area 2												
Single	100	100	100	100	100	100	100	100	100	105	105	105	105
Couple	125	125	125	125	125	125	125	125	125	155	155	155	155
Couple with kids	165	165	165	165	165	165	165	165	165	220	220	220	220
	Area 3												
Single	65	65	65	65	65	65	65	65	65	80	80	80	80
Couple	75	75	75	75	75	75	75	75	75	105	105	105	105
Couple with kids	120	120	120	120	120	120	120	120	120	160	160	160	160
	Area 4												
Single	45	45	45	45	45	45	45	45	45	70	70	70	70
Couple	55	55	55	55	55	55	55	55	55	80	80	80	80
Couple with kids	75	75	75	75	75	75	75	75	75	120	120	120	120
DA													
Standard	55.88	56.98	59.12	60.17	60.54	61.38	61.69	61.69	62.37	63.22	64.29	65.36	66.11
Special	34.87	35.55	36.88	37.53	37.76	38.28	38.48	38.48	38.90	39.43	40.10	40.77	41.24

Source: Work and Income and Ministry of Social Development

2.3 KiwiSaver

KiwiSaver, which was introduced in 2007, is a voluntary, work-based savings scheme initiative to provide a better living standard when people retire. It is a save-as-you-go scheme, where employees can choose to contribute to KiwiSaver at the rate of 3, 4, 6, 8, or 10 percent of their gross salary, together with employers' usual contribution of at least 3 percent. Furthermore, the NZ Government provides participants with an annual member tax credit, which is 50 cents for every dollar an individual contributes, up to a maximum annual amount of $521.43. Contributions to KiwiSaver are invested by scheme-approved providers.

Unlike NZS, Kiwisaver has no residency requirements. It just requires an individual to have citizenship or to be able to live permanently in NZ. Kiwisaver is open to people of all ages. Individuals over the age of 18 may enter Kiwisaver either directly through their employer or through a Kiwisaver scheme provider. At least one legal guardian must sign the application if the applicant is between the ages of 16 and 17. Under the age of 16, the consent of all legal guardians is required.

Normally, an individual would be able to access the money when reaching age 65. However, it could also be accessed earlier under certain circumstances, such as serious illness, purchasing the first house, or experiencing financial hardship. The condition for withdrawing the funds of KiwiSaver for a first home is being a member of the scheme for more than 3 years where at least $1,000 must remain in the account after this withdrawal.

Though having only been in existence for a short while, the take-up rate of Kiwisaver for those aged 15 to 64 jumped to 64 percent in 2011, the highest among OECD countries for voluntary pension schemes (OECD, 2013). While Kiwisaver provides additional income for older New Zealanders, it doesn't do anything to reduce the fiscal burden of the NZS.

This study does not include an analysis of Kiwisaver for three reasons. First, since Kiwisaver was only introduced in 2007, the cohorts' maximum years of contribution are too short. For example, the youngest cohort evaluated in this study only contributed a maximum of 5 years to Kiwisaver, which may have little impact on the overall pension amount.[18] The oldest cohort was already 67 years old when Kiwisaver was introduced. They were unable to make any contribution to the fund before reaching age 65. Second,

[18] The cohorts evaluated in this study were people born between 1940 to 1947.

Inland Revenue does not have administrative data on Kiwisaver. Third, the government contribution to Kiwisaver is significantly lower than the expense of NZS, with Kiwisaver accounting for an average of 1.3 percent of total government expenditures versus 14.8 percent of NZS from 2008 to 2020.[19]

2.4 Labour Supply Behaviour of Individuals Aged 55 and Over

2.4.1 LFPR and Unemployment Rate

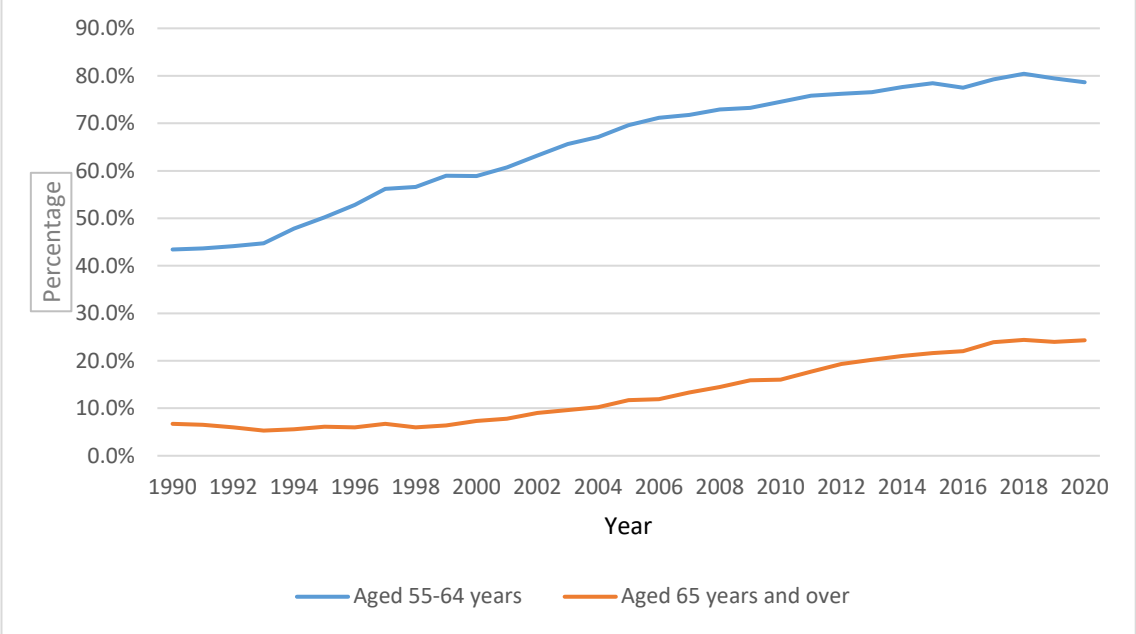
The LFPR of individuals aged 55 and over, has been increasing since 1990 (Figure 2.5). In these diagrams, LFPR is measured as the ratio of people who were either employed or unemployed to the total population. The LFPR for individuals aged 55 to 64 nearly doubled from 43.4 percent in 1990 to 78.6 in 2020. The LFPR for people aged 65 and over increased nearly fourfold from 6.7 percent in 1990 to 24.3 percent in 2020 – a higher rate of increase than that for those aged 55 to 64 where the participation rate roughly doubled.

The increase in LFPR was even greater for people aged 65 to 69 than in any other age group (Figure 2.6). The rate rose by more than fourfold just in the last two decades alone. This suggests that an increasing number of superannuitants are extending their working lives, either full-time or part-time (Khawaja et al., 2009).

The average LFPR of individuals aged 55 to 64 was 50 percentage points higher than those aged 65 and over between 1990 and 2020. This indicates a significant cultural convention that age 65 is the typical, expected age of retirement. But the magnitude of the impact and how it affects different subgroups is worth noting.

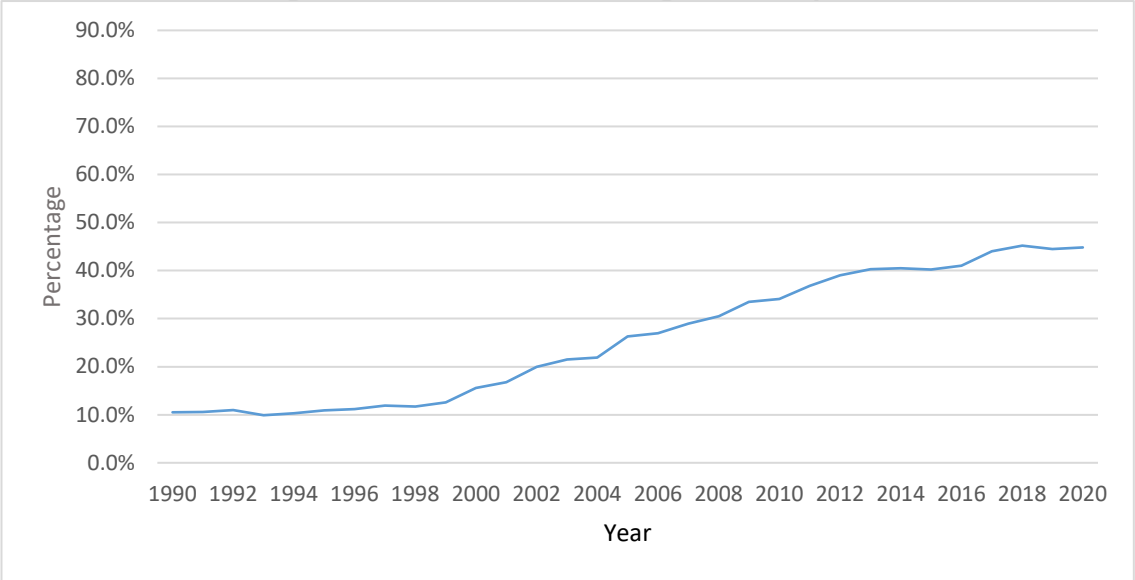
[19] Source: Financial Statements of the Government of New Zealand (2008-2020), The Treasury.

Figure 2.5 LFPR for individuals aged 55 and over



Source: Statistics New Zealand, *Infoshare*, *Household Labour Force Survey*
Notes: Rates in Figure 2.5, Figure 2.6, and Figure 2.7 were all annual March rates.

Figure 2.6 LFPR for individuals aged 65 to 69 years

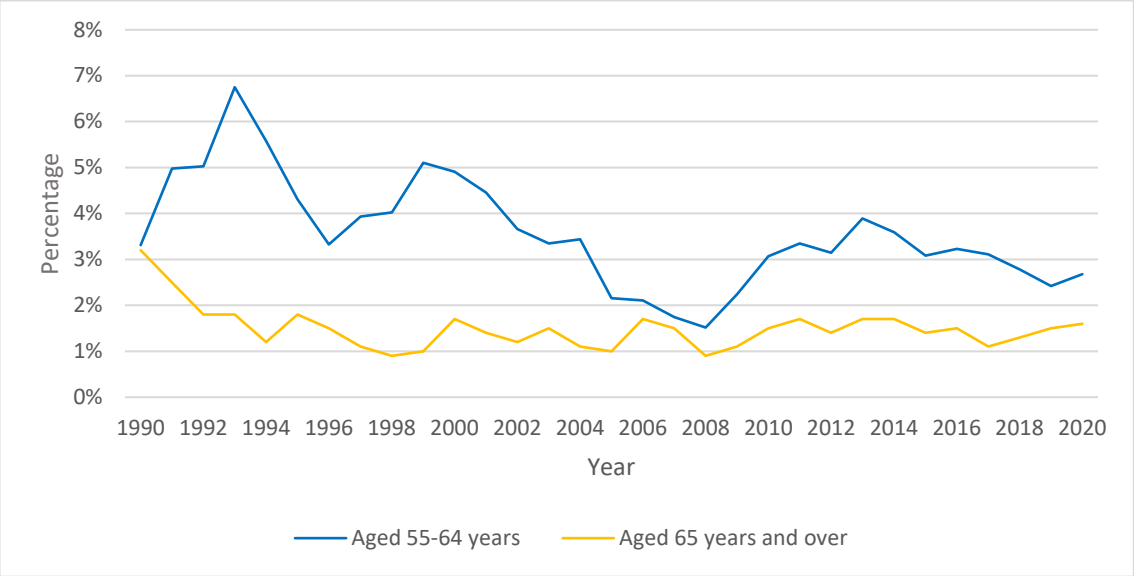


Source: Statistics New Zealand, *Infoshare*, *Household Labour Force Survey*

In comparison to other OECD countries, NZ's unemployment rate is relatively low, particularly among the elderly (Figure 2.7). The unemployment rate is measured as the ratio of unemployed people (those actively seeking work) to the labour force. In 1990, the unemployment rate for people aged 65 and over peaked at 3.2 percent. Since then, it has declined steadily and remained below 2 percent. Even the Global Financial Crisis of 2008 did not have a significant impact on it. Due to the low unemployment rate, the employment rate of this cohort was quite similar to the LFPR. Thus, the changes in

employment rate are a good approximation for changes in LFPR (and therefore labour supply) for this older age group.

Figure 2.7 Unemployment rates for individuals aged 55 and over

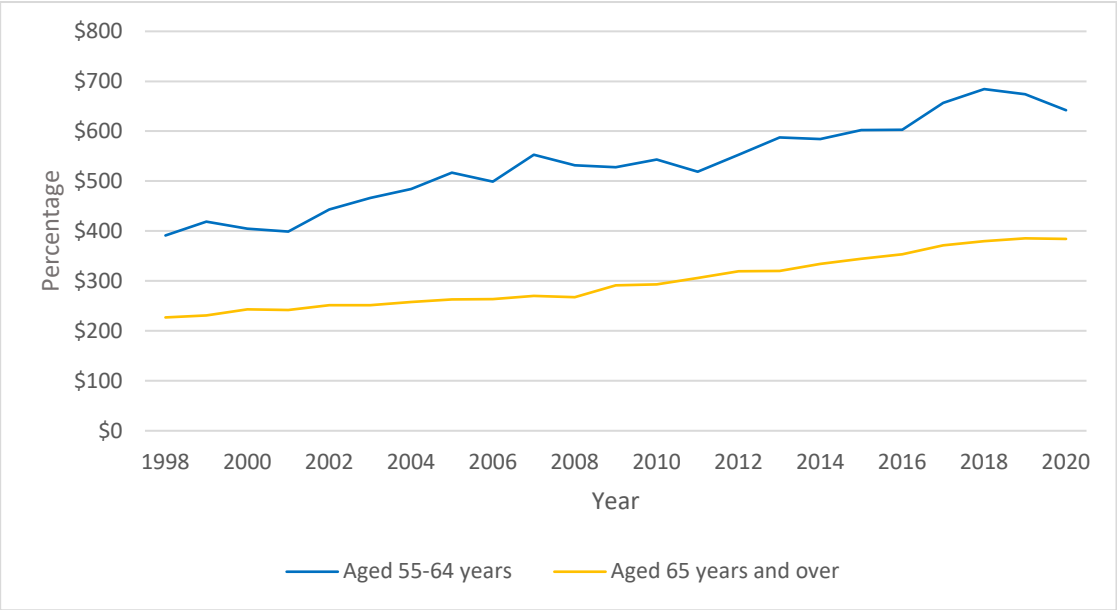


Source: Statistics New Zealand, *Infoshare*, *Household Labour Force Survey*

2.4.2 Average Income

The real average weekly income of those aged 55 and over has been increasing since 1998 (Figure 2.8). Incomes for those aged 65 and over were generally lower than those aged 55 to 64. This is expected because, in comparison to individuals aged 55 to 64, some people aged 65 and over have already left the labour force after reaching the normal retirement age of 65. Figure 2.8 only shows the average weekly income of the two cohorts over the sample period. It does not track the income change as individuals age. Thus, documenting how income changes before and after receiving NZS becomes critical.

Figure 2.8 Average real weekly income for individuals aged 55 and over



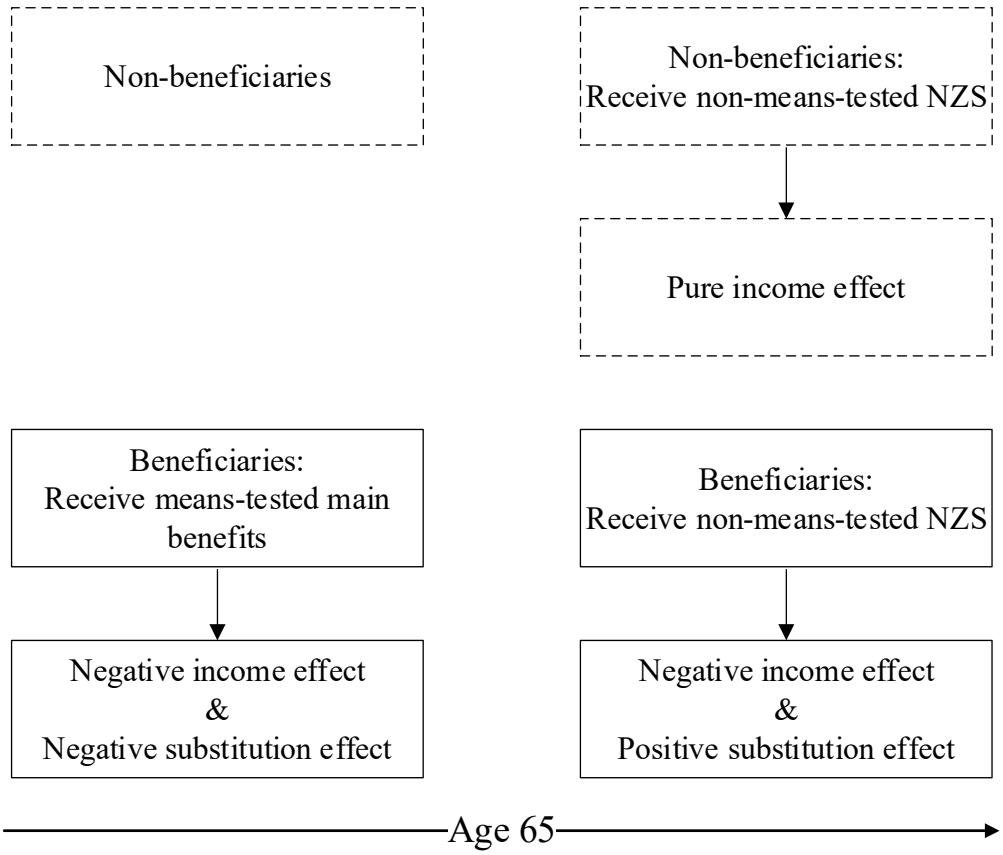
Source: Statistics New Zealand, http://nzdotstat.stats.govt.nz/wbos/Index.aspx?DataSetCode=TABLECODE7471
Notes: The earliest aggregate data for average income is available since 1998. The data only includes income from earnings, self-employment and government transfer payments, and the value is in 1998 NZ dollars.

2.4.3 Transition from Pre- to Post-65

Individuals can be divided into two groups at the time when they turn 65. The first group consists of people who were not on a main benefit. After reaching age 65, they may choose to exit the labour market due to a rise in the non-labour income of NZS.

The second group includes people who received main benefits. When this group reached 65, they transitioned from a means-tested main benefit scheme to a non-means-tested NZS. Two issues will arise during this process. The first issue is the change in labour supply behaviour. Before 65, they would be disincentivised from working, because of both negative income and substitution effects that we have already discussed that occur due to means-testing. After 65, their incentive to re-entering the labour force may increase because NZS is not means-tested. To the extent that NZS provides a higher payment than the main benefit, there might be income effects that discourage work; however, to the extent that NZS is not means-tested, the higher effective wage will encourage more work. The process is illustrated in Figure 2.9.

Figure 2.9 Labour supply behavioural change pre- and post-65



Source: Author's derivation according to Ministry of Social Development and labour supply model.

The second issue is that some beneficiaries might still prefer to remain on main benefits after 65. Comparing the main benefit (Table 2.3) and NZS rates (Table 2.4), the NZS payment is considerably higher than all main benefits. It would be reasonable to assume that all beneficiaries should have switched to the 'more generous' NZS after age 65. However, as discussed in Section 2.2.3, a person might be more likely to receive both main benefits and supplementary benefits or other forms of assistance at the same time. In addition, supplementary benefits are non-taxable, playing the role of a bonus to the main benefits. In this case, it is possible that the total benefit amount a person receives will exceed NZS payments. As a result, they chose not to transit from main benefits to NZS after being pension eligible. On the other hand, some people may remain on main benefits after age 65 even if they would have received higher income by transitioning to NZS, which indicates a take-up issue.

Based on the above analysis, it is of need to investigate the labour supply effects of beneficiaries and non-beneficiaries upon reaching pension age separately. Our hypothesis is that those who are not on a main benefit will be more likely to reduce their labour

supply; whilst those on a main benefit may increase or decrease their labour supply depending on the strength of the income and substitution effects.

2.5 Theoretical Framework

The theoretical frameworks for the retirement incentives and labour supply models, both static and dynamic labour supply models (Killingsworth, 1983; Myck & Reed, 2006), as well as Permanent Income hypothesis (PIH) (Friedman, 1957), that are relevant for this study are analysed in this section.

There is no universal agreement on the definition of 'retirement'. One possible definition of retirement is simply a transition from fully employed to being entirely out of the labour force (i.e., someone wanted to work zero hours). Another possible definition is ceasing regular, career-type jobs (e.g., dropping from full-time to part-time work, changing the type of work, or working intermittently). Under the first definition, part-time work then means that individuals haven't yet retired. These alternative definitions are reflected in different contributions to the literature.

A number of papers have noted that a typical retirement transition process is from full-time to no work, instead of gradually reducing working hours (Blundell, French, & Tetlow, 2016; Chandler & Tetlow, 2014; Chang & Kim, 2006; Chetty, Guren, Manoli, & Weber, 2011; Erosa, Fuster, & Kambourov, 2016; Ljungqvist & Sargent, 2014; Ljungqvist, Sargent, Blanchard, & Prescott, 2006). For example, Blundell et al. (2016) showed that employment rates dropped sharply between ages 62 and 65 in the United States, while hours of work among those remaining in employment declined slightly, which is consistent with the finding of Rupert and Zanella (2015). They showed that part-time work was very rare around retirement age in the United States. Similarly, employment rates declined dramatically after age 60 in France, while hours worked for those continuing to work dropped modestly. Chandler and Tetlow (2014) found that 68 percent of males and 60 percent of females transitioned directly from full-time to no work after retirement between 2002-03 and 2012-13 in the United Kingdom. However, some individuals do take partial retirement process or re-enter the labour market after initial retirement (Maestas, 2010; Ruhm, 1990).

This thesis defines retirement as a simple transition from being employed to being entirely out of work for people aged 65 and over. Three reasons are given. Firstly, we want to include people who enter retirement with a history of part-time work. Secondly, working

hours information is not available in the Integrated Data Infrastructure (see Section 4.3), which prevents us from knowing who is fully employed. Thirdly, labour force status is not observable in administrative data. All we know is whether a person is working or not in a month. Their unemployment status (i.e., actively searching and available for work) is not available.

2.5.1 Static Labour Supply Model

In neoclassical models, it's assumed that individual labour supply decisions are a result of utility maximization subject to constraints. Under the static (single-period) labour supply model, the individual's utility depends on his tastes and the amount of consumption and hours of leisure that he consumes per period. The model assumes everything is done in a single period. Variation in time (i.e., multiple periods) is not taken into account.

A simple static labour supply model looks at individuals who choose to work or not at a given wage. A static labour supply approach models individual's utility or well-being by maximizing a utility function over consumption and leisure at a point in time:

$$U(C, L) \tag{2.1}$$

subject to a budget constraint:

$$PC = W(T - L) + Y \tag{2.2}$$

Where C is individual consumption, P is the price level, W is the individual wage, L is leisure, Y is unearned income, and T is the fixed total available time for an individual per period. The left-hand side of the budget constraint is total expenditure. The right-hand side is total income, including all earnings and nonlabour income. In other words, it means an individual "spends" his "available income" on consumption to maximize his utility. An optimal choice of leisure and consumption (C^*, L^*) maximizes the individual's utility.

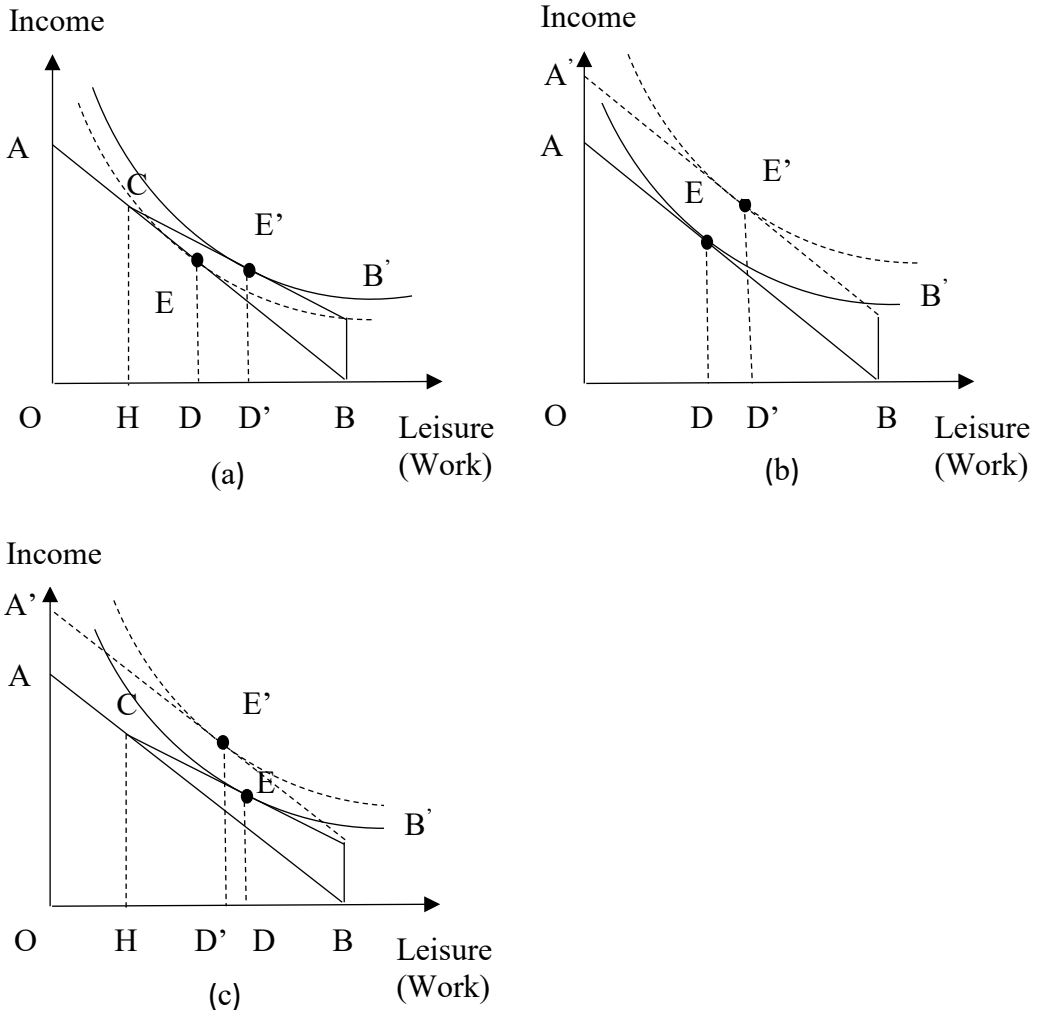
With transfer payments from the government, such as health-related or pension benefits, this thesis uses Figure 2.10 to illustrate the resulting changes in optimal choices. Figure 2.10 captures the difference in budget constraints under a standard means-tested pension (or main benefits) scheme (a) and a non-means-tested pension system (b) like NZS, as well as a combination of them (c). In Figure 2.10 (a), AB is the budget constraint in the absence of a pension (or main benefits). The slope of AB represents the after-tax hourly

wage, W. ACB' represents the effective budget constraint when a person faces a means-tested pension (or main benefits). In this case, individuals face a uniformly lower effective wage rate (price of leisure) while they're receiving some benefits. This benefit-reduction-rate creates a greater work disincentive generated by both substitution and income effects (working hours reduce from DB to $D'B$), with the slope of CB' being less than W. At H, the entire amount of the pension (or main benefits) drops to zero with this work income (AKA the breakeven point). That is, if a person works more than H hours per week, he or she will not receive any pension (or main benefits).

In contrast to the means-tested pension scheme displayed in Figure 2.10 (a), Figure 2.10 (b) presents the non-means-tested NZS. Unlike the segments connected to budget constraint in (a), (b) shows a simple parallel budget constraint shifting the effective budget constraint from AB to $A'B'$, with the effective wage rate remaining constant as W. All NZS recipients face a pure income effect, which leads to an increase in leisure consumption from OD to OD' , assuming leisure is a normal good. On the other hand, working hours reduce from DB to $D'B$.

Based on the discussion in Section 2.4.3, main beneficiaries face an effective budget constraint of ACB' in Figure 2.10 (c) before age 65. The uniformly lower effective wage rate creates a work disincentive, with the slope of CB' being less than W. The working hours under main benefits is DB. After being pension eligible, they transition from the means-tested main benefits to the non-means-tested NZS. Their budget constraint while on the benefit effectively changes from ACB' to $A'B'$, with an increase in the effective wage rate back to W. People face a substitution effect that increases their labour supply. At the same time, they face an income effect generated by NZS, which will most likely lead to a decrease in labour supply. The specific impact of this change on individual labour supply will depend on whether the substitution or income effect dominates. Figure 2.10 (c) assumes that the substitution effect dominates, leading to an increase in optimal working hours of $D'D$. But other possibilities might occur, with income effect dominates or substitution effect equals to the income effect. The impact on aggregate labour supply in such a situation is ultimately an empirical question.

Figure 2.10 Annual budget constraint under means-tested and non-means-tested pension



Source: Author's derivation of static labour supply models.

In a simple static labour supply framework, three basic factors would affect retirement, such as changes in budget constraints, non-labour income, and indifference curves.

When budget constraint becomes much flatter (e.g., wages drop or, in the extreme, jobs disappear), this could be related to the depreciation of human capital, which has been discussed by Blundell et al. (2016). Fan, Seshadri, and Taber (2022) found that as human capital depreciates as people age, there is an incentive to cluster the working hours in a short amount of time. The reduction in working hours normally results in a reduction in future wages, which leads people to keep working a high number of hours before retirement. Fan (2015) showed that people in the United States with defined benefit pensions are more likely to make a direct transition from full-time work to non-work than

those without such pension schemes, because the value of the pension benefit is a function of their final salary. A reduction in working hours would lead to lower earnings and thus pension benefits, which would prevent them from transitioning gradually from full-time work to retirement. However, NZS is a universal payment, which is determined only by age, partnership status, and resident requirements. It does not relate to individuals' salary histories or contribution years. That is to say, the depreciation of human capital in some sense affects the retirement incentives of New Zealanders, but this effect would be less than in countries with a defined benefit pension, such as the United States.

Higher indifference curves will be attained when non-labour income increases (e.g., returns from savings or availability of pension), resulting in higher levels of utility. When indifference curves become 'steeper' (reflecting an age-related change in preferences/health/culture norm, etc.), an increase in the reservation wage or the effective value of non-work time in making optimal labour supply decisions would occur. For example, people's retirement behaviour is strongly affected by declining health (Blundell et al., 2016). In the first place, declining health makes it less pleasant to work and it reduces work productivity. Second, health shocks may occur and thus reduce life expectancy, which eventually affects the amount of savings needed for retirement. Third, it makes an individual more likely to qualify for health-related benefits, which motivates them to exit from work. Gustman and Steinmeier (2018) discovered that health is a crucial determinant in determining early retirement, with current population health reducing retirement age by one year when compared to those in good health. However, the third factor has less impact in the case of NZ. As NZS rate is more generous than other main benefit rates (see Section 2.2), individuals would prefer choosing NZS instead of health-related benefits. In addition, NZS is not means-tested. That is, individuals with some health issues may remain in the labour force with fewer working hours, receiving NZS at the same time.

Other retirement incentives could also affect the decisions of whether to continue working or not while reaching retirement age, such as fixed costs of work and financial incentives (substitution effects, wealth effects, and liquidity effects) (Blundell et al., 2016).

Fixed costs associated with working may partly affect retirement decisions, including transportation and food costs. For example, Juster and Stafford (1991) estimated that the mean time in transportation ranges from 7 percent to 10 percent of market work time in several countries. Banks, Blundell, and Tanner (1998) found an average of 20 percent

reduction in spending at retirement in Britain, which is partly due to transportation and food costs. Employers may also have work-related fix costs, including recruiting, hiring, employee training, and other firm-related costs, which would be spread over to employees (Blundell et al., 2016). These imply that working part-time after retirement is less advantageous for an individual (French, 2005).

Financial incentives play important roles in determining retirement behaviour, such as substitution effects, wealth effects, and liquidity effects (Blundell et al., 2016). Substitution effects indicate the relative attractiveness of working could be affected by the change in wage opportunities as people age, implicit tax rates, benefits, and pension systems. Wealth effects indicate the redistribution or insurance aspect of public pensions, which has a significant impact on those with low income. Liquidity effects indicate the liquidity of public pensions. Public pensions tend to be illiquid because people cannot borrow against future benefits. In other words, many people cannot finance their retirement until they are eligible for a pension. However, people may delay retirement if public pensions crowd out private savings that would have been more liquid.

Several factors specifically affect the retirement incentives under public pension systems (Blundell et al., 2016). Firstly, earnings test has a significant impact on the employment of the elderly, particularly for older men (Baker & Benjamin, 1999; Blinder, Gordon, & Wise, 1980; Brinch, Vestad, & Zweimüller, 2015; Disney & Smith, 2002; Friedberg, 2000; Gelber, Jones, & Sacks, 2013; Haider & Loughran, 2001; Song & Manchester, 2007). This is because earnings test will affect the budget constraint that people face when reaching retirement age.

Secondly, actuarial adjustments for delayed claimant of public pension affect people's retirement decisions. For example, Pingle (2006) found that the Delayed Retirement Credit (DRC) in the United Stated had a positive effect on employment for older workers. However, Crawford and Tetlow (2008) found that actuarial adjustments had little impact on the timing of pension claims between state pension age and 75, which means it had little impact on people's employment rate.

Third, changing the early and normal retirement age could also affect retirement incentives. One possible explanation is that early and normal retirement age may include some social norm of 'retirement'. Gruber and Wise (2002) discovered that labour force exits are concentrated around early and normal retirement ages among eleven developed

countries. Some scholars tried to simulate the labour supply effects of changing either early or normal retirement age and found significant impacts (Coile & Gruber, 2000; Fields & Mitchell, 1984; French, 2005; Gustman & Steinmeier, 1985; Rust & Phelan, 1997). Other scholars found that the results of ex-post estimations showed even larger effects than the simulation results, because ex-post estimation often picked up the short-run changes in early and normal retirement ages (Atalay & Barrett, 2015; Börsch-Supan, 1992; Burtless & Moffitt, 1985; Cribb, Emmerson, & Tetlow, 2013; Pingle, 2006; Staubli & Zweimüller, 2013).

The last factor cited is benefit generosity. The more generous a program, the larger possibility people are going to retire early. For example, Snyder and Evans (2006) examined the impact of benefit generosity on labour supply by using the US 'notch' cohort in the period from 1917 to 1922, whose benefits were lower than those born earlier. They found that younger cohorts responded to lower incomes by increasing the post-retirement workforce. However, Krueger and Pischke (1992) found no evidence of the impact of benefit generosity on labour supply.

In the case of NZ, there is no means-testing on NZS. It is a universal payment (i.e., it doesn't relate to individual salary histories or contribution years, like some European countries and the United States), which is determined only by age, partnership status, and residency requirements. Under a static model, when people become pension eligible, NZS only generates a pure income effect on labour supply, without a substitution effect. This is very different from other public pension systems.

2.5.2 Dynamic Labour Supply Model

One can do 'comparative statics' with the static model (i.e., compare equilibria under different scenarios). Time is artificial under the static model, where the time dimension in the dynamic model is real.

To extend the static labour supply model to a dynamic framework, the simplest way is to change the one-period labour supply model in equation (2.1) to multiple periods, treating leisure and consumption at different times as different goods. The lifetime utility can be specified as:

$$U = U(C_0, L_0, C_1, L_1, \dots, C_T, L_T) \tag{2.3}$$

Where C_t is individual consumption at time t, L_t is leisure at time t, and an individual's lifetime runs from $t = 0$ to $t = T$.

A dynamic labour supply model generally assumes away credit constraints, allowing individuals to borrow from future income. Lifetime utility, U, is maximised subject to a binding budget constraint that assumes that individuals exhaust their lifetime income (i.e., they spend every dollar of their income over their lifetimes):

$$\sum_{t=0}^{T} \frac{P_t C_t}{(1+r)^t} = \sum_{t=0}^{T} \frac{W_t H_t + Y_t}{(1+r)^t} \tag{2.4}$$

where W_t ,P_t, H_t, and Y_t refer to the individual's wage rate, price level, hours worked, and unearned income at time t. Equation (2.4) assumes away any initial wealth/endowment and interest rate is assumed to be constant over time for convenience. It indicates that the present value of lifetime consumption must equal (or at least not exceed) the present value of lifetime income from all sources. Because individuals can borrow and save in a perfect capital market, total consumption does not need to equal to total income in a given period.

An optimal set of leisure and consumption levels over time $(C_0^*, L_0^*, C_0^*, L_0^*, \dots, C_T^*, L_T^*)$ it a biproduct of this lifetime utility maximisation. The optimal labour supply in a given period, H_t^*, is a function of wage rates and non-labour income at every age, can be denoted as:

$$H_t^* = f(W_0, W_1, \dots, W_T, Y_0, Y_1, \dots, Y_T) \tag{2.5}$$

One of the values of Y_t in equation (2.5) is NZS. In other words, NZS is affecting the labour supply at every period, not only at age 65 and older.

The dynamic labour supply model is closely related to the Permanent income hypothesis (PIH), which states that individuals would like to smooth consumption in lifetime (Friedman, 1957). The formal representation of the PIH specifies that:

$$c_p = k(r, z) y_p \tag{2.6}$$

$$y = y_p + y_t \tag{2.7}$$

$$c = c_p + c_t \tag{2.8}$$

where y indicates measured income as the sum of permanent income (y_p) and transitory income (y_t), c indicates measured consumption as the sum of permanent consumption (c_p) and transitory consumption (c_t). $k(r, z)$ stands for average (or marginal) propensity to consume out of permanent income that is related to rate of interest r and taste shifter z. Genuine fluctuations or measurement errors may be shown in the transitory components.

An important part of the PIH hypothesis is the assumption that the transitory components are uncorrelated with each other, as well as the permanent component, which indicates that transitory components do not affect individual consumption plans. Because NZS is fully anticipated, it is part of the permanent income, not transitory income.

Under the dynamic labour supply model, which is closely related to PIH, the optimal labour supply is determined at the beginning of life, with full information and a perfect capital market. NZS is non-labour income and could be thought of as fully anticipated at earlier ages. It should not only impact labour supply beginning at age 65, but at every age due to full information and perfect capital because people could borrow against the future. No sudden change in labour supply at the age 65 should be observed as a direct result of NZS eligibility. However, the dynamic labour supply framework (and PIH) could still hold if something else changed at 65, such as age-specific preferences, incapacities, changing wage rates, or the cultural norm of age 65 being the expected or normal age of retirement.

A sudden change in labour supply behaviour at age 65 would be consistent with the static labour supply model where non-labour income suddenly increases for the entire eligible population. Although the standard dynamic labour supply model would not predict a change in labour supply at age 65 because of NZS eligibility that can be fully anticipated, other factors that are related to this ageing process (declining wages and employment opportunities, worsening health, and adherence to a cultural norm of retiring at this age) could result in a similar change in labour supply at this age. Additionally, even within a more realistic dynamic framework, relaxing the assumptions of perfect information and a perfect capital market could also produce changes in labour supply at age 65.

2.6 Conclusions

This chapter provided background information on the structure of the social welfare system, labour supply behaviour of the old-age cohorts, retirement incentives, and labour

supply models that will be used in the subsequent analysis. The social welfare system in NZ allows a person, who is either on a main benefit or NZS, to receive supplementary benefits at the same time. Normally, the possibility of a person being on the main benefits and supplementary benefits is higher than those receiving both NZS and supplementary benefits. This raises the question of whether they will completely switch from the main benefits to NZS once they become pension eligible, since the total amount from the main benefits and supplementary benefits may exceed NZS payments (see Section 2.2.3).

The rising LFPR for people aged 55 and over stands out from all other OECD countries since 1990.[20] This may be largely related to a low initial rate in the early years with lower pension eligibility age and means-tested pension, as well as a strong increase in the subsequent years with the rising pension eligibility age and removal of means-testing on a pension. For those aged 55 to 64, NZ shared a rise of 81.1 percent in LFPR compared to 28.4 percent in average OECD countries between 1990 and 2020. This rate was even greater for people aged 65 and over, with almost fourfold for NZ, while average OECD countries had a rise of 49.0 percent over the same period of time. This forms a unique labour supply structure in NZ compared to other OECD countries, particularly under the non-means-tested NZS. Two strong incentives are identified. The first is to analyse the direct labour supply effect of the non-means-tested NZS at pension age. The second is to further examine the differential labour supply behaviour of beneficiaries and non-beneficiaries when people become pension eligible, since NZS has a differential impact on these two groups of people.

[20] For people aged 55 to 64, the LFPR for NZ was 43.4 percent in 1990 and 78.6 percent in 2020, 49.7 percent in 1990 and 63.8 in 2020 for average OECD countries. For people aged 65 and over, the LFPR for NZ was 6.5 percent in 1990 and 24.2 percent in 2020, 10.4 percent in 1990 and 15.5 in 2020 for average OECD countries.

3 Literature Review

3.1 Introduction

This chapter provides a brief overview of literature relating to the social welfare benefits take-up issues, income around pre- and post-retirement, and behavioural effects of pension eligibility.

First, the low take-up of the social security benefits and pensions are addressed. The take-up issues are commonly associated with means-tested social welfare programmes due to their complex income and asset tests (Cole, 1958; Hancock et al., 2004; Hemming, 1962; Hernanz et al., 2004; Van Oorschot, 1991). In addition, some evidence of supplementary benefits take-up issues is also found in New Zealand (NZ) (WEAG, 2018). Various perspectives on the causes of non-take-up issues are presented, which are significant for both academic and policy-making aspects. A number of recommendations are made to improve the uptake of social welfare benefits both internationally and domestically.

Second, literature about pre- and post-retirement income changes is discussed. The post-retirement income is closely related to the pension take-up rates (Barr & Diamond, 2006; Van Oorschot, 1991). Income inequality among subgroups, such as race, gender, and educational attainments, particularly in the post-retirement period are reviewed. The source of income before and after retirement is also discussed.

Finally, both international and domestic literature related to the impact of pension eligibility on labour market behaviour is reviewed. It summarises the findings of studies that examine the behavioural effects of pension eligibility with or without pension reform.

The following first section addresses the findings of take-up issues for social welfare benefits. The second section provides some discussion of several studies about pre- and post-retirement income. The third section provides an overview of the labour supply behaviour of pension eligibility both internationally and domestically. Finally, a brief conclusion is provided.

3.2 Take-up Issues for Social Welfare Benefits

The non-take-up of social security benefits suggests the ineffectiveness and injustice of a social security system, which could lead to poverty in later life (Van Oorschot, 1991). The ineffectiveness of a system means the aim of a 100 percent take-up rate is not met.

This issue may exist in any good social security scheme, which may be due to the inefficiency and applicant burden in the administrative process, a cultural norm in some places that people should support themselves as they age (Taylor-Gooby, 1976), or a failure of a political system. The injustice of the social security system implies the inequality between the claimants and non-claimants given their rights.

To date, the non-take-up of social security benefits has not received sufficient attention in many countries. With limited evidence, some literature has looked at the non-take-up of social security benefits in some OECD countries, including Canada, Denmark, France, Germany, Greece, Netherlands, NZ, the United Kingdom, and the United States (Cole, 1958; Hancock et al., 2004; Hemming, 1962; Hernanz et al., 2004; Van Oorschot, 1991). However, social assistance, supplementary benefits, family income supplements, and housing benefits comprised the majority of the social security benefits studied. Only a small amount of research has been done on the non-take-up of publicly-funded pension schemes.

In general, among the existing literature, the non-take-up rates were relatively high among the countries and programmes being reviewed (Hancock et al., 2004; Hernanz et al., 2004; Van Oorschot, 1991). The non-take-up rates for social assistance and housing programmes normally range from 20 to 60 percent, while unemployment benefits range from 20 to 40 percent.

Britain, with literature dating back to the 1960s, was one of the first countries to regularly investigate the non-take-up of the means-tested benefits (e.g., supplementary benefits, family income supplement, housing benefits, and one parent benefit) (Craig, 1991). Means-tested benefits had a high non-take-up rate, while non-means-tested benefits had a relatively low non-take-up rate. Hancock et al. (2004) discovered that 36 percent of pensioners did not take up at least one of the means-tested income support, housing benefit, or council tax benefit due to administration processes or social stigma related to these three types of benefits.

Various points of view have been expressed regarding the causes of non-take-up issues. Hernanz et al. (2004) argued that four reasons would result in high non-take-up rates, including pecuniary determinants, information costs, administrative costs, and cultural attitudes and social stigma. First, pecuniary determinants refer to both the generosity of the benefits and their duration, which is linked to the cost-benefit theory. If the potential gains outweigh the costs, individuals are more likely to apply for social welfare benefits.

For example, Warlick (1982) claimed that the take-up of Supplementary Security Income was positively related to the amount of Supplementary Security Income. Similarly, Riphahn (2001) stated that a larger expected benefit amount would increase the social assistance take-up rates. Another major factor affecting the pecuniary determinants is the tax system (Anderson & Meyer, 1997; Ashenfelter, 1983).

Second, information costs refer to the complexity of applying for a specific type of benefits, including the time and effort required in the application process. Some remote areas are more likely to have relatively higher non-take-up rates than areas with convenient administrative facilities if applications have to be lodged in person (Bramley, Lancaster, & Gordon, 2000; Daponte, Sanders, & Taylor, 1999; Warlick, 1982). Some other evidence about information costs is also available. For example, the majority of people who were eligible for food stamps in the United States but did not receive them is because they were unaware of the benefit (Coe, 1979). [21] According to Dorsett and Heady (1991) and Zedlewski (1999), if a beneficiary is currently claiming a benefit, which indirectly helps them gain more information about other benefits, their possibility of receiving other benefits increases. Zedlewski (1999) also found that the administrator will automatically assist beneficiaries in enrolling in another benefit programme or informing them of other possible benefits. Another factor that affects the information costs is geographic location. Bramley et al. (2000) stated that urban areas had relatively higher benefit take-up rates than rural areas because urban areas had more formal access to benefits information.

Third, administrative costs refer to the delayed administrative process and the uncertainty about the application outcomes. There are often time gaps between the application date and the issue date if a social security programme is not subject to automatic enrolment. Storer and Van Audenrode (1995) discovered that the unemployment benefit non-take-up rate among eligible beneficiaries was less than 50 percent within the first month between 1981 and 1986. Halpern and Hausman (1986) found that if the probability of a successful application was low, eligible individuals were less inclined to apply for benefits.

Fourth, cultural attitudes and social stigma are considered to be some of the key causes of high non-take-up rates. Moffitt (1983) found that social stigma significantly affected

[21] The Food Stamp program is aimed to provide low income families with nutritionally adequate diets (Coe, 1979).

the decision to take up social warfare benefits in the first place, but it varied less with the level of benefits once people were on welfare. Kayser and Frick (2000) found that individuals who were less attached to social groups and more pessimistic about life had relatively higher take-up rates.

Van Oorschot (1991) argued that three major problems could lead to non-take-up, including the complexity of the benefits scheme, the administration process, and individual claim behaviour. He concluded that non-take-up was significantly related to the means-tested benefits, which became a commonly held view in the following years. However, Currie (2004) found that the non-means-tested social security programs had the same non-take-up issue.

Some scholars discovered that the non-take-up issue is largely related to individual choice behaviour, rather than the administration process. McGarry (1996) claimed that the primary determinant of the elderly participating in the Supplemental Security Income was the financial situation of the eligible elderly, instead of the administration process. Menefee, Edwards, and Schieber (1981) argued that the non-take-up of Supplemental Security Income could be due to three individual behavioural factors. The first was the financial and human capital resources of the elderly. The second was the self-assessments of their lives and subjective needs. The final one was a lack of the awareness of the existence or application process for the benefit.

The take-up issues are commonly associated with means-tested social welfare programmes due to their complex income and asset tests (i.e., it is always difficult to identify who is and is not eligible for the benefits). Similarly, those who potentially could apply benefits find it difficult to determine as well. For example, people may not take-up unemployment benefits because they expect to take a job quickly and the short period of benefit receipt doesn't justify the application costs.

WEAG (2018) found some evidence of lower take-up with supplementary benefits in NZ, such as Accommodation Supplement (AS) and Temporary Additional Support (TAS). They found that it is possible that another 100,000 people (35 percent of the current AS recipients) are eligible for AS and approximately 33,000 to 53,000 people (54 to 87 percent of the current TAS recipients) are eligible for TAS but do not receive them. The lower take-up rates exist particularly among the working-age population who are not receiving a main benefit. They stated that the key reasons for lower take-up of income support in NZ include a lack of awareness of payments and eligibility criteria,

administration costs, stigma, and a lack of trust and confidence in agencies, which is in line with the international literature. Some of those reasons are due to the complexity of the policy and legislative settings.

More attention should be paid to the non-take-up issues by both academic research and policy analysis (Hernanz et al., 2004). To begin, the government should cut administrative costs by simplifying the application process, such as changing the manual application process to an automatically enrolling process.

Second, the government should try to minimize the information costs. This can be done through two methods. First, professional assistants should be provided to assist potential beneficiaries in filling out either paper or online applications, as Zedlewski (1999) discovered that with the assistance of professional assistants, take-up rates were significantly increased. Second, the government should promote public awareness of the availability of social security benefits and the application procedures in order to increase the number of people who apply for them.

Third, the government should have a careful design of the regulations and eligibility requirements for multiple welfare programmes, which could help increase information access as obtaining one form of benefit enhances the likelihood of receiving another.

Fourth, more research and empirical evidence are needed to assess the efficiency of the current social welfare system so that they could provide better advice for policymakers. Hernanz et al. (2004) urged the government to produce regular estimates of take-up rates for benefits and conduct further analysis into the reasons behind non-take-up issues.

In consistent with the international literature, WEAG (2018) provided several suggestions to improve the take-up of income support in NZ, such as simplifying the application process and making use of information and communication technologies across government, being proactive with applications and advising individuals of their possible eligibility, having reasonably constant and transparent eligibility criteria, advertising to increase the awareness of eligibility and application process, creating collaborations with local service providers, non-governmental organisations, labour unions, and employers to help inform the eligibility information, providing better measurement and monitor of take-up.

The non-take-up of pensions has similar reasons to the general social welfare benefits. The ethnic inequalities, which have been discussed by (Ginn & Arber, 2001; Steventon

& Sanchez, 2008; Vlachantoni et al., 2017), are one of the major concerns of the pension take-up issue. They found that the minority ethnic groups had relatively lower take-up rates for occupational and private pensions in the United Kingdom.

Gender gaps also exist in pension take-up rates. Even and Macpherson (1990) showed that females were 11 to 19 percent less likely to take up pensions than males. Similar results have been found by Bardasi and Jenkins (2010) in Britain.

Hurnard (2005) mentioned that the NZS take-up rate was estimated to be more than 95 percent of the age-eligible population. However, he did not mention how this rate was derived, nor how the sample population was constructed. In addition, he did not indicate whether this rate included those who failed to meet the residency requirements.

Dixon and Hyslop (2008) measured NZS take-up rates of people born between 1 April 1936 and 31 March 1940 over the observation period between 1 April 1999 and 31 March 2007 for both males and females, allowing at least two years before and after they reached 65. They found that the overall NZS take-up rate peaked at around 92 percent at the age of 66 and began to decrease in the following years. They did not mention any concerns about the low take-up rates, and explained that the decline in the take-up rates was most likely due to incorrect accounting of those who are resident in the country – and the decline could be due to death or emigration. One of the drawbacks of their study is that they lack the data to correctly identify the eligible population. In other words, some of those not taking up NZS may be ineligible due to residency requirements (an individual must be a NZ citizen or a permanent resident and have resided in NZ at least 10 years after the age of 20 and 5 years after the age of 50).

NZ government aims to grant and assess the full and correct entitlement to all eligible individuals (WEAG, 2018). However, Hurnard (2005) and Dixon and Hyslop (2008) found that after pension eligibility age, the maximum NZS take-up rates were around 95 percent and 92 percent, respectively. This falls far short of the government's objective of full and correct entitlement. Moreover, no concerns about the low take-up rates have been raised. As NZS has such simple eligibility criteria (age of 65, partnership, and residency criteria) and an unlimited benefit horizon, it would be fairly easy to identify the eligible population. In addition, once an individual takes it up, there would be no other factors affecting their decisions. Thus, identifying the take-up issue for NZS is critical.

3.3 Pre- and Post-Retirement Income Changes

As discussed in the previous section, low pension take-up rates would likely lead to low retirement income, resulting in poverty in post-retirement life (Barr & Diamond, 2006; Van Oorschot, 1991). People with less education, an intermittent employment history, low earnings and less accumulated wealth when entering retirement age were more likely to suffer from poverty after retirement (Chen, 1991; Crystal & Shea, 1990; O'Rand, 1996). In the United Kingdom, the average pre-retirement weekly income was substantially higher than the post-retirement income in 1994/1995. This pre- and post-retirement income gap was reduced in the years leading up to 2013/2014 (Department for Work and Pensions, 2014).

Income inequality exists among subgroups, such as race, gender, and educational attainments, particularly in the post-retirement period.

Choi (1997) estimated the role of Social Security and Supplementary Security Income and income from private sources. He found that ethnic income inequality grew among the elders between 1970 and 1990. This is especially serious for elderly singles among minority groups, such as Blacks, Hispanic groups, and females. In addition, he stated that Social Security was the most important source of income source for both elderly singles and couples after retirement. Brown (2016) studied wealth inequality among the Whites, Blacks, and Mexican Americans in their middle to elder life. Significant inequality was detected in their net wealth between Whites and the minority groups, with Whites having the highest net wealth, Mexican Americans second, Blacks the third. Whites experienced a rapid rate of accumulation of net wealth between their 50s and 60s, reaching the peak at age 66. As a result, the wealth inequality between Whites and minority groups increased. One of the major reasons that ethnic minority groups had relatively lower pension income than the Whites was because of the non-take-up of private and state pension benefits (Department for Work and Pensions, 2014). However, limited evidence shows that the minorities in other countries have lower take-up rates for publicly-funded pensions that are similar in nature of NZS. Heisig et al. (2018) looked into whether ethnic inequality persists in retirement income among 16 Western European countries and concluded that it does.

Gender gaps exist for average income among people both pre- and post-retirement ages. Before reaching retirement age, Johnson, Sambamoorthi, and Crystal (1999) found that for people with pension coverage who earned work-related income, males had 76 percent

higher median pension wealth than females in the United States. Differences in wages, years of job tenure, and industry would account for the majority of the gender gaps in average income. Females in less-advantaged employment situations in their middle ages remained in lower average income than males in their elder lives, which is similar to the findings of (Ginn & Arber, 1994; Woods, 1988). After reaching retirement age, the gender gap has been largely attributed to the difference in private pension schemes in the United Kingdom (Bardasi & Jenkins, 2010; Ginn & Arber, 1996). Of people aged over 65, only one-third of females received private pensions, while two-thirds of males received private pensions between 1993 and 1994 (Ginn & Arber, 1999). The same results have been discovered by Even and Macpherson (1994), with further evidence that females receive much lower pensions and total incomes than males. Even and Macpherson (2004) documented the gender gap difference in Social Security and private pensions and forecasted that even with the relative rise of females' private pensions in the next 20 years, a substantial gender gap still existed in pension wealth. This gender gap in private pension schemes indicates that females have a relatively lower labour supply in working years, which directly results in relatively lower pension benefits (Ginn & Arber, 1994; Woods, 1988). The gender gap in pension benefits was largely reduced when females had relatively higher private pension coverage rates (Barrientos, 1998).

Educational attainments had a considerable impact on midlife earnings for women born in the early post-war period. However, Crystal, Shea, and Krishnaswami (1992) argued that Social Security Income had an equalized effect on different educational groups for the elders, whereas private pensions and other retirement incomes were strongly dependent on educational backgrounds.

Limited research has been conducted on post-retirement income sources. According to Department for Work and Pensions (2014), the total pension income in the United Kingdom consisted of 43 percent of state benefits, 32 percent of private pensions, 16 percent of earnings, and 8 percent of investment income. Apart from the Social Security and National Insurance Trust pension benefits, Quartey, Kunawotor, and Danquah (2016) found that rental income, post-retirement employment, and remittances from family and friends played an important role in post-retirement income in Ghana. Pre-retirement income is largely determined by working in the labour market, whereas post-retirement income is mostly dependent on public and private pensions. It is a common misconception that post-retirement income is more evenly distributed than pre-retirement income (Fuchs, 1984; Hurd & Shoven, 1985). However, Crystal and Shea (1990) discovered that

the economic inequality after retirement was the greatest among the elderly. Later, Crystal, Shea, and Reyes (2017) expanded on their research in the 1990s by comparing economic inequality across age cohorts in 2010 with 1983-1984. They showed that income inequality increased during the post-retirement period, with a less steep age difference in 2010 than in 1983-1984. However, different pension systems play a significant role in determining the consequence of income inequality in various countries (Crystal & Siegel, 2009; Siegel, Akincigil, Amin, & Crystal, 2009; Whitehouse & Disney, 2002). Private pensions, on the other hand, have become the primary source of retirement income for Canadians since the 1990s and large disparities exist across Canadian households (Curtis & McMullin, 2019).

Dixon and Hyslop (2008) measured the total annual incomes at least two years before and after the sample cohort reached 65, including earnings, self-employed income, and government benefits. The total annual income received by males decreased with a rise in age, though a small rise occurred with the receipt of NZS at the age of 65. In the case of females, the total annual income was relatively flat before 65, and had a bigger rise compared to males after being pension eligible. These rises in income at the pension age captured both the availability of NZS and any changes in earnings and other income. This included both the direct and indirect effects of NZS on individual income. One of the drawbacks of including annual self-employed income is that one cannot measure the accuracy and sensitivity of changes in income at a monthly level. This is because self-employment income is only observed annually.

The changes in retirement incomes have different patterns for people with high, medium, and low-income levels. Using longitudinal data, LaRochelle-Côté, Myles, and Picot (2008) tracked individuals from age 55 through retirement years for a total of twenty years. They discovered that average family income peaked at about age 60, then declined until age 68, resulting in about 80 percent of the income level of age 55. This pattern, however, varied significantly across the income distribution. For individuals at the bottom income quintile, little change in income was found since 55, which is mostly attributed to public pensions. For individuals at the top quintile, substantial income declines were discovered after retirement.

3.4 Labour Supply Effects of Pension Eligibility

The earliest research related to labour supply effects of pension eligibility dates back to the 1980s, and most early studies used survey data. In the 2000s, researchers began using

administrative data to assess the labour supply of older workers since these data allow an individual to be tracked monthly over an extended observation period.

There are two typical groups of studies that address the behavioural effects of pension eligibility: static simulation studies and reform studies. Static simulation studies often measure the labour supply effects of pension eligibility under the existing pension scheme, and calculate what would or could happen under alternate rules. To simulate the labour supply effects with earnings test, a conventional measure of income and substitution effects is often utilized. It is common to see negative income and substitution effects. Most countries have means-tested pension schemes, with just a few exceptions, such as NZ, Ireland, Netherlands, having a non-means-tested pension system (OECD, 2017). Therefore, most of these simulation studies ask what would happen if the existing means-testing was removed. They typically predict a negative labour supply effect - i.e. leisure/retirement is a normal good.

Reform studies often investigate the pension eligibility effects under the pension reforms so that shifts in pre- and post-reform labour supply can be compared. Pension reform can be carried out in many ways, and the major changes can involve abolishing the earnings test for pensions, altering the pension age, and changing the level of pension benefits. Regardless of the evaluation carried out under the current pension scheme or pension reform, the generally evaluated outcomes are the Labour Supply Participation Rate (LFPR) or employment rate, the pension take-up rate, and annual income.

Various approaches are used by researchers, the most common being Difference-in-Differences (DID) and regression analysis. DID (Angrist & Pischke, 2008) is a quasi-experimental design that uses empirical data from the treatment and control groups to gain an effective counterfactual to assess the causal effect. It is usually used to estimate the impact of a particular intervention or procedure (such as legislation or policy enactment) by measuring the differences in outcomes over time between the population involved in the programme (the treatment group) and a population that is ineligible for the programme (the control group).

The international literature reviewed three aspects of pension schemes. In the first place, a number of studies discussed the impact of labour supply under the means-tested pension systems. As mentioned in the previous chapter, means-testing has work disincentives from both lowering the effective wage rate and increasing non-labour income. The majority of individuals will directly switch from employment to retirement in response to

the work disincentives. Second, several studies looked at the elimination of the earnings test and found significant increases in labour supply. Third, some articles analysed the impact of a change in pension eligibility age on the participation of the workforce. As the age of pension eligibility increase, the labour supply usually increase. At the same time, people were more likely to substitute for other benefits instead. This is because, with the loss of anticipated pension benefit amounts, individuals often found other ways to exit the labour market.

The NZ studies only covered two aspects of the pension scheme. First, they evaluated the behavioural consequences of the rise in the pension age from 60 to 65 between 1992 and 2001. Second, they examined the labour supply changes upon reaching the pension eligibility age of 65 under the current non-means-tested pension system.

3.4.1 The International Literature

Findings from international studies are discussed in this section, which include the labour supply behaviour effects under both existing pension schemes and pension reforms. This study did not limit the literature to specific countries but looked at all countries, focusing on empirical estimations of publicly funded systems. The countries evaluated under the existing pension schemes are South Africa and the United States (US). The countries assessed under the pension reforms include the US, the United Kingdom (UK), Canada, Norway, Austria, Australia, Germany, and Switzerland. Three major pension reforms were evaluated, including the elimination of the earnings test on pensions, the change in pension ages, and the change in pension amounts. A brief summary is provided in the following table, showing that labour supply is significantly affected by the change in the pension system.

Table 3.1 Summary of international literature on labour supply effects of pension eligibility

Study	Policy	Cohort	Data	Model	Finding	Country
Ranchhod (2006)	Existing earnings test	Cohort of 50-75	South African Labour Force Survey	Probit	Significant decrease was discovered in labour supply due to the earnings test, both in extensive and intensive margins.	South Africa
Burtless and Moffitt (1985)	Existing earnings test	Males aged 58-63	Longitudinal Retirement History Survey (LRHS)	Life-cycle model Maximum likelihood	Simulations showed that a decrease in Social Security benefits and a rise in the normal retirement age would delay the retirement and increase the average hours of working after retirement. Simulations also showed that the removal of the earnings test would increase the average working hours after retirement.	US
Hanoch and Honig (1983)	Existing earnings test	Married males and unmarried females Born between 1906-1911	Retirement History Surveys (RHS)	Linear probability estimates for LFPR 3SLS for other dependent variables	Health, education and income had small effects on labour supply for the elderly, including participation and working hours. The potential size of the Social Security Primary Insurance Amount (PIA) had a strong negative effect on participation, particularly among women.	US
Gordon and Blinder (1980)	Existing earnings test	White males aged 58-67	LRHS	Life cycle model Maximum likelihood	Retirement decisions were highly related to ageing, poor health, private pension plans with mandatory retirement age, and market wages.	US
Disney and Smith (2002)	Removal of the earnings test	Males aged 65-69 and females aged 60-64	Family Expenditure Survey	Difference in difference (DID)	The elimination of the earnings test had positive effects on average hours of working and earnings for both males and females, with females having a smaller impact.	UK

Baker and Benjamin (1999)	Removal of CPP earnings test in 1975 Removal of QPP earnings test in 1977	Males aged 65-69	Census	DID	The abolition of the earnings test resulted in an increase in take-up rates, little impact on employment in the reference year, and a shift from part-year full-time to full-year full-time working.	Canada
Friedberg (2000)	Change of earnings test rules between 1978-1990, particularly the elimination of means testing in 1983	Males aged 65-69 and 70-71	March Current Population Survey (CPS)	Labour supply model	The elimination of the earnings test in 1983 had significant labour supply effects on males.	US
Gruber and Orszag (2003)	Change of earnings test structure over past 25 years	Cohort of 59-75	CPS	Regression	Loosening the earnings test on Social Security resulted in little labour supply responses on males, but significant impact on females' earnings. It also led to a rise in Social Security benefit recipiency.	US
Haider and Loughran (2006)	Removal of the earnings test in 1983 and 200	Males aged 63-76	CPS New Beneficiary Data System (NBDS) Social Security Benefit and Earnings Public Use File (BEPUF)	DID	The abolition of the earnings test had a substantial impact on male labour supply, with younger males having a greater impact.	US
Engelhardt and Kumar (2007)	Removal of the earnings test in 2000	Males aged 62-72	Health and Retirement study (HRS)	DID and Ordinary least squares (OLS)	The elimination of the earnings test increased male working hours by 12-17 percent relative to the mean value, with those having high-school degrees increasing by 19-26 percent.	US

Song and Manchester (2007)	Removal of the earnings test in 2000	62-64 control 65 younger treatment 65-69 older treatment 70-72 older control	Social security Administrative data	Reduced-form quantile regression DID	The elimination of the earnings test in 2000 increased the uptake of Social Security benefits by 2-5 percentage points for those aged 65 to 69, and by 3-7 percentage points for those reaching 65. The effect on earnings in lower percentiles was not significant, but it was significant in higher percentiles (50 to 80) and the effect was large. No evidence of labour force participation was found.	US
Brinch et al. (2015)	Removal of the earnings test and an introduction of actuarial adjustments	Treatment 62-64 Control 59-61	Administrative data Register of Employers and Employees panel	DID	The removal of the earnings test and an introduction of actuarial adjustments significantly increased the employment and annual earnings for early retirement scheme workers. No evidence of benefit substitution was found.	Norway
Hernæs et al. (2016)	Removal of the earnings test and an introduction of actuarial adjustments	Cohorts of 1946-1947 and 1949-1950 who reached 63 in 2009-2010 and 2012-2013, respectively	Administrative data	Within-group linear regression	The removal of the earnings test and an introduction of actuarial adjustments had significant positive effects on labour supply, as well as income.	Norway

Vestad (2013)	Reduce early retirement age from 64 to 62	People born between Jan 1 and May 31 of 1933 and 1937	Administrative data of Register of Employers and Employees Individual pensionable earnings data	DID Triple differences	The reduction in the early retirement age from 64 to 62 had significant labour supply impacts. More than 2/3 of early retirement pensioners would be working at the age of 63 if the age limit was 64 instead of 62. The substitution effect of disability insurance was obvious.	Norway
Cribb et al. (2013)	Increase pension age for women	Females aged 56-62	Labour Force Survey	DID OLS Probit	They found that every one-year increase in pension age led to a rise of 7.3 percentage points in women's employment rates, and a 4.2 percentage points increase in their partners' employment rates.	UK
Staubli and Zweimüller (2013)	Increase early retirement age (ERA)	Males aged 57 -64 and females aged 52-59	Austrian Social Security Database (ASSD)	OLS	They concluded that the rise in the ERA increased the employment rate by 9.75 percentage points for males, and 11 percentage points for females. Also, it increased the benefit substitution effect for unemployment benefits.	Austria
Manoli and Weber (2016)	Increase ERA	Males born between 1930-1948 and females born between 1935-1952	ASSD	Regression kink design	They showed that a one-year increase in the ERA led to a 0.4-year increase in job exiting age, and a 0.5-year increase in average pension claiming age.	Austria
Atalay and Barrett (2015)	Increase pension age for women	Cohort of 60-64	Australian Bureau of Statistics Income and housing Costs Survey	DID Probit	An increase in pension age for women significantly increased their labour force participation by 10 percentage points. Also, with the phased-in pension reform, the take-up rates of other government benefits had a large increase of 12 to 30 percentage points, especially disability benefits.	Australia

Engels et al. (2017)	Increase normal retirement age (NRA) and actuarial deduction of early retirement for women	Females born between 1938 and 1944	German Pension Insurance Administrative	Regression	One percentage point deduction of the benefit amount reduced the average retirement rate by about 2 percentage points. It also resulted in a rise in the employment rate and a decrease in the unemployment rate. A shifting effect to unemployment benefits was also found.	Germany
Hanel and Riphahn (2012)	Increase NRA for women	Females aged 60-65	Swiss Labour Force Survey	DID	Significant labour supply effects were found in response to the increase in NRA for women. A 3.4 percentage-point reduction in retirement benefits induced a decrease in retirement probability by over 50 percentage points. The responses varied with educational attainments, with lower education attainments responding most strongly.	Switzerland
Lalive and Staubli (2015)	Increase NRA for women	Females born between 1938-1939 and 1941-1942	Swiss Social Security Data	RDD	A one-year rise in the NRA led to a 7.9-month delay in job exiting, and a 6.6-month delay in the pension claiming age.	Switzerland
Duggan et al. (2007)	Increase full retirement age from 65 to 67 Increase penalty for claiming benefits at early retirement age of 62 (1983 Amendments)	Cohorts of 45-64	US Census Bureau National Center for Health Statistics	Regression	The 1983 Social Security Amendments significantly increased the Social Security Disability Insurance take-up rates, with 0.6 percent for males and 0.9 percent for females between the ages of 45 and 64. Benefit substitution to disable insurance was found.	US

Li and Maestas (2008)	Increase full retirement age from 65 to 67 Increase penalty for claiming benefits at early retirement age of 62 (1983 Amendments)	Cohorts born between 1931 and 1941	HRS	Probit	They found that the rise in the NRA contributed to the increase in the Social Security Disability Insurance benefit take-up rates.	US
Mastrobuoni (2009)	Increase full retirement age from 65 to 67 Increase penalty for claiming benefits at early retirement age of 62 (1983 Amendments)	Cohorts aged 61-65	CPS	Least square	An increase in full retirement age delayed the mean retirement age.	US
Hurd and Boskin (1984)	Increase of Social Security benefits in early 1970s	Males aged 58-67	RHS Social Security Earnings History Data	Logit	A large increase in Social Security benefits reduced labour force participation. The retirement effect induced was large.	US
Krueger and Pischke (1992)	Reduce the benefits for specific cohort people (1977 Amendments)	Males aged 60-68	CPS	Reduced-form labour-supply model	Wage indexation introduced by 1977 amendments reduced the labour force for the affected cohort, speeding up the early retirement. A weak relationship between Social Security wealth and labour supply was found.	US
Pingle (2006)	Increase of Delayed Retirement Credit (DRC) from 3% to 8% (1983 Amendments)	Males aged 60-74	Survey of Income and Programme Participation (SIPP)	Regression DID	The change in DRC had positive effects on employment rates of those aged 65 and over.	US

Labour Supply Effects under Existing Pension Systems

A particular class of studies, which can be called static simulation studies, measure the labour supply effects under existing pension systems. They don't rely on any changes in the structure of these pension schemes to calculate the labour supply effects. Instead, they model the effects on wages and non-labour income and simulate the likely impacts by using relevant income and substitution elasticities.

Ranchhod (2006) claimed that the introduction of an earnings test on the pension system had a negative impact on labour supply in South Africa. His research indicated statistically significant reductions in the labour supply due to the earnings test, with an 8.4 percentage-point decrease for males and a 12.6 percentage-point decrease for females. Intensive margins were also observed for the examined group. That is, for those who continued to work after reaching retirement age, their decision to work shifted from fixed and full-time to flexible and fewer hours.

Using the Longitudinal Retirement History Survey (LRHS), Burtless and Morffitt (1985) followed a piecewise linear budget constraint approach to determine the labour supply effects of the earnings test on the Social Security benefit. They calculated the impacts of the change in the Social Security system on labour supply using simulations of the model. First, they found that a decrease in Social Security benefits and a rise in the normal retirement age would delay retirement and increase the average hours of working after retirement. Second, they discovered that the removal of the earnings test would increase the average working hours after retirement. Using the same dataset, Hanoch and Honig (1983) showed that health, education and income had little influence on labour force participation and working hours. They discovered, however, that the potential amount of Social Security income negatively affects labour force participation, particularly for women.

Gordon and Blinder (1980) demonstrated that the Social Security scheme had a weak impact on retirement decisions. In comparison to the findings of Hanoch and Honig (1983), they pointed out that poor health accelerated retirement. In addition, they found that retirement decisions were highly related to ageing, private pension plans with mandatory retirement age, and market wages. However, they neglected the implications of Social Security legislation on the transfer of properties, which may have an impact on retirement behaviour.

Labour Supply Effects of Pension Reforms

Many countries have implemented pension reforms with the aim of increasing the labour supply of the elderly and reducing the fiscal burden. The most common ones include the elimination of the earnings test, the change in the pension age, and the change in benefit amounts. This section summarises the labour supply impact focusing on those three major pension reforms.

Elimination of the Earnings Test

In 1989, the UK abolished the earnings test, enabling men aged 65-69 and women aged 60-64 to receive non-means-tested pensions until they reached the state 'retirement age' (70 for men and 65 for women).[22] The purpose of this pension reform was to encourage individuals to increase working hours at the state pension age, aiming to minimise the disincentive of work arising from the earnings test. Disney and Smith (2002) measured the labour supply impacts of the pension reform at an intensive margin, including the working hours and earnings of older employees. They noticed that the reform had a considerable positive effect on the working hours and earnings of both male and female workers, with males having a greater impact. However, there was no effect on LFPR.

Using the Family Expenditure Survey from April 1984 to March 1994, they selected males aged 65 to 69 and females aged 60 to 64 as treatment groups. The five-year pre- and post-reform cohorts were chosen as control groups (males aged 60-64 and 70-74, females aged 55-59 and 65-69). Regression analyses of OLS and Tobit were performed on both males and females. The model is as follows:

$$Y_i = \alpha + \beta Treat + \gamma Young + \delta Post + \theta Treat * Post + \lambda X_i + \varepsilon \qquad (3.1)$$

where Y_i is weekly labour supply activity status (working hours, earnings) for individuals; $Treat = 1$ if an individual is in the treatment group; $Young = 1$ if an individual is in the younger control group, age 60-64 for males and age 55-59 for females; $Post = 1$ when the individual is in the post-reform period. X_i measures individual characteristics and ε is the disturbance term. θ measures the change in working hours (earnings) of the treatment group compared to the control groups after the reform.

The regression results for OLS and Tobit were similar. A substantial increase of 4.15 working hours was observed for males in the treatment group during the post-reform

[22] If an individual chooses to defer the claimant of the pension, the pension entitlement will increase at an annual rate of 7.5% for up to 5 years.

period. At the same time, earnings increased dramatically by £42 a week. Similar important findings were obtained for females, although the effects were smaller. Weekly working hours increased by 2.35 hours and earnings increased by £24. The results suggested an increase in the intensive margin, which is in line with the work of Baker and Benjamin (1999).

There were, however, two potential problems in their analysis. First, an anticipation effect might exist for knowing the removal of the earnings test for the younger control group. It might create spillover effects on the working decisions of individuals at pension age. On the one hand, knowing the elimination of the earnings test in advance, some younger cohorts would continue to work after reaching pension age to earn more income. On the other hand, certain workers would reduce working hours as a result of receiving non-means-tested full pension amounts. Second, the balance between full-time and part-time employees was different in the younger control and treatment groups, but similar in the older control and treatment groups, which might cause differential labour supply impacts on the macro environment.

Baker and Benjamin (1999) avoided the issue of using a younger control group that might lead to bias. The control group and the treatment group they used were of the same age, but of different geography. They evaluated the sequential abolition of the earnings test in the Canadian public pension system, including the elimination of the earnings test in the Quebec Pension Plan (QPP) in 1975 and the Canada Pension Plan (CPP) in 1977. The QPP applied only to individuals in the province of Quebec and the CPP covered individuals for the rest of the country. In their study, elimination of the earnings test is a simple tax loss, which offers a straightforward analysis of the labour supply consequences. They indicated that the pension reform did not affect the working decisions of pension eligible individuals. Compared to the work of Disney and Smith (2002), some effects of pension take-up rates were discovered by Baker and Benjamin (1999). This is because the UK had an actuarially favourable delayed pension plan that offered accumulated pension benefits to individuals at a rate of 7.5 percent each year, with a maximum of 5 years, which resulted in no change in take-up rates. Besides, some evidence of a shift from part-year full-time to full-year full-time work was found.

Unlike the pension scheme in other countries, the US has a comparatively complex structure in which the pension entitlements are dependent on past contributions. Also, the Actuarial Reduction Factor (ARF) applies when individuals wish to claim early

retirement at an annual rate of 8 percent. The earnings test plays two roles in the Social Security system: tax and transfer (Song & Manchester, 2007). The tax role includes the threshold amount for benefits and withholding rates. The threshold is different depending on the test applying year and the age of beneficiaries. The withholding rates vary based on whether the individual's age falls between 62-64 or 65-69. The transfer role compensates for the withholding benefit amounts by an actuarially fair accumulation of the Delayed Retirement Credit (DRC) and the recalculation of benefit amounts. This indicates the potential increase in future benefits due to the current loss of benefit amounts caused by means-testing.

Some significant legislative changes to the social security system have been made over the past 25 years. In 1978, there was a relative upward shift of the earnings test threshold for those over 65 compared to the age 62 to 64 cohort. The rate for DRC was phased in after 1983 at a rate from 3 to 8 percent. After 1983, the earnings test for those aged 70 and 71 was removed. The benefit reduction rate was lowered from 50 to 33 percent in 1990 for those aged 65 to 69, and the earnings threshold increased for those over age 65 in real terms in 1996. In addition, the earnings test was abolished for those over the normal retirement age (NRA) (scheduled to increase to 67 by 2022) in 2000, but it remained the same for those aged 62 to 64.

Some research focused on the labour supply impact of the removal of the earnings test on older males. Using a quasi-experimental method, Friedberg (2000) found that the elimination of the earnings test in 1983 had significant labour supply effects on males. However, she only documented the impact on conditional working hours, not on working decisions which may bias her findings relative to the total labour supply. Loughran and Haider (2006) investigated the effect of the 1983 and 2000 amendments on the abolition of the earnings test. They discovered that the pension reform had a substantial impact on males' working hours, with younger males having a greater impact. Engelhardt and Kumar (2007) measured the removal of the earnings test in 2000. They showed that the intensive margin of labour supply increased by 12 to 17 percent, with most of the effects focused on high school graduates, whose labour supply increased by 19 to 26 percent. These studies ignored the role of older females participating in the labour force.

Taking both males and females into consideration, Gruber and Orszag (2000) studied the impact of changing Social Security policies over the last 25 years on working decisions, working hours, earnings, and take-up rates in the US. They found that the earnings test

had no significant impact on the male labour supply while having some effect on the female labour supply. Moreover, the pension take-up rate was very sensitive to the earnings test. The dataset used in their analysis was the March Supplement to the Current Population Survey (CPS), a series of cross-sections from 1973 to 1998, covering age cohorts from 59 to 71. The regression is as follows:

$$Y_{at} = \alpha + \beta_1 THRESH_{at} + \beta_2 TDUM_{at} + \beta_3 X_{at} + \beta_4 \delta_a + \beta_5 \tau_t + \epsilon \quad (3.2)$$

where Y is an indicator of the labour supply (employment, hours of work, earnings, and status of receiving social security benefit); a indicates age and t indicates year; $THRESH$ is the real value threshold of the earnings test for age group a in year t, which equals to 0 if an individual was not subject to the earnings test. $TDUM = 1$ if the age group is subject to the earnings test, 0 otherwise. X is a set of demographic characteristics, including ethnicity, education, marital status, veteran status, and dummies for nine US regions. δ_a and τ_t are age and year dummies, respectively. Another regression specification with an age-specific benefit deductible rate TAX_{at} was also estimated.

The above models were estimated separately for males and females. Among males, the basic model resulted in the expected signs on the coefficients, suggesting that higher earning test thresholds led to higher employment rates, but the presence of the earnings test reduced the labour supply. After including age-specific trends in the estimation process, both linear and quadratic, the estimated coefficients on hours of work and earnings, however, became wrong-signed and insignificant. Thus, Gruber and Orszag (2000) argued that earnings test had no impact on males' working decisions, which is consistent with the findings of (Baker & Benjamin, 1999; Disney & Smith, 2002). Similarly, no robust evidence was found for working hours and earnings. In comparison with the impact of working decisions and working hours, Gruber and Orszag (2000) suggested that loosening the earnings test policy contributed to higher take-up rates. The findings were further validated by models including age-specific trends. They found that every $1,000 threshold increase raised the take-up rate by 0.69 percentage points. In particular, the complete elimination of the earnings test raised the take-up rate by 5.2 percentage points. These findings are in line with the results of Baker and Benjamin (1999), a result of more than ten percentage points increase in pension take-up rate related to the abolition of the earnings test in Canada.

Considering the effect of benefit deductible rates, similar calculations were rendered with the inclusion of the TAX_{at} variable. In the case of labour supply indicators, the results

turned out to be wrongly signed for most coefficients. Significantly estimated coefficients with the expected signs were found for take-up rates with both the threshold level and the earnings test dummy, whereas an insignificant coefficient was found for benefit deductible rate. They claimed that the earnings test threshold had an effect on the take-up rates while benefit deductible rates had no effect.

Among females, a statistically insignificant impact of the change in earnings threshold was found on employment rates. The estimations on hours were incorrectly signed. Substantial effects were found on earnings due to the statistically insignificant impact on employment. It indicated that every $1,000 rise in the threshold contributed to an increase in average earnings of $167. In addition, an important effect on the Social Security take-up rate was also reported, with a $1,000 rise in the earnings test threshold leading to a 3.34 percentage-point increase in take-up rate.

Based on the above discussion, Gruber and Orszag (2000) concluded that the earnings test had little impact on the supply of male labour, but had a considerable effect on female earnings and their labour supply. Besides, the removal of the earnings test increased the Social Security benefit take-up rate. The advantage of their method was the direct analysis of the aggregate labour supply behaviour among cohorts, without any structural assumptions imposed. The disadvantage was that the income and substitution effects could not be separated. Moreover, the individual level of labour supply behaviour could not be measured. Finally, this analysis failed to measure the long-run impact of the earnings test that could reveal the real labour supply effects.

Most of the studies described before used reduced-form DID methods, detecting average changes in working hours and earnings, using affected individuals as a treatment group and correspondingly unaffected individuals as a control group. One criticism of the approach was that eliminating the earnings test can have different effects on the labour supply of individuals across different earnings distributions, whereas this approach only provided a mean-based estimation. Song and Manchester (2007), however, were able to identify unequal impacts across various income distributions using quantile regression. Quantile regression was first introduced by Koenker and Bassett Jr (1978), an extension of linear regression where linear regression assumptions (i.e., linearity, normality, or independence) are not met. In comparison to linear regression that uses the least-squares method for estimating the conditional mean of the response variable, quantile regression estimates either the conditional median or other quantiles of the response variable.

Using a 1 percent randomly chosen sample from Social Security Administration data, Song and Manchester (2007) measured the Social Security take-up rates and labour force participation with the abolition of the Social Security Act earnings test in 2000, which abolished the earnings test for those aged 65 and over. However, individuals between age 62 and NRA were still subject to the earnings test. Using the DID and the quantile regression process, important effects on Social Security benefits take-up rates and uneven effects on different earnings distribution groups were discovered.

Unlike previous studies using survey datasets, Song and Manchester (2007) used administrative data to perform the analysis. Based on the complexity of the US Social Security system, the survey data lacked the precision to reliably capture changes in withholding benefits that relied on the month and year of birth, the beneficiary status, and the month and year of benefit receipts. Administrative data provided more accuracy on these details. It also provided a larger sample size.

The evaluation population consisted of primary workers aged between 62 and 72 years, with sample sizes ranging from 168,486 to 178,217. The assessment period was from 1996 to 2003, four years before and after they reached the age of 65. Two control groups and two treatment groups were selected for the analysis. Control groups included those aged 62 to 64 and 70 to 72. Treatment groups included those who turned 65 and those aged 65 to 69.

They regressed independently on the two treatment groups separately, using the following:

$$y_{ijt} = a + \beta\Delta_{jt} + \gamma\Delta_t + \delta\Delta_j + \theta' X_i + e_{ijt} \tag{3.3}$$

where y indicates dependent variables of Social Security benefit take-up status, employment rates, and earnings; Δs are dummies, where $j = 1$ indicates the treatment group, and $j = 0$ indicates control group; t indicates the time from the year 1996 to 2003; X is the vector of demographic characteristics. The coefficient of interest is β, which captures the year-specific and post-treatment effects. Probit was used to measure the effects of benefit take-up rate and labour force participation. The quantile regression technique was used to detect the uneven impact of the different earnings distribution groups.

Three critical findings were explored by them. First, with the abolition of the earnings test, Social Security benefit take-up rates significantly increased by 2 to 5 percentage points and 3 to 7 percentage points for cohorts aged 65-69 and those reaching age 65, respectively. Second, after the removal of the earnings test, a statistically significant effect was reported on employment rates for cohorts aged 65-69, with a substantial increase from 0.8 to 2 percentage points. Conversely, no evidence was found for those reaching age 65. Finally, statistically significant uneven effects were reported across different earnings distribution groups. The impact on the lower percentile earnings distribution was not substantial, but the result was large for the 50^{th} to 80^{th} percentiles. The rise in earnings ranged from $180 and $1670 for the age group of 65-69. And for those reaching the age of 65, earnings increased between $1,500 and $2,800.

There were two concerns in their report. The first was the elimination of the earnings test for individuals aged 65-69 could affect the younger cohorts' benefit take-up decisions. Using a single control group of individuals aged 62-64 could lead to an overestimation of the results. The second was the gradual increase of the full retirement age from 65 to 67 by 2023 since 1983, which could also result in an overestimation of the labour supply effects.

Similar to other countries, the Norwegian Government implemented a pension reform in 2011 aiming at promoting the near-retirement labour supply as a response to increasing fiscal burdens. The pension reform consisted of two sections, elimination of the earnings test and reducing the early retirement age to 62, based on actuarial adjustments. Actuarial adjustments indicated that the deferred pension claimant would result in a higher pension amount, but the net present value of the lump sum pension amount was the same. The pension reform affected individuals both under the early retirement scheme (AFP) and the full public pension scheme (FTP). Prior to the reform, AFP workers were those who could access their means-tested pension between age 62 and 67 without any actuarial adjustments for deferred pension claimants. FTP workers were those who could only access the pension from the age of 67. The pre-reform pension scheme in Norway prevented individuals from continuing to work while applying for the pension, because the pension was means-tested and there were no actuarial adjustments. Individuals switched straight from employment to retirement at retirement age, leading to a decline in the labour supply. Also, under the regime of no actuarial adjustments on pension benefits, they preferred to claim the pension as early as possible, which further decreased labour force participation. In contrast, the post-reform enabled individuals to combine

work and retirement at the same time. Without the earnings test on the pension, individuals would remain in the job market.

The reformed pension scheme in Norway is relevant to the current situation of NZ, since NZ does not have means-testing on pension benefits and has not followed international moves to raise the pension eligibility age. Norway has now stepped closer to a policy that NZ already has in place. The evaluation of Norwegian pension reform will provide insight into the labour supply consequences of the NZ pension scheme.

Brinch et al. (2015) investigated the above Norwegian pension reform and found strong positive effects on AFP workers. They quantified the labour supply effects of the pension reform using administrative data. They chose pre- and post-reform cohorts as treatment (age between 62-64) and control (age between 59-61) groups.

The following DID model was used:

$$Y_{at} = \propto + \lambda_t + \gamma_a + \beta Post_t D_a + \eta X + \varepsilon_{at} \quad (3.4)$$

Y_{at} is the outcome of interest (e.g., employment rates, pension take-up rates, and annual earnings); λ_t and γ_a are fixed effects of year and age; $Post_t = 1$ if the time period is after the reform, 0 otherwise; D_a indicates whether an individual is in a treatment group; X is demographic characteristics, including gender, education, income quartiles, etc. β captures the difference in the outcome between the two groups.

The DID estimation suggested large labour supply effects for AFP workers, with a 22 percentage-point increase in the employment rate and a 10 percentage-point increase in annual earnings. No significant effects were found, however, for non-AFP workers at the extensive margin of labour supply. They also discovered that the reform had no benefit substitution effects, such as unemployment and disability benefits.

Likewise, Hernæs, Markussen, Piggott, and Røed (2016) analysed the 2011 Norwegian pension reform, extending Brinch et al. (2015)'s research into both the AFP and the FTP schemes. Strong labour supply responses from an extensive margin and a substantial reduction in the cost of pension expenditure were reported.

The effects on the labour supply activities of cohorts aged 63 and 64 were examined using administrative data. A pure intra-group difference analysis was conducted to analyse the labour force response:

$$y_i = \lambda x_i^{'} + \theta R_i + \varepsilon_i \quad (3.5)$$

y_i is the labour supply outcome (including weekly working hours, annual earnings, employment, employment with/without reduced hours, retirement with/without disability insurance); x_i is a vector of control variables, including gender, education, country of birth, earnings, and weekly working hours at age 60. $R_i = 1$ if an individual is affected by the reform, otherwise 0; ε_i is the residual. The above regression was carried out separately for three specific groups, which included those who had only experienced a decrease in the pension age, those who had only had the removal of the earnings test and a combination of both.

Hernæs et al. (2016) concluded that the removal of the earnings test had dramatic positive impacts on labour supply which was in line with the results of Brinch et al. (2015), with a rise of 7 working hours per week (30 percent) at age 63 and 8 working hours per week (46 percent) at age 64. At the same time, the effects on earnings were also large, with weekly earnings almost doubling after the removal of the earnings test. Unsurprisingly, they found that the decrease in pension age from 67 to 62 had a subdued effect on the labour supply due to the actuarially fair work incentive.

They also pointed out that the abolition of the earnings test did not raise the fiscal expenditure but reduced the burden of the fiscal budget by increasing tax revenues. By removing the earnings test on the pension, on the one hand, the government gained less as individuals continued to work after retirement. On the other hand, a large proportion of individuals who remained in the job market increased tax revenues. The removal of the earnings test directly increased pension payments but indirectly increased tax revenue by leading to an increase in earnings. Finally, the net effect was a fiscal gain.

One of the critiques of Hernæs et al. (2016)'s study was the lack of a relevant control group similar to the work of Disney and Smith (2002). These policies have taken place over time, and other relevant factors that were changing over time could not be held constant.

Change in Pension Age

Apart from abolishing the earnings test on the pension, increasing the pension age is another way of encouraging the labour supply near the retirement age (OECD, 2011). On the one hand, raising the pension eligibility age lowers the pension payments paid by governments, reducing the fiscal burdens. On the other hand, it helps raise additional tax

revenue with individuals working in the labour market over a longer period. Many countries have implemented pension reforms that increase their pension age, such as the UK, Austria, Australia, Germany, Switzerland, and the US, while other countries, such as Norway, have lowered their pension access age. The majority of studies have shown that the rise in the pension age results in a significant increase in the participation of the workforce.

In fact, there were two concerns surrounding the rise in the pension age (Staubli & Zweimüller, 2013). The first concern was that the policy lacked effectiveness due to the insufficient employment opportunities for old-age workers. It would eventually increase the benefit substitution effects, such as disability and unemployment benefits. The second concern was that the rise in the pension age would be unfair to those workers with health issues due to limitations on their employment opportunities.

Having considered the above concerns, this section provides a review of the implications of a rise in the pension age in other countries and the evidence of substitution for other benefits that it induced.

Vestad (2013) examined the labour supply effects of a reduction of the early retirement age from age 64 to 62 in Norway. Using DID and triple difference frameworks, he found that if the early pension eligibility age was 64 instead of 62, more than two-thirds of early retirement pension receivers would continue to work at age 63, indicating that restricting access to early retirement age would lead to a large increase of labour supply. At the same time, he explored some benefit substitution effects, such as unemployment and disability benefits, as exiting routes from the labour market. He further discovered that disability benefits played the most important role for people to exit the labour market.

Cribb et al. (2013) evaluated the pension reform of raising the pension age for women in the UK. They found strong and positive impacts on labour supply behaviour for both women and their partners. Prior to the pension reform, the pensionable age was 60 for women and 65 for men. And the pension amount was not means-tested. In 1995, the government enacted legislation to increase the pension age for women from 60 to 65 between 2010 and 2020, with one-month pension age increase over every two calendar months. On the basis of the pension reform and the latest available data, Cribb et al. (2013) analysed the effects of a rise in the pension age for women from age 60 to 61.

The data used was a quarterly Labour Force Survey, a dataset containing individuals' working information and demographic information, including gender, birth information, ethnicity, marital status, education, and partner's information. The cohort evaluated were individuals who were born between 1949-1950 to 1952-1953. The treatment group was the cohort under the state pension age and the control group was the cohort above the state pension age. The specification of DID was used:

$$Y_{ict} = \alpha(Underspa_{ict}) + \gamma_t + \lambda_c + \sum_{a=1}^{A} \delta_a(age_{ict} = a) + \beta X_{ict} + \varepsilon_{ict} \qquad (3.6)$$

where Y_{ict} is the outcome of interest, i.e. employment rates; i is individual; c is cohort and t is time. $Underspa_{ict} = 1$ if an individual is below the state pension age, 0 otherwise. $\gamma_t, \lambda_c, \sum_{a=1}^{A} \delta_a(age_{ict} = a)$ are fixed time, cohort, and age effects, respectively. X_{ict} controls a vector of demographic characteristics, including ethnicity, education, marital status, partner's age, partner's education, etc.

The Probit model was estimated and the result showed a substantial rise of 7.3 percentage points in the employment rate for women following an increase in the pension age. Similar findings were also seen among their spouses, with a rise of 4.2 percentage points in the employment rate.

Compared to the average OECD countries, Austria had a lower old-age labour force participation rate. For individuals aged from 55 to 64, the LFPR ranged from 29.8 to 45.5 percent from 2000 to 2013. In contrast, the rate varied from 50.0 to 59.7 percent for the average OECD countries over the same period.[23] With the aims of increasing labour supply participation around retirement and reducing the fiscal burden, the Austrian Government introduced two major pension reforms in 2000 and 2003.

Using administrative data, Staubli and Zweimüller (2013) conducted research on the rise in early retirement age (ERA) for both males and females. They noticed that a one-year increase in ERA lowered the pension take-up rates by 26.34 percentage points for males, and 34.45 percentage points for females. It also increased the employment rates by 9.75 percentage points and 11 percentage points for males and females, respectively. In addition, there existed large benefit substitution effects. They found that a one-year rise in ERA raised the unemployment benefit take-up rates by 12.5 percentage points for males, and 11.8 percentage points for females. The disability take-up rates, however,

[23] Source: OECD (2020), Labour force participation rate (indicator). doi: 10.1787/8a801325-en.

almost remained the same. Based on the above benefit substitution effects, a further step was taken to investigate the different labour supply effects on earnings and health status. They found that workers with good health status had a stronger employment response than workers with poor health status for both genders.[24] Moreover, the responses of good-health and high-wage employees were even higher.[25] Finally, they calculated the overall fiscal consequences based on the labour supply changes. Whereas the one-year rise in ERA increased pension, unemployment and disability benefits, the net tax revenues generated overweighed all the increased costs, leading to a reduction of almost 229 million euros in government spending, accounting for 1.1 percent of pension, unemployment and disability benefits costs in 2000. One drawback of their research was that they measured only the short-term labour supply effects. Long-run labour supply effects could change as younger cohorts responded earlier to the rise of the ERA.

Likewise, Manoli and Weber (2016) estimated the same pension reform in Austria. They found that a one-year increase in the ERA postponed the labour market exiting age by 0.4 years, and delayed the pension claiming age by 0.5 years. Furthermore, they argued that these labour supply impacts were primarily due to individuals who kept their pre-retirement jobs longer.

The Australian pension system shares some similarities with the NZ pension scheme, in that it does not impose a compulsory retirement age. Individuals can continue to work after reaching what might be considered the typical retirement age. Like New Zealand Superannuation (NZS), the Australian Age Pension scheme depends only on residence and age requirements, not on past contribution history. The key distinction between the two systems is that the Australian Age Pension programme is both income and asset tested while NZS is not. With the same goal as other countries to increase the participation of older workers in the labour market, Australia introduced a pension reform that gradually raised the pension eligibility age for women from age 60 to 65 in 1993, which is similar to the 1992 NZ pension reform (see Section 2.2.2). The evaluation of the Australian pension scheme offers a specific insight into the evaluation of the NZ pension scheme.

In order to exploit the labour supply impact of the Australian pension reform, Atalay and Barrett (2015) estimated the corresponding individual retirement decisions of the policy change, using the DID framework. They used the annual Australian Bureau of Statistics

[24] Workers with good health status were those whose sick leave days were below the 75th percentile in the sick leave distribution.
[25] High-wage and low-wage were classified by above and below the average earnings.

Income and Housing Costs Surveys to examine the impact. The dataset contains detailed individual demographic information, including labour supply status, earnings, income and source of income. The cohort of individuals between the ages of 60 and 64 who were born between 1929 and 1948 was chosen. The female cohort was selected as the treatment group. The male cohort was selected as the control group because males did not experience the rise in the pension age. The observation period was from 1994 to 2008, with four years of unreleased data information. There were two limitations to the dataset. First, there was a lack of an exact date of birth, which resulted in misclassification of the assignment of the correct treatment group. Second, there was some missing education information, which led to an error in the control variable.

The results of a Probit model demonstrated that a one-year rise in the pension eligibility age substantially increased labour force participation by 10 percentage points for the affected female cohorts. Moreover, significant benefit substitution effects were also reported. For example, when the pension age increased from 60.5 to 61, other benefit take-up rates increased by 12 percentage points. When the pension age increased from 61.5 to 62, other benefit take-up rates increased by 24 percentage points at age 60 and 12 percentage points at age 61. Furthermore, after reaching the pension eligibility age, other benefit take-up rates ceased to increase, which further illustrated the benefit substitution effect of the pension reform. Of all the substitution effects, the disability benefits stood out with an average rise of 10 percentage points.

There were, however, two issues with their analysis. The first was that males might not be an appropriate control group. The reason was that, without a policy change in the pension age of females, they assumed that males and females would experience the same labour supply trends, which might not be the case. In addition, labour supply might be a family-based decision for many households. Changing the rules for females could have an indirect effect on the labour supply of males. Second, since the cohort was an older age group, they argued that the shocks to the labour supply were the same for both males and females. However, the observed labour supply trends were quite different between the two.

With the same aim of reducing fiscal burden, Germany adopted a pension reform to increase the NRA from 60 to 65 for women in 1992, while the pension eligibility age (60) and mandatory retirement age (65) were the same. At the same time, an actuarial deduction for early retirement was also introduced. In other words, with the increase in

the NRA, if an individual wanted to retire early, he would suffer some loss of pension benefits. Engels, Geyer, and Haan (2017) assessed whether the pension reform had an effect on the labour supply behaviour for women. First, they estimated the direct impact of the pension reform on the labour supply. Second, they addressed the anticipation effect of the policy change, which showed the labour supply behaviour upon reaching the pension eligibility age.

Using administrative data from German pension insurance, they found that every one-percentage-point decrease in early retirement benefits was associated with a 1.9 percentage-point decrease in the retirement rate, an 1.0 percentage-point rise in the employment rate, and about 0.9 percentage-point rise in the unemployment rate. The reason they included the analysis of unemployment was that unemployment was often used as a bridge to retirement. In other words, people could claim unemployment benefits before transitioning to retirement. Then they found significant anticipation effects before individuals reached pension eligibility age. First, employment rate increased before age 60. Second, unemployment rate decreased before age 60 and increased after 60, resulting in almost zero overall change. This suggested that the pension reform did not lead to a benefit substitution effect like Staubli and Zweimüller (2013) found. Instead, it was a shifting effect from younger to an older age.

Similar to the pension reform in Germany, Switzerland implemented a pension reform that increased women's NRA from age 62 to 64 in two one-year increments in 1997. With the rise in the NRA, the pension benefit decreased by 3.4 percent a year for early retirement. Hanel and Riphahn (2012) showed that a reduction of pension benefit by 3.4 percent led to a reduction of more than 50 percent in the probability of retirement in Switzerland. The results varied with educational background, with lower educated individuals having stronger labour supply effects, which is similar to the findings of Ranchhod (2006), who claimed that education played a vital role in labour supply effects after reaching pension age. Lalive and Staubli (2015) also found similar significant labour supply effects to the Swiss retirement reform. They showed that a one-year raise in the NRA led to a 7.9-month delay in job exiting. It also increased the pension claiming age by 6.6 months.

Mastrobuoni (2009) investigated whether the 1983 amendments of increasing the NRA in the US had an impact on labour supply behaviour. He noted that the rise in the NRA had a deferral effect on retirement age. It showed that, with actuarially fair benefit

reductions for early retirement, every 2-month rise in the NRA contributed to a one-month increase in the Social Security benefit claiming age. It also implied that the rise in the NRA increased labour supply for those individuals between the ages of 60 and 64. Likewise, (Duggan, Singleton, & Song, 2007; Li & Maestas, 2008) measured the same pension reform in the US. Nevertheless, they focused on the spillover effects of Social Security Disability Insurance (SSDI) with the fact that SSDI remained unchanged compared to the actuarially modified Social Security benefits. They argued that the rise in the NRA contributed to the increase in the SSDI benefit take-up rate. Significant disability substitution effects indicated that the majority of individuals took disability benefits as an alternative source of retirement income. This is consistent with the findings of (Atalay & Barrett, 2015; Vestad, 2013) but contrasts with the results of (Staubli & Zweimüller, 2013), which showed that disability benefits played a subtle role in the spillover effects, whereas unemployment benefits played an important role.

Change in Pension Amount

The last category of major pension changes is the adjustment in the amount of the pension. Hurd and Boskin (1984) argued that a significant increase in Social Security benefits in the early 1970s decreased the LFPR, which shows different results from the work of Gordon and Blinder (1980). Krueger and Pischke (1992) found that the implementation of the 1977 amendment of reducing the incentive for continuing to work after retirement reduced the labour force for the affected cohort, and accelerated early retirement. Pingle (2006) focused primarily on the impact of the changed DRC on older Americans' employment behaviour. He pointed out that the rise in the DRC rate from 3 to 8 percent increased the employment rates for those aged 65 and over.

3.4.2 The New Zealand Literature

Of all the pension reforms implemented in NZ (see Section 2.2.2), the increase in the pension age from 60 to 65 is the most well-known, resulting in a significant increase in the number of older employees who remain in the workforce. The non-means-tested pension feature further encourages older age workers to remain in the labour market. Several studies have been conducted to explore the shifts in labour force participation and the transition pattern from employment to retirement, using the Census, Household Labour Force Survey (HLFS), Household Economic Survey (HES), and Linked Employer-Employed Dataset (LEED).

The following section first describes the findings of studies that estimated the behavioural effects of the rise in the pension age from 60 to 65. Second, it summarises the findings of studies that measured the labour supply effects of being pension eligible. Lastly, it introduces the finding of measuring the rise in labour force participation of the older workers.

Table 3.2 Summary of domestic literature on labour supply effects of pension eligibility

Study	Pension Age	Cohort	Data	Model	Finding
Maloney (2000)	Increase from 60 to 65	Cohorts of 16-64	Household Labour Force Survey (HLFS)	Weighted, Generalized Least-Squares (GLS)	The rise in pension age significantly increased LFPR by 5.1 percentage points overall.
Kalb and Scutella (2004)	Increase from 60 to 65	Cohorts of 16-64	Household Economic Survey (HES)	Probit and linear regression	The rise in pension age increased labour supply participation.
Hurnard (2005)	Decrease from 65 to 60 in 1977 Increase from 60 to 65 in 1991	Cohorts of 45 and over	Census	Linear Regression	Significant negative labour supply effects were found after being pension eligible. Females' LFPR began to drop five years before reaching pension eligibility age.
Dixon and Hyslop (2008)	65	Cohorts of 59- 70	Linked Employer-employee Dataset (LEED)	Linear Regression	Employment rate for males decreased by 4.2 percentage points and 2.1 percentage points for females at age 65.
Khawaja et al. (2009)	65	Cohorts of 65 and over	Census	NA	Over the past two decades, the LFPR of individuals aged 65 and over increased significantly.

Maloney (2000) used regression analysis to investigate the social impacts and labour supply of changing welfare programmes in NZ – including NZS. The motivation of this paper was that NZ has a relatively simple social welfare system compared to the complex structures in other countries. Based on this fact, it was much easier to isolate the social impacts and labour supply on the changing welfare system.

Maloney (2000) focused primarily on reviewing three major welfare programme changes in NZ, including the Domestic Purposes Benefit (DPB), NZS, and Unemployment Benefit (UB). DPB was provided to single-parented families, also for women living alone with age 50 and over. NZS was provided for individuals who reached pension age. UB was intended to support individuals before they found jobs. DPB and UB had income thresholds and abatement rates once their earned income was higher than the threshold, while NZS did not have. In late 1990, the NZ Government tightened the eligibility criteria, e.g., increased the eligibility age for UB and DPB from 16 to 18, gradually increased the Superannuation age from 60 to 65 between 1992 and 2001, and reduced the UB benefit for those aged 16 or 17.

The research used quarterly aggregated data of the HLFS, which was sometimes referred to as synthetic panel data, from December 1985 to December 1995. The model was estimated:

$$H_{it} = \eta_t + X_{it}^{'}\gamma + \alpha lnG_{it} + \beta lnE_{it} + \delta Q_{it}^{'} + u_{it} \tag{3.7}$$

H_{it} is the dependent variable of labour supply, e.g., labour force participation, weekly hours of working, and labour force participation and education. The subscript i indicates mean outcomes in these cells. η_t is quarterly dummy, $X_{it}^{'}$ is the demographic characteristics, lnG_{it} is the maximum amount of natural logarithm of real weekly benefit, lnE_{it} is the natural logarithm of breakeven income, $Q_{it}^{'}$ measures the change of benefit eligibility, using two variables. The first dummy variable measures the change of eligibility age of UB and DPB from 16 to 18. The second variable captures the increase of NZS eligibility age from 60 to 65, with a value from zero to one.

To estimate the parameters, Weighted, Generalized Least-Squares (GLS), which is also referred to as random effects estimation, is used.

$$u_{it} = v_i + \varepsilon_{it} \tag{3.8}$$

where

$$E(v_i) = 0 \quad Var(v_i) = \sigma_v^2 Cov(v_i, \varepsilon_{it}) = 0 \tag{3.9}$$

u_{it} is the disturbance term, v_i is a component contained by u_{it} that is specific for each individual.

$$Corr(u_{it}, u_{is}) = \frac{\sigma_v^2}{\sigma_v^2 + \sigma_\varepsilon^2} \text{ for } t \neq s \tag{3.10}$$

Maloney (2000) measured the effects of the control variables on three dependent variables, including the labour force participation rate, weekly working hours, and labour force participation and education. Most of the regression results were in line with the hypotheses. In terms of ethnicity, the labour force participation of Māori and Pacifica was relatively lower than other races. The involvement of the workforce was positively associated with education. The increase in NZS age had a significant positive impact on labour supply behaviour. An one-year increase in pension eligibility age resulted in an estimated 5.1 percentage-point increase in labour force participation and 2.33 hours of weekly labour supply.

The advantage of this research is that it uses data both before and after the reform to capture the labour supply effects. However, the time span of the data is from 1985:4 to 1995:4, and so stops short of the full transition to the age of 65 eligibility – pension eligibility age has only increased to 62.75, only halfway through 65. The limited time period does not allow the full effects to be observed.

To explore the factors that contribute to the changes in employment and wage rates, Kalb and Scutella (2004) carried out an in-depth analysis of labour behaviour for working-age individuals between 1991 to 2001, covering the entire transition period in the rise in pension age from 60 to 65. [26] Instead of using aggregate data, they used eight-year pooled data of Household Economic Surveys (HES) between 1991/92 and 2000/01, which enabled them to measure the driving factors on employment and wage rates at an individual level.

[26] Wage rates indicate average working wage.

To minimise the selection bias, they allowed the correlation between estimating employment and wage rates. The models they used were a combination of Probit and regression conditional on being employed. The first model was Probit:

$$E_i^* = z_i'\gamma + u_i \tag{3.11}$$

$$E_i = \begin{cases} 1\ if E_i^* > 0\ occurring\ with\ prob.\ \Phi(z_i'\gamma) \\ 0\ if E_i^* \leq 0\ occurring\ with\ prob.\ 1 - \Phi(z_i'\gamma) \end{cases} \tag{3.12}$$

where $E_i = 1$ if individual's market wage is higher than the reservation wage, z_i are personal characteristics, u_i is assumed to have a normal distribution, $\Phi(z_i'\gamma)$ is the standard normal cumulative distribution function with a normal density function of $\phi(z_i')$.

The second regression model was:

$$w_i|_{E_i=1} = x_i'\beta + \varepsilon_i \tag{3.13}$$

where w_i is the logarithm of the wage, x_i is demographic characteristics, ε_i is normally distributed. Then maximum likelihood estimation is utilised, where

$$\varepsilon_i, u_i \sim N(0, \sum),\ with \sum = \begin{bmatrix} \sigma_\varepsilon^2 & \rho\sigma_\varepsilon \\ \rho\sigma_\varepsilon & 1 \end{bmatrix} \tag{3.14}$$

Five groups were assessed using the above models, including sole parents, single women with no kids, single men with no kids, married women, and married men. They found that the estimation results were most consistent with their hypotheses, except for sole parents. They found that education was positively correlated with wage rates and had a significant impact on them. Higher education increased the probability of being employed, particularly for women. In terms of ethnicity, European descendants had the highest wages, followed by Māori and Pacifica (which were classified in the same group), whereas other ethnicities shared the lowest. Similar to what (Hurnard, 2005; Maloney, 2000) found, there was a considerable increase in employment rates during the study period as a result of the rise in the pension age.

However, some concerns remain in this study. First, they only included the working-age population and excluded individuals who were over age 65. This leads to an inability to observe the elderly's retirement behaviour. Second, disabled individuals were also excluded from the study, which prevents the examination of shifts from means-tested main benefits to non-means-tested NZS in labour behaviour. Finally, this study fails to

measure the aggregate change in total income due to the exclusion of self-employed individuals.

Hurnard (2005) examined the labour supply impact of being pension eligible, using five-year Census data. His research covered the period of two policy changes. The first was the introduction of the non-means-tested universal National Superannuation in 1977, which reduced the pension age from 65 to 60. Before 1977, the pension was means-tested for people aged 60 and 64 (Age Benefit), and not means-tested for people aged 65 and over (universal Superannuation). The second was the raising of the pension age from 60 to 65 between 1992 and 2001. He concluded that being pension eligible significantly decreased the LFPR for both males and females.

He pointed out that the strength and rapid response of increasing the pension age to the labour supply in NZ was unique among OECD countries. Four NZS features were provided to support his discovery. The first was NZS's aim to provide social security. It helped to eliminate the gap in wealth between people after they retired. The second was the outlawing of mandatory retirement based on the NZ's Human Rights Act 1993, which states that it is unlawful for an employer to require compulsory retirement for an employee since 1999. Third, NZS does not rely on previous employment history as part of its universal benefit (non-means-tested), which only depends on residency and partnership requirements. Finally, NZ has limited early retirement options, allowing NZS recipients to include non-qualified partners that would be subject to a means-test.

His study used Census data from 1976, 1981,1986, 1991,1996, and 2001. Five age groups (45-49, 50-54, 55-59, 60-64, 65 and over) and two genders were included, making a total of 60 observations. To evaluate the effects of the NZS eligibility age on the labour supply, the following model was used:

$$P_{gjt} = a + bU_t + cE_{gjt} + dD_{gj} + \varepsilon_{gjt} \tag{3.15}$$

where P_{gjt} is the LFPR for specific gender and age group, g indicates gender, j indicates age group and t is census year. U_t is the aggregate unemployment rate, E_{gjt} is the percentage of specific gender and age group that is eligible for NZS in year t. $E_{gjt} = 0$ if an individual is under age 60 and $E_{gjt} = 1$ if an individual is older than age 65. For individuals aged between 60 to 64, $E_{gjt} = 0.28$ for males and $E_{gjt} = 0.4$ for females in 1976, which denoted the percentages of people receiving means-tested Age Benefit for each gender before 1977; $E_{gjt} = 1$ in 1981, 1986 and 1991, $E_{gjt} = 0.5$ in 1996 (halfway

of the rise in pension age since 1992) and $E_{gjt} = 0$ in 2001. In addition, E_{gjt} was interacted with gender to capture the differential labour supply effects of being pension eligible between males and females. D_{gj} is the dummy variable indicating gender and age group. ε_{gjt} is a disturbance term that is assumed to follow a normal distribution

He found that being pension eligible decreased the LFPR by 21 percentage points for males, and 7 percentage points for females. He also detected that being pension eligible was not the only reason that caused the rapid decline in females' LFPR. Within several years before reaching pension age, females' LFPR declined by about 11 percentage points.

One of the biggest limitations of his study is that he did not allow the separation of the aging process and being pension eligible in his estimation, as the aging process independently has a significant impact on labour force participation. His finding was only a broad estimation of the labour supply change before and after being pension eligible.

Dixon and Hyslop (2008) examined individual labour supply behaviour of reaching the age of pension eligibility of 65, using longitudinal unit record data of Linked Employer-Employee Data (LEED) between 1 April 1999 and 31 March 2007. They evaluated the NZS take-up rates, employment patterns, and income changes over the study period.

LEED includes information on individuals' monthly earnings, annual self-employed income, and general government benefits (main benefits, Accident Compensation Corporation, and NZS). They selected individuals, who once had payments recorded in LEED, and were born between 1 April 1936 and 31 March 1940 for their analysis, allowing at least two years before and after they reached 65. As LEED contains information of those born in NZ and foreign countries and those who might have died over the study period, they restricted their sample cohort to those who had either received income or benefit payments at age 66. The final sample size was 106,070.

Using earnings as a proxy for employment status, they first ran a linear regression on age, birth cohort, being pension eligible or not, and an interaction between being pension eligible and age, for males and females separately. Significant labour supply effects were discovered between the ages of 59 and 71. They found that the annual decline in the employment rates was 1.8 percentage points before 65, and 2.2 percentage points after 65 for males. For females, the annual decline in employment rates was 2.2 percentage points before 65 and 1.7 percentage points after 65.

Furthermore, there was a one-off permanent drop in employment rates at age 65, with a decrease of 4.2 percentage points for males and 2.1 percentage points for females. These results were not comparable to the findings of Hurnard (2005), who found that being pension eligible decreased the LFPR by about 21 percentage points for males, and about 7 percentage points for females. Their study allowed the separation of the ageing process and being pension eligible, which Hurnard (2005) failed to include. Moreover, their study more precisely captured the labour supply change one month before and after being pension eligible, whereas Hurnard (2005) only measured a broad labour supply change before and after being pension eligible over years.

Khawaja and Boddington (2009) used five-year census data from 1986 to 2006 to examine the trends in LFPR among older people in NZ. They described the trends in subgroups such as gender, age, ethnicity, education, and region. Over the past two decades, the LFPR of individuals aged 65 and over has increased from 6.4 percent to 17.1 percent. In the case of superannuitants, their LFPR increased by 11 percent from 1991 to 2006. They also indicated that men were more likely to continue to work after reaching pension age. Finally, they demonstrated that individuals were more likely to work after reaching pension age with higher education compared to those with lower educational attainments.

However, as the data they used came from the five-year censuses, it was not possible for them to track the monthly employment change for a specific person. Moreover, the results they provided were just descriptive statistics, not econometric findings.

3.5 Conclusions

The international literature on publicly running pension programmes discussed the impact on the labour supply in three aspects. First, the earnings test of pensions normally has a negative impact on the labour supply, such as in the case of South Africa (Ranchhod, 2006). In addition, individuals' retirement decisions and labour supply were significantly affected by the Social Security system (Burtless & Moffitt, 1985; Gordon & Blinder, 1980; Hanoch & Honig, 1983).

Second, most studies show that the removal of the earnings test has significant positive effects on the participation of the workforce. Three forms were displayed for the labour supply changes, including intensive margins, extensive margins, and the change of pension take-up rates (for voluntary pension systems). (Baker & Benjamin, 1999; Disney

& Smith, 2002; Engelhardt & Kumar, 2007; Haider & Loughran, 2001) discovered the changes in labour supply in intensive margins. (Brinch et al., 2015; Friedberg, 2000; Gruber & Orszag, 2000; Hernæs et al., 2016) found the change of labour supply in extensive margins. (Baker & Benjamin, 1999; Gruber & Orszag, 2000; Haider & Loughran, 2001; Song & Manchester, 2007) estimated the rise in pension take-up rates.

Third, the rise in the pension age normally delays individuals' pension take-up decisions from 1 to 7.9 months (Engels et al., 2017; Hanel & Riphahn, 2012; Lalive, 2007; Li & Maestas, 2008; Manoli & Weber, 2016; Mastrobuoni, 2009). It also increased labour supply around retirement (Atalay & Barrett, 2015; Cribb et al., 2013; Engels et al., 2017; Lalive, 2007; Manoli & Weber, 2016; Staubli & Zweimüller, 2013; Vestad, 2013). The estimated labour supply effects were broadly consistent across studies, with the effects on females normally higher than males. It also led to benefit substitution effects such as individuals remaining on unemployment (Engels et al., 2017; Staubli & Zweimüller, 2013) and disability benefits (Atalay & Barrett, 2015; Duggan et al., 2007; Vestad, 2013).

The domestic literature mainly focuses on evaluating the labour supply effects of the rise in pension eligibility age from 60 to 65. Positive labour supply effects were found by (Hurnard, 2005; Kalb & Scutella, 2004; Maloney, 2000). Kalb and Scutella (2004) mainly focused on evaluating the income change of the pension reform. They did not exactly show the percentage change of the LFPR. Maloney (2000) showed that the rise in pension age increased LSPR by 5.1 percentage points. Hurnard (2005) measured the labour supply effects of being pension eligible and found a significant decrease in LFPR, with 21 percentage points for males and 7 percentage points for females.

On the one hand, these studies provide some insights into the labour supply effects of the NZ pension scheme. On the other hand, some concerns related to the current study are also raised. The first question is, under the current non-means-tested pension scheme, whether NZ has labour supply responses that are comparable to other countries, such as Norway, which adopts a scheme closer to that of NZ? The second question is that scholars generally evaluate the labour supply behaviour of the working-age population, stating that the retirees' labour behaviour is quite different. Does NZ share the same pattern as other countries? Or does NZ share a different labour supply pattern for the elders? The third question comes from the non-means-tested NZS. Will the shift from the pre-65 means-tested main benefits to the post-65 non-means-tested NZS have an effect on labour supply? If it does, what is the direction and magnitude of the impact?

A further issue is to extend the study of Dixon and Hyslop (2008), including the NZS take-up rates, employment rates, and total income changes. First, will the NZS take-up rates be different when excluding those who died and emigrated from NZ? Are there gaps within the subpopulations on the uptake of NZS like other pension schemes, such as gender (Bardasi & Jenkins, 2010; Even & Macpherson, 1990)? Does take-up issue exist under the publicly-funded and non-means-tested pension scheme in NZ, which are based solely on the age of 65, partnership, and residency requirements? Ethnic inequalities are one of the major concerns in the pension take-up for occupational and private pensions (Ginn & Arber, 2001; Steventon & Sanchez, 2008; Vlachantoni et al., 2017). However, limited evidence shows that the minorities in other countries have lower take-up rates for publicly-funded pensions that are similar in nature of NZS. The evaluation of NZS take-up rates would add to the international literature on take-up issues in a publicly-funded and non-means-tested pension system.

Second, will the employment rates around pension eligibility age be different for subpopulations? For the main beneficiaries, will the employment increase when transitioning from means-tested main benefits to non-means-tested NZS? The evaluation of the employment rates before and after being pension eligible in NZ could offer a potential contribution to the international literature about the evidence on older workers' labour supply and retirement behaviour under a publicly-funded and non-means-tested policy environment.

Third, income inequality exists among subgroups, such as race, gender, and educational attainments, particularly in the post-retirement (Brown, 2016; Choi, 1997; Heisig et al., 2018; Pensions, 2014). Is this the same case in NZ? What are the overall income changes and distribution? How does total income change at age 70 relative to age 60? Is the pension benefit not adequate to sustain the retirement life of the elders? The evaluation of the income and source of income changes around pension age in NZ will offer a new perspective to the international literature.

4 Data and Descriptive Statistics

4.1 Introduction

This study uses data from the Integrated Data Infrastructure (IDI), which is managed by the Statistics New Zealand (Stats NZ). The IDI is a large research database that contains high-quality administrative data about individuals and households from a range of government agencies, Stats NZ and non-government organisations. Data in the IDI has a unique identifier and is de-identified. The unique identifier enables researchers to link variables from multiple sources to gain system-wide insights. The data is accessed via a secure data lab, to which only approved researchers can get access. All outputs are subject to confidential rules and will be checked by Stats NZ staff before release. A disclaimer statement is provided at the beginning of this research.

4.2 Datasets

This study uses a combination of survey and administrative data, including the 2013 Census, Tax data, Benefit Dynamic data, International Travel and Migration data, and Personal Details data.

4.2.1 2013 Census

Between 1851 and 1887, the Census was conducted every three years by Stats NZ. After 1887, it was revised to be carried out every five years. It provides individual-level data on those who were in NZ on the Census night (e.g., 5 March 2013), including visitors from overseas. However, it excludes NZ residents who were not in the country on the night of the Census. It contains detailed information on individual characteristics, such as the year and the month of birth (the day of birth is redacted in the IDI), age, gender, ethnicity, education, country of birth, income, etc.

This study uses data from the 2013 Census since it was the most up-to-date Census available at the time of this research. Six variables from the 2013 Census were used: the year and the month of birth, gender, ethnicity, country of birth, and education.

Ethnicity can be found in a number of IDI datasets, such as the 2013 Census, Health data, Education and Training data, and Personal Details data. The ethnic variable in the 2013 Census was chosen because this study uses the 2013 Census as the ‘spine’, and it has a relatively higher response rate compared to other datasets. In the 2013 Census, ethnicity is self-identified and up to six ethnicities can be identified by each person. In other words,

people can have multiple ethnicities. As a result, two primary options are often used to present ethnicity, using prioritised ethnic groups and total response (overlapping) ethnic groups.

Prioritised ethnic groups include individuals being assigned to a single ethnic group, with the order of priority as Māori, Pacifica, Asian and European/Other (Ministry of Health, 2017). For example, if anyone identifies that they are Pacifica and Māori at the same time, they will be classified as Māori under the prioritisation rule. Total response (overlapping) ethnic groups refer to individuals assigned to more than one ethnic group simultaneously (Ministry of Health, 2017). For example, if anyone identifies themselves as Pacifica and Māori, they will be classified as both Pacifica and Māori.

This study uses the total response ethnic groups for analysis, as suggested by Stats NZ, who discontinued the use of prioritisation as a standard output (Stats NZ, 2014). Two reasons are provided for this decision. First, the percentage of individuals identified with more than one ethnicity has increased over the last decade, with 9.0 percent in 2001, 10.4 percent in 2006 and 11.2 percent in 2013 (Stats NZ, 2014). Thus, using the total response ethnic groups will provide a better understanding of the diversity of ethnic identity in NZ than the prioritisation rule (Stats NZ, 2004). Second, the use of the prioritisation rule could lead to a significant underestimation of certain ethnic groups which have high levels of intermarriage, especially for the Pacifica group (Stats NZ, 2004).

The educational indicator in the 2013 Census is used to categorise the educational history of a person, as all individuals in this research had reached the age of 65 in 2013. For the vast majority of individuals, their level of education was set decades prior to this Census. Furthermore, education data in the IDI was only available for those enrolled in primary and secondary schools after 2007 and those with tertiary education after 1994, which is too late to capture the educational details of the older cohorts analysed in this study.

4.2.2 Tax Data

Income data for this study come from two sources, one is the Employee Monthly Schedule (EMS) data and the other is the Individual Income Tax Return (IR3) data, both of which are taxable income and available within the Tax data module of the IDI deposited by the Inland Revenue Department (IRD).

The EMS is the primary source of income for this research. It contains monthly data on the earnings of workers, the working-age main benefits, and the NZS. It does not contain

supplementary benefit payments (see Section 2.2.3). The earnings of workers in the EMS are reported by employers to IRD on a monthly basis for the purposes of workers' pay-as-you-earn (PAYE) tax. The monthly working-age main benefit payments (without benefit type) and the NZS payments available in the EMS are provided by the Ministry of Social Development (MSD) who administer those payments.

The second source of income in the IDI is the IR3 records which provide all other income data, including interest, dividends, estate or trust, overseas, partnership, shareholder, rent, self-employed, etc. IR3 records are filed by individuals at the end of each tax year and so only annual income from these sources is provided. As this study evaluates income on a monthly basis, the annualised IR3 data is converted into imputed monthly income by dividing it by 12.

Another important indicator the EMS contains is the employer ID number. It tracks the changing status of a person's employment in a company. For example, it shows the employment status of a person who has stopped working entirely or has changed jobs while being pension eligible.

4.2.3 Benefit Dynamics Data

The Benefit Dynamics data (BDD) includes information on individuals who received a working-age main benefit or supplementary benefit payment over a period of time as spells, including the start and the end dates on which benefits have been received since January 1993. It traces an individual's benefit history since the benefit was first granted. The majority of variables in the dataset are extracted from the Social Welfare Information for Tomorrow Today (SWIFTT) system by MSD.

The BDD specifies not only the benefit amount, which includes the taxable working-age main benefits and non-taxable supplementary benefit payments, but also the benefit types. It enables this study to investigate the major types of main benefits that a person has after reaching age 65. More specifically, the information on supplementary benefits helps to establish the monthly status of the people in our study with respect to their receipt of a main benefit – after age 65, when they were supposed to switch to NZS.

4.2.4 International Travel and Migration Data

The International Travel and Migration (ITM) data from the Stats NZ provided this study with information on all individuals who had a record of movement across the NZ border since 1997. The NZ Customs Service provides Stats NZ with electronic passport and

flight records for passengers, as well as information on departure and arrival cards.[27] The departure and arrival cards were initially used to process and account for all travellers who departed or arrived in NZ. Later, the cards were used by Stats NZ to collect information on tourism and migration. Departure (Arrival) cards are filed when an individual departs (arrives) NZ, identifying their purpose of departure (arrival) and duration of departure (staying). The purpose includes whether an individual leaves (stays) NZ permanently or not. Stats NZ processes all arrivals and departures and assigns them to three different passenger categories: overseas visitors, NZ resident travellers, and permanent and long-term migrants. These records allow us to establish travel history for the individuals in the study as well as determine whether a person was constantly residing in New Zealand in any given month.

4.2.5 Personal Details Data

The Personal Details data is a derived dataset from Stats NZ, offering the most up-to-date demographic information for individuals born in NZ, including gender, year and month of birth, year and month of death, and ethnicity using all available sources.

4.3 Study Outcomes

Three primary economic outcomes are reported in this study, including NZS take-up rates, employment rates, and overall gross income. The first is the NZS take-up rates, which use the receipt of NZS in the reference month as a proxy.

The second is employment rates. Due to the lack of a measure of labour force status in the IDI, the labour force participation rate (LFPR) of individuals cannot be directly assessed in this study. Moreover, for individuals aged 60 to 69, the unemployment rate decreased from 4.7 percent in the first quarter of 2000 to the lowest of 1.0 percent in the third quarter of 2007. It then increased slowly to 4.0 percent in the third quarter of 2012. After the fourth quarter of 2012, it varied between 2.0 to 3.0 percent to the end of 2017. The average unemployment rate between 2000 and 2017 was only 2.6 percent.[28] The relatively low unemployment rate for this group provides this study with an opportunity of using the employment rate to measure labour force activity, with the employment rate being just slightly under the LFPR.

[27] The departure cards have been removed since November 2018, NZ Customs Service.
[28] Source: Household Labour Force Survey, Infoshare, Stats NZ.

Because employment cannot be directly observed, this study uses work income (as recorded in the IRD) as a proxy for labour force status (where reporting earnings or self-employment income to IRD in a reference month is taken as the person being in the labour force in that month).[29] However, since the IR3 only contains annual self-employed income data, it is impossible to exactly determine which month a person was self-employed over the year. We assume that if a person receives self-employed income in that year, he or she is treated to work every month during that year. Under this situation, the monthly employment rates observed will be overestimated. But if only including earnings, the estimation will be underestimated. In order to fully capture the changes in employment, this study includes those who earned self-employed income (as recorded in the IR3) from the definition of 'being employed'.

The third outcome is overall gross income. This contains income from all sources recorded in both EMS and IR3, including earned income, main benefits, NZS, and unearned income.

4.4 Sample Cohorts

This research focuses on a group of individuals who were born between 1940 and 1947. One reason for choosing this cohort is that it not only enables us to track the labour supply behaviour upon reaching the pension eligibility age, but also allows us to evaluate the changes in labour supply five years after eligibility. This extended duration helps us to understand the responses to changes in the effective marginal tax rates among older workers, particularly those who transitioned from the means-tested main benefits scheme before age 65 to the non-means-tested NZS scheme after age 65. Another reason is that the Tax data are only available since 1999, which restricts this study to a consistent assessment period of no more than ten years for all these birth cohorts.

To obtain a better understanding of the labour supply effects of pension eligibility, this research aims to ensure that the cohorts assessed are all eligible to continuously receive NZS (NZS requires an individual must be a NZ citizen or a permanent resident and have resided in NZ at least 10 years after the age of 20 and 5 years after the age of 50). However, because the IMT data is only available after 1997,we can only ensure that our sample cohort meets the five years of residency between the ages of 60 and 65. We cannot guarantee that all individuals have 10 years of residency since age 20. Additionally, since

[29] Work income indicates work-related income, including earnings and self-employment income.

this study assumes that a person is not participating in the labour force (rather than that he or she has died or left the country) when having no record in the Tax data, it is important to account for who is actually living in NZ during the study period.

The Tax data contains three groups of individuals who may not permanently reside in NZ (and are therefore not eligible for NZS). The first is NZ residents who used to live in NZ (during the study period) and have emigrated permanently abroad. The second is non-NZ residents who were born overseas but have lived and worked in NZ for a short time (during the study period). The third is NZ residents who have earned income and died at some point. Since the ITM data contains all information on departures and arrivals, this makes it possible to differentiate directly from a person who does not reside permanently in NZ. At the same time, the Personal Details data, which provides a date of death, help us assess whether or not an individual is still alive. The combination of these datasets allows us to build a well-defined population base that increases the precision of the aggregate employment rate analysis.

4.5 Sample Construction

Figure 4.1 Summary of sample construction

- Inclusion:
    - Cohort in Census 2013 born between 1940 and 1947 (N = 290,889)
- Exclusion:
    - Month of birth information missing (N=561)
    - Do not appear in EMS or IR3 data (N =37,158)
    - Died between age 60 and 70 (N=5,421)
    - Arrived in New Zealand with passenger class that was not permanent or resident since 1997 (N=25,983)
    - Emigrate abroad permanently between age 60 and 70 (N=498)
- Final sample size: N = 221,268

Source: Data generated by the author from Integrated Data Infrastructure, using sample cohorts born between 1940 and 1947 with an evaluation period from 2000 to 2017.
Notes: Due to the confidential rule of Statistics New Zealand, all counts derived from the Integrated Data Infrastructure dataset in this study are randomly rounded as a base number of 3.

The summary of the sample construction of this study is illustrated in Figure 4.1. First, the 2013 Census was chosen as the spine to link the datasets. From the spine, 290,889 individuals born between 1940 and 1947 (aged between 66 and 73 at the time of the 2013 Census) were selected. The overall strategy is to then follow them both backwards and forwards in time around this spine to examine their circumstances between age 60 and 70, with an evaluation period from 2000 to 2017. Their demographic information was kept, including the year and month of birth, gender, ethnicity, country of birth, and education. Second, 561 individuals were excluded due to a lack of information on the month of birth. Third, each person in the cohort was matched to the EMS or the IR3 data to link their earnings or other income, the working-age main benefits and the NZS. 37,158 individuals were excluded for never having any EMS or IR3 information because it is difficult to distinguish between those who legitimately have never earned an income (e.g.,

non-working partners) and missing data. If these people with erroneous data were included in our sample, this could bias our findings. Fourth, the ten-year observation window was kept from their 60th to 70th birthdays, a total of 121 months. The death records from Personal Details data were linked and 5,421 individuals who died between the ages of 60 and 70 were excluded. Finally, the movements across the NZ border from the ITM data were linked. Border movement records provide detailed information on the dates of exit and entry into NZ before and after 2013, as well as the passenger class (i.e., overseas visitors, NZ resident travellers, permanent and long-term migrants). 25,983 individuals whose first entry into NZ was after 1997 and whose passenger class was not permanent or resident were removed. 498 individuals who emigrated permanently to another country between the assessment period were also excluded. The final sample for this study is 221,268 (or 76.1% of the original sample taken from the 2013 Census).

4.6 Descriptive Statistics

4.6.1 Summary Statistics

Table 4.1 provides the summary statistics on the data that will be used in the following chapters. The total population evaluated in this study is 221,268, with 108,426 males (49 percent) and 112,842 females (51 percent). The major ethnic groups studied in this research are European (87.1 percent), Māori (6.6 percent), Pacifica (2.5 percent) and Asian (3.6 percent). The remaining 0.3 percent of MELAA and 2.4 percent who either identified themselves as other ethnicity or did not specify the ethnicity will be categarized as 'Other Ethnicities' in the estimation (see Table 4.2).[30] The sum of all ethnic groups is more than 100 percent because this study uses the total response ethnic group identification (see Section 4.2.1), which means that a person can have multiple ethnicities. The number of individuals born in NZ was almost three times that of those born in foreign countries. Individuals born in younger cohorts were more than those born in older cohorts, with the exception of the 1942 and 1943 cohorts. The percentages of these two cohorts decreased slightly, by 0.1 and 0.3 percentage points compared to the rate of 1941 cohort, respectively. The number of individuals obtaining qualifications less than university degrees was the highest, with 47.2 percent. The percentage of individuals receiving university degrees was 10.5 percent. 33.5 percent of individuals did not have any qualifications, and 8.7 percent of individuals had unspecified qualifications.

[30] MELAA indicates the ethnicity of Middle Eastern or Latin American or African.

The average real monthly rates were $65 from main benefits, $521 from NZS, $1,155 from work income, $278 from other income – with a total income of $2,018.[31] Over the ten-year observation period, the average monthly employment rate was 48.8 percent. The employment rate is the proportion of the total population who were employed in the current month. The average share of people receiving main benefits in a month was 8.8 percent. More than half of the main benefits received were health-related main benefits, which would have an impact on people's working abilities.

Regarding benefit history, 16.8 percent of individuals had *sometimes* received a working-age main benefit between the ages of 60 and 64 (referred to as the Sometimes Benefit group).[32] 9.3 percent of individuals had *continuously* received working-age main benefits for each month between the ages of 60 and 64 (referred to as the Continuous Benefit group). 73.9 percent of individuals *never* received a main benefit before reaching age 65 (referred to as the Never Benefit group).

In terms of pre- and post-65 labour supply behaviour, the proportion of months receiving zero income dropped to 0.9 percent after 65, compared to 18.5 percent before 65. This is convincing evidence that NZS helps to protect people from poverty after they turn 65. The proportion of months earning main benefits was 16.7 percent before 65, and 1.0 percent after 65, which indicates that not all beneficiaries transitioned to NZS after being pension eligible. The proportion of months receiving work income was 59.4 percent before 65, and 38.3 percent after 65, with the conditional average total monthly income being $2,906 before 65, and $3,393 after 65.

[31] All the income amounts in this section and the sections followed are adjusted as 2000 quarter one NZ dollars.
[32] In this study, 'between the ages of 60 and 64' refers to the time period between the 60th birthday to the month prior to the 65th birthday.

Table 4.1 Summary statistics of cohorts born between 1940 to 1947

Variables	Mean	Standard Deviation	Minimum	Maximum
Employment rate	0.488	0.500	0	1
European	0.871	0.335	0	1
Māori	0.066	0.249	0	1
Pacifica	0.025	0.156	0	1
Asian	0.036	0.186	0	1
NZ born	0.749	0.433	0	1
Male	0.490	0.500	0	1
Born in 1940	0.110	0.313	0	1
Born in 1941	0.115	0.319	0	1
Born in 1942	0.114	0.318	0	1
Born in 1943	0.112	0.315	0	1
Born in 1944	0.122	0.327	0	1
Born in 1945	0.130	0.336	0	1
Born in 1946	0.144	0.351	0	1
Born in 1947	0.154	0.361	0	1
No Qualification	0.335	0.472	0	1
Qualification Less Than University Degree	0.472	0.499	0	1
University Degree	0.105	0.307	0	1
Qualification Unknown	0.087	0.282	0	1
Sometimes Benefit group	0.168	0.374	0	1
Continuous Benefit group	0.093	0.291	0	1
Never Benefit group	0.739	0.439	0	1
NZS status	0.521	0.500	0	1
Benefits status	0.088	0.088	0	1
Health-related benefits	0.048	0.213	0	1
Other benefits	0.040	0.196	0	1
Real monthly main benefit	$64.514	223.481	-[33]	-
Real monthly NZS	$520.529	535.048	-	-
Real monthly work income	$1,154.948	2,616.455	-	-
Real monthly other income	$278.289	2,762.925	-	-
Real monthly total income	$2,018.279	3,739.155	-	-

Source: Data generated by the author from Integrated Data Infrastructure, using sample cohorts born between 1940 and 1947 with an evaluation period from 2000 to 2017.

4.6.2 Key Variables

Table 4.2 displays the key observative variables and their sources.

[33] Due to the confidential rule of Stats NZ, all minimum and maximum values that could identify an individual have to be suppressed.

Table 4.2 Key observative variables

Name	Dataset	Categories	Source
Income	EMS	Monthly earnings Monthly main benefits Monthly NZS	Employer reported MSD reported MSD reported
	IR3	Estimated monthly earnings from the IR3	Self-reported for tax filing
NZS	EMS	Receiving NZS	MSD reported
Benefit history	EMS	Sometimes Benefit group Continuous Benefit group Never Benefit group	MSD reported
Gender	2013 Census	Male Female	Survey response
Birth cohorts	2013 Census	Born in 1940 Born in 1941 Born in 1942 Born in 1943 Born in 1944 Born in 1945 Born in 1946 Born in 1947	Survey response
Country of birth	2013 Census	NZ born Foreign born	Survey response
Ethnicity	2013 Census	European Māori Pacifica Asian Other ethnicities	Survey response
Education	2013 Census	No Qualification Qualification Less Than University Degree University Degree Qualification Unknown	Survey response
Benefit type	BDD	Health-related benefits Other benefits	SWIFTT extracted

Source: Statistics New Zealand, *Integrated Data Infrastructure*, Data Dictionaries

There are four constructed categories for education subgroups, including 'No Qualification', 'Qualification Less Than University Degree', 'University Degree', and 'Qualification Unknown'. 'No Qualification' is classified as those who did not report any qualification in the 2013 Census. 'Qualification Less Than University Degree' is classified as those who earned either a level 1-4 certificate, a level 5-6 diploma, or an overseas secondary school qualification as the highest qualification. 'University Degree' are those who received either a bachelor's degree, a level 7 qualification, a postgraduate

and honours degree, a master's degree, or a doctor's degree as the highest qualification. 'Qualification Unknown' are those whose education levels were unidentified or not stated.

The analysis for this research is all focused on the variables illustrated above.

4.7 Advantages and Limitations

The datasets used in this research have some advantages over previous studies. First, unlike the single snapshots of self-reported annual income from surveys, longitudinal administrative data is closer to continuous information on income and sources. It offers greater accuracy than the self-reported income. Second, monthly data allows this study to measure the sensitivity of employment and income changes around pension eligibility age. Third, this study covers a ten-year observation period, allowing for the tracking of labour supply activities not only upon reaching pension eligibility age, but also several years after. Finally, the sample size is large enough to provide accurate empirical results.

There are also some limitations with respect to the sample data. First, one cannot tell the reasons for those who continuously lived in NZ and did not receive any work or other income. They may depend on their spouses or do not report their income through IRD. Second, family information is lacking in the IDI, which prevents this study from conducting a household-level investigation. Third, as arrival (departure) cards only capture the purpose of an individual's arrival (departure) at the time when they arrived (departed), they may alter their intentions after the arrival (departure). This could lead to the exclusion of those who should be included and the inclusion of those who should be excluded in our sample cohort. Another issue is the misreporting of the aim of the arrival (departure) cards, as it is self-identified information. There is a possibility that when a person entered (exited) NZ and did not indicate that he or she would permanently live (leave) here. Fourth, the estimated employment rates were overestimated, due to including annual self-employed income as a proxy of employment and assuming that a person was employed for every month if receiving self-employed income. Finally, the labour supply changes can only be evaluated at an extensive margin due to the lack of working hours information in the IDI. Nevertheless, changes in earnings over time can provide some indication of changes in working hours if we assume that hourly wages are less likely to change. For example, if we saw a 50 percent drop in earnings before and after the age of 65, it is likely to suggest that the individual reduced their monthly hours of work (e.g., dropping from full-time to part-time).

5 NZS Take-up Rates

5.1 Introduction

Due to the fact that people must formally apply to receive New Zealand Superannuation (NZS), this study analyses take-up rates for those reaching the age of eligibility for this public pension scheme. NZS take-up rate refers to the proportion of individuals who are legitimately eligible for NZS and receive this pension. Unlike other pension schemes, which will be affected by the contribution rates and the means-testing rules, NZS solely depends on the age of 65, partnership, and residency status. Once an individual took it up, there would be no other factors affecting their decision. This motivates us to see a 100 percent take-up rate after age 65 for the eligible cohort. The government also aims to achieve a 100 percent take-up rate after age 65 to alleviate poverty among the elderly (WEAG, 2018). However, two prior studies (Dixon & Hyslop, 2008; Hurnard, 2005) found that after pension eligibility age, the maximum NZS take-up rates were around 95 percent and 92 percent, respectively. This falls far short of the government's objective of 100 percent.

The eligible population in these previous studies may not have been well identified. In other words, some of those not taking up NZS may be ineligible due to residency requirements (an individual must be a New Zealand (NZ) citizen or a permanent resident and have resided in NZ at least 10 years after the age of 20 and 5 years after the age of 50). In this study, we will try to exclude those who appear to be ineligible for NZS from our sample cohort. We excluded those who migrated into NZ without a permanent or resident visa since 1997. We removed individuals who emigrated permanently to other countries, as well as those who died over the observation period. However, due to data limitations, we can only ensure that our sample cohort meets five years of residency between the ages of 60 and 65. We cannot guarantee that all individuals have 10 years of residency since age 20. It is also possible that some individuals in our sample were neither NZ citizens nor permanent residents, which could not be identified in administrative data.

This chapter provides a thorough examination of the NZS take-up rates upon reaching the age of pension eligibility. It looks at the take-up rates right at the month in which individuals reach their 65^{th} birthdays and tracks the changes over the next five years. It also explores why some subpopulations have lower take-up rates. Section 5.2 first looks at the NZS take-up rate for the entire sample. It then examines the take-up rates for a

variety of subsamples, based on differences in gender, birth cohorts, country of birth, ethnicity, education, and pre-65 benefit history. Section 5.3 presents the empirical analysis using Hazard-based duration models. Finally, a brief conclusion, as well as policy implications, is provided in Section 5.4.

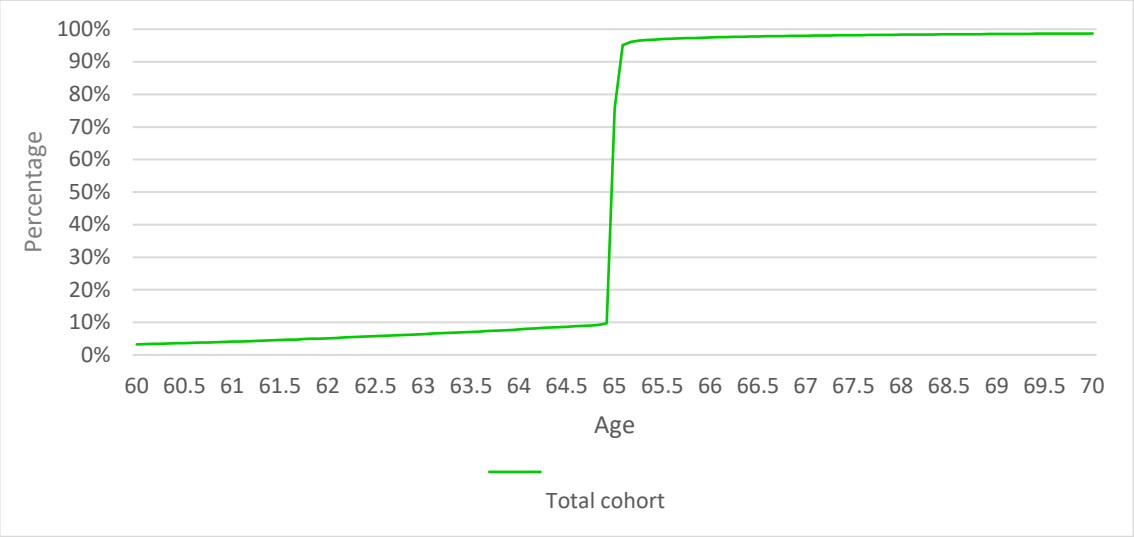
5.2 NZS Take-up Rates

Figure 5.1 provides the monthly NZS take-up rates for the entire study cohort over a ten-year period. It pinpoints the take-up rate in the month in which the person reaches age 65. Before age 65, less than 10 percent of the entire cohort received NZS. Those who were receiving NZS prior to age 65 are probably doing so because they can be included in an eligible partner's NZS, but we are unable to verify because the Integrated Data Infrastructure (IDI) does not have information on couples. In other words, we don't know who under the age of 65 was categorically eligible for NZS.

As the IDI does not have information on the day of birth, the exact day within a month when an individual turns age 65 is not known. In this study, the take-up month is dated as the month in which the first NZS payment is received. If an individual turns 65 on the last day of a month but receives his or her first payment at the beginning of the next month, this might look like a one-month delay in take-up. In fact, the receipt occurred immediately with the 65th birthday. This largely explains why the take-up rate in the 65th birthday month (75.8 percent) was 19.3 percentage points lower than the following month (95.1 percent).

We found that in contrast to the declining rate of take-up observed by Dixon and Hyslop (2008), NZS take-up rates continue to grow until age 70, with 75.8 percent at the 65th birthday month, 96.4 percent three months after turning 65, and 98.7 percent at the 70th birthday month, as shown in Figure 5.1. The difference is probably due to the fact that in the Dixon and Hyslop (2008) study, many of those who should have been expected to take up had died or emigrated.

Figure 5.1 NZS take-up rates for total cohort



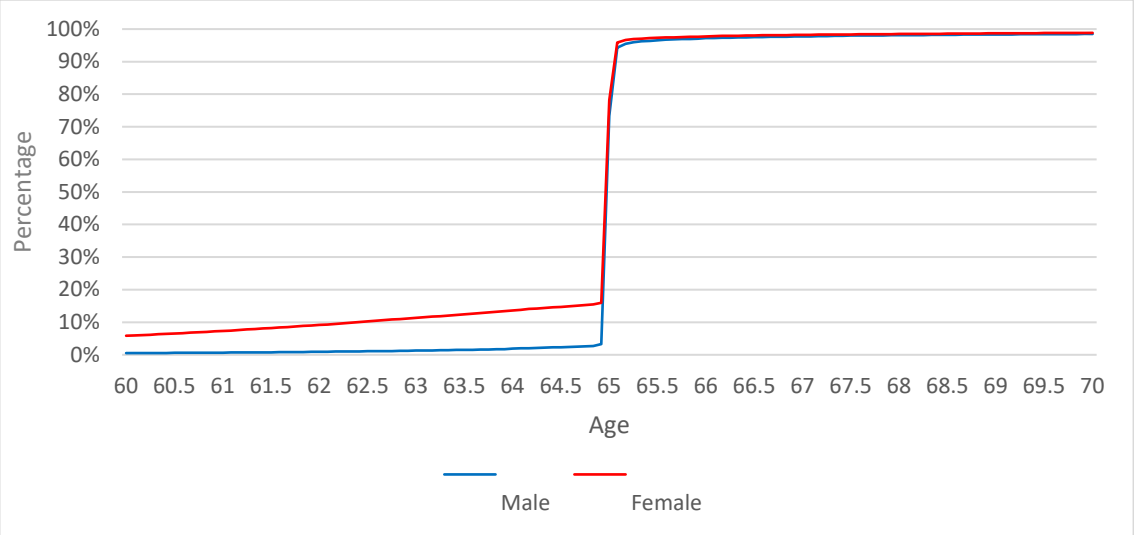
Source: Data generated by the author from Integrated Data Infrastructure, using sample cohorts born between 1940 and 1947 with an evaluation period from 2000 to 2017 (between their 60th and 70th birthdays).

5.2.1 Differences in NZS Take-up by Gender

The differences in NZS take-up rates by gender are depicted in Figure 5.2. Before age 65, females were more likely than males to receive NZS, with rates increasing steadily from 5.9 to 15.9 percent. Males, on the other hand, had a lower take-up rate than females, with the rate growing from 0.5 to 3.2 percent. The disparity in receipt of NZS by gender before age 65 may be due to the proportion of younger females married to older males being higher than the proportion of younger males married to older females.[34] It may also be because males are more likely than females to be employed and earning prior to 65 (Johnston, 2005). At the 65th birthday month, the take-up rate for females jumps to 78.2 percent, while the take-up rate for males jumps to 73.4 percent. Three months after reaching age 65, the take-up rate reaches 96.9 percent for females and 96.0 percent for males. At age 70, the take-up rate is 98.8 percent for females and 98.5 for males. The gender gap in take-up rates narrows between 65 and 70, decreasing from 4.8 to 0.3 percentage points. On average, females had higher take-up rates than males, which contradicts the findings of (Bardasi & Jenkins, 2010; Even & Macpherson, 1990) suggesting females were less likely to take up pension than males.

[34] In this study, marry refers to two person either formally married, in a civil union, or in a de facto relationship.

Figure 5.2 NZS take-up rates by gender



Source: Refer to Figure 5.1 for further information

5.2.2 Differences in NZS Take-up by Birth Cohorts

Appendix A 5.1 and Figure 5.3 show that younger cohorts had lower pre-65 NZS take-up rates and higher post-65 NZS take-up rates for both males and females.

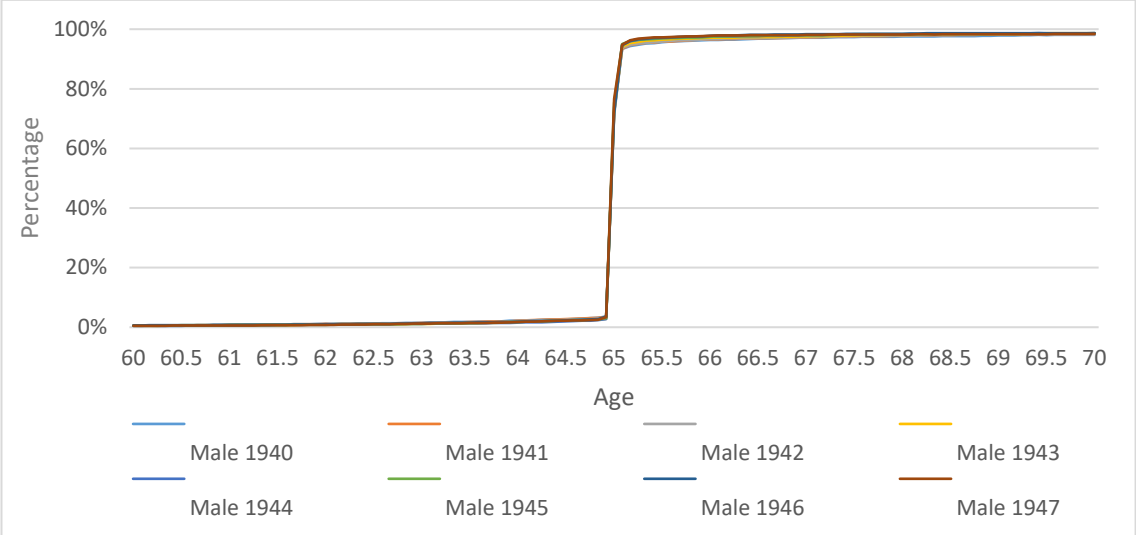
Before age 65, the percentage of males who received NZS was less than 4.0 percent, and it differs less across different cohorts. Females, on the other hand, had higher pre-65 take-up rates than males, ranging from 3.6 to 21.0 percent. Large variations existed in take-up rates across different female cohorts. For example, 9.3 percent of women born in 1940 claimed NZS at age 60. The rate increased to 21.0 percent one month before reaching age 65. For women born in 1947, 3.6 percent received NZS at age 60 and the rate rose to 14.0 one month prior to age 65. The receipt of NZS decreased across birth cohorts for females prior to age 65.

Three possible explanations could be given for this result. First, the proportion of younger women married to older men is falling over time, resulting in fewer women claiming NZS with their qualified husbands. Second, younger female cohorts' increase in education levels qualifies them for better-paying jobs, making them unwilling to receive the means-tested NZS with their qualified husbands. Probably most importantly, a steady increase in the labour force participation rate (LFPR) of females over time increased the work income for females before 65 (Johnston, 2005), which would reduce their early take-up

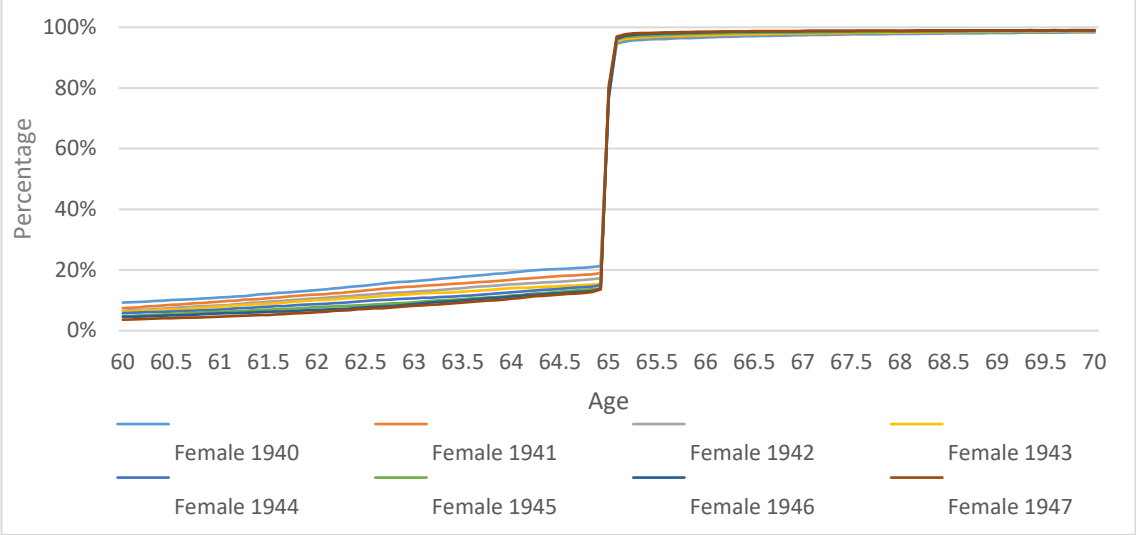
for NZS due to the means-tested feature.[35] In other words, the profiles for men and women should continue to converge for later birth cohorts.

The post-65 NZS take-up rates did not differ significantly for both male and female cohorts, which is in line with Figure 5.2. At age 70, their take-up rates were all above 98.0 percent.

Figure 5.3 NZS take-up rates by birth cohort



(a) Males



(b) Females

Source: Refer to Figure 5.1 for further information

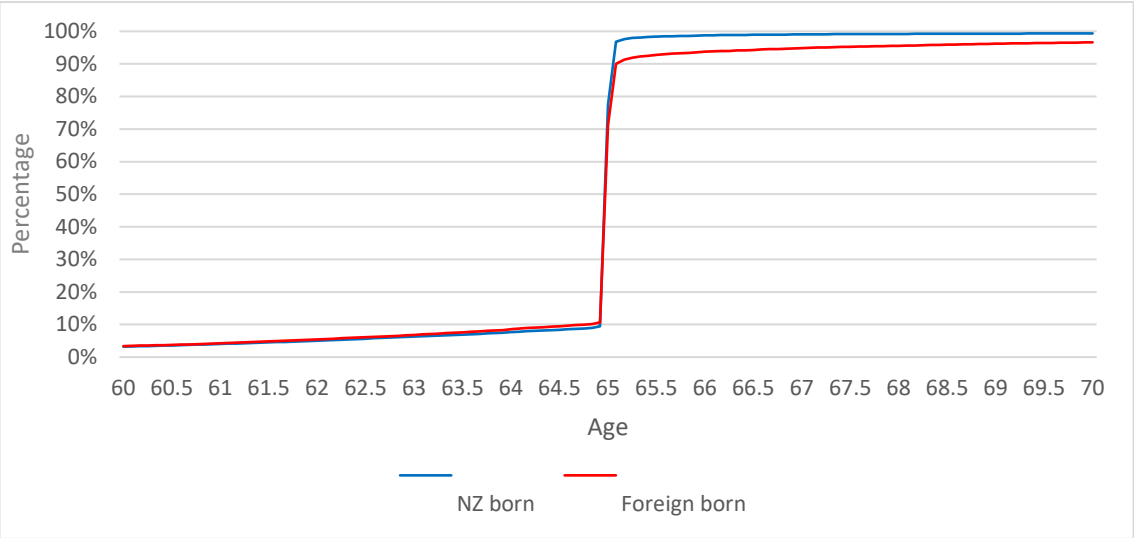
[35] The rise in employment rates for the later born females could give some indication of the rise in LFPR, as illustrated in Appendix 7.1 of Chapter 7.

5.2.3 Differences in NZS Take-up by Country of Birth

Figure 5.4 illustrates the variations in NZS take-up rates for those born in NZ and those born overseas. It shows that the proportion of individuals who received NZS before age 65 was similar for both groups, with rates growing from 3.3 to 10.6 percent. However, individuals born in NZ had a higher take-up rate after age 65. When reaching age 65, the take-up rate for those born in NZ is 77.4 percent. Three months later, it increases to 97.9 percent. At the 70th birthday month, the take-up rate peaks at 99.4 percent, implying that almost everyone born in NZ received NZS.

For those born in foreign countries, the take-up rate is 71.1 percent at the 65th birthday month. It increases to 91.9 percent three months later. At age 70, the take-up rate is 96.6 percent. This means that 3.4 percent of foreign-born people still did not receive NZS at age 70, which may be due to the failure to meet NZS residency requirements or the receipt of equivalent overseas pension income. As mentioned earlier, we tried to eliminate the foreign-born individuals who may not meet the residency requirements from our analysis (e.g., all individuals were observed living in NZ between ages 60 and 65). However, due to data limitations, we could not eliminate all of those that might be ineligible for NZS. The take-up rate gap between the two groups narrows from 6.3 to 2.8 percentage points between the ages of 65 and 70, possibly owing to foreign-born individuals gradually meeting NZS residency requirements.

Figure 5.4 NZS take-up rates by country of birth



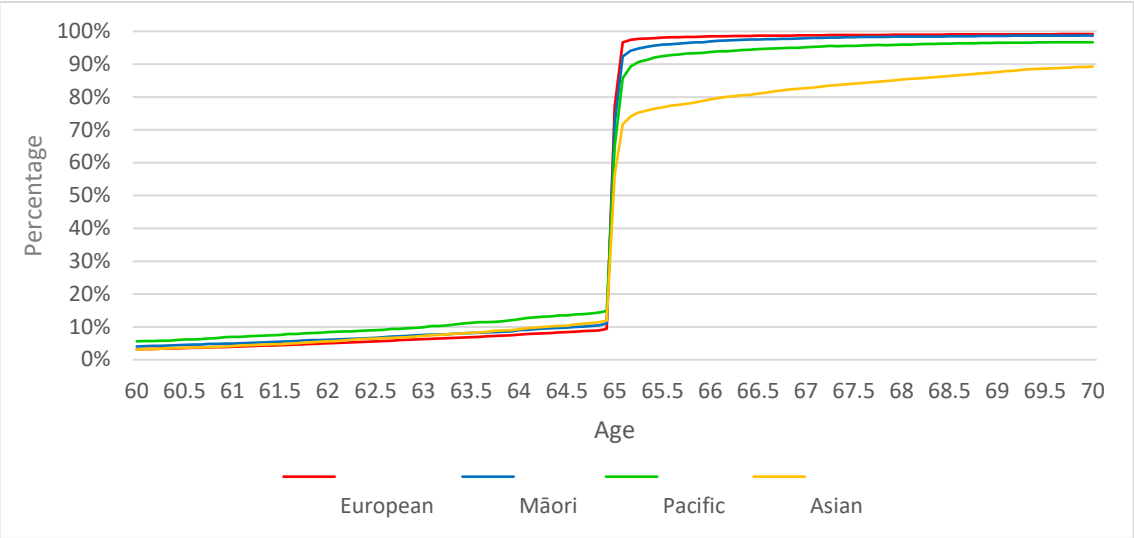
Source: Refer to Figure 5.1 for further information

5.2.4 Differences in NZS Take-up by Ethnicity

Figure 5.5 presents the differences in NZS take-up rates among the four major ethnic groups. Upon reaching age 65, the take-up rate is 77.3 percent for Europeans, 72.2 percent for Māori, and 65.0 percent for Pacifica. Three months later, it increases to 97.7 percent for Europeans, 94.8 percent for Māori, and 90.7 percent for Pacifica. At age 70, the take-up rate is 99.2 percent for Europeans, 98.7 percent for Māori, and 96.7 percent for Pacifica. Asians had a very different take-up pattern than the other three ethnic groups. The take-up rate at age 65 is only 56.4 percent. Three months later, it reaches 75.3 percent and continues to grow at a comparatively faster speed than the other three ethnic groups. Finally, it hits 89.3 percent at age 70, which was still lower than the other three ethnic groups. It is possible that the Asian take-up rate may continue increasing and eventually converge with the other ethnic groups after age 70.

The lower NZS take-up rates for Asians and Pacifica are likely due to the failure to meet NZS residency criteria. In our sample cohort, only 10 percent of Asian and 5 percent of Pacifica people were born in NZ. The rest were all immigrants from other countries. The large proportion of Asian and Pacifica immigrants can be linked to the relaxation of immigration policies introduced in 1986 and the new Immigration Act (1987), which led to a significant rise in immigrants from Asia and Pacifica countries (Bedford, Bedford, Ho, & Lidgard, 2002). This suggests that country of birth has an important impact on NZS take-up rates.

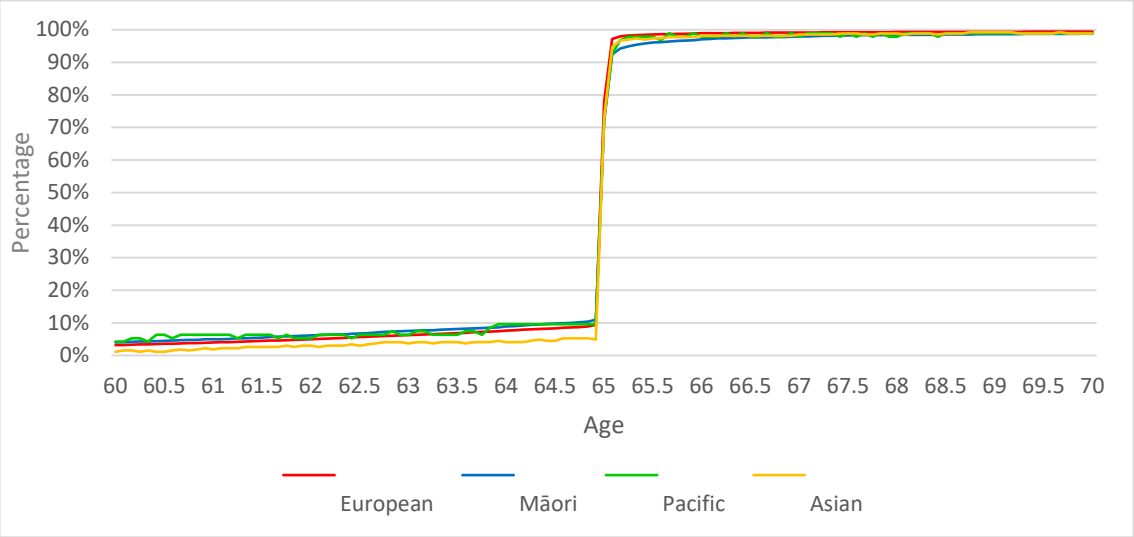
Figure 5.5 NZS take-up rates by ethnicity



Source: Refer to Figure 5.1 for further information

When people born in other countries were excluded, the disparity in take-up rates among ethnicities is shown in Figure 5.6. It demonstrates that the take-up rates are fairly similar after age 65 for the four ethnic groups born in NZ compared to those shown in Figure 5.5. This outcome could be attributed to two reasons. First, because they were all born in NZ, they all met the NZS residency requirements. Second, while NZS is not an automatically enrolled system, NZ-born individuals may have received better information regarding the application process compared to those born in foreign countries, which could be linked to the information costs that prevent people from taking up benefits (Hernanz et al., 2004).

Figure 5.6 NZS take-up rates by ethnicity (NZ born only)



Source: Refer to Figure 5.1 for further information

However, it is worth noting that after excluding those born in foreign countries, 'ethnicity gaps' still exist after age 65, and they narrow as individuals age. For example, the

European-Māori gap is 3.3 percentage points three months after turning 65, 1.9 percentage points at age 66, 0.9 percentage points at age 68, and 0.7 percentage points at age 70. The European-Pacifica gap is relatively inconsistent, with 0.3 percentage points three months after turning 65, 1.0 percentage points at age 66, 1.4 percentage points at age 68, and 0.5 percentage points at age 70. This relatively inconsistent gap may be due to the small sample size of NZ-born Pacifica people, which accounts for less than 1.0 percent of the entire cohort. The European-Asian gap is 1.2 percentage points three months after turning 65, 0.8 percentage points at age 66, 0.4 percentage points at age 68, and 0.5 percentage points at age 70.

These 'ethnicity gaps' in NZS take-up at age 70 are almost the same, all less than 1.0 percentage points. As all these individuals were born in NZ, so they were likely to have met the NZS residency criteria. In this situation, we might expect that there would be no 'ethnicity gaps' between ethnic groups.

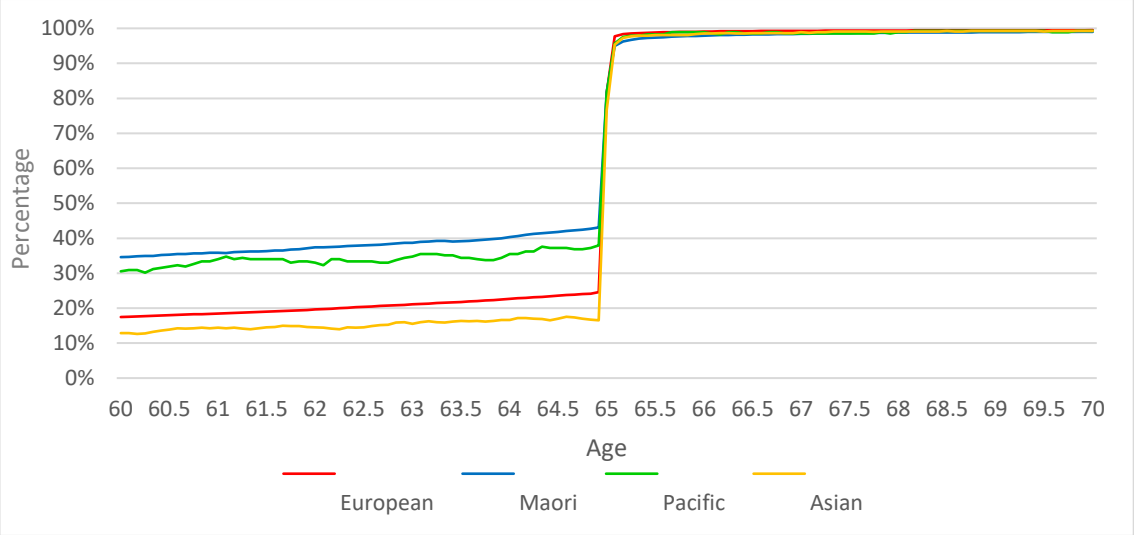
One explanation for these persistent ethnicity gaps would be that some of them continued receiving the main benefits instead of transitioning to NZS. If considering the 'take-up rates' as those either having received main benefits or NZS, the gaps after age 65 narrow, but they still exist before 66 (Figure 5.7). Three months after turning 65, the European-Māori gap is 2.0 percentage points, the European-Pacifica and the European-Asian gaps are both 1.0 percentage points. At age 66, the European-Māori gap is 1.0 percentage points, the European-Pacifica and the European-Asian gaps are zero. At age 70, all these gaps are zero. Among all the gaps, the European-Māori gap is the largest and it lasts for a longer time. This implies that there may be some take-up issues for people with other ethnicities, adding to the current literature on ethnic take-up issues in a publicly-funded, non-means-tested pension scheme (Ginn & Arber, 2001; Steventon & Sanchez, 2008; Vlachantoni et al., 2017). Though the NZ social welfare system seeks to remove any ethnic differences in benefit receipt (Marie, Fergusson, & Boden, 2011), the above analysis shows that this issue appears to exist with NZS.

Three possible reasons can lead to ethnic take-up issues. First, language could be one of the reasons that causes the take-up rate issue for Pacifica and Asians. Due to the manual application process of NZS, people have to apply for NZS by themselves within 12 weeks before turning 65.[36] Some Pacifica and Asian people who cannot speak English may have difficulty understanding and processing the NZS application, resulting in lower take-up

[36] Source: Work and Income

rates than Europeans. As more than 99 percent of Māori in our sample cohort can speak English, language should not be a problem for them. Second, a lack of internet access could lead to the take-up issue. People who live in rural areas without access to the internet may be unaware of NZS information. Third, a lack of computer literacy may also cause the take-up issue, which may result from poor education and a lack of exposure to modern computing. For example, people may have difficulty filling out all of the electronic files online and uploading them.

Figure 5.7 NZS/main-benefit take-up rates by ethnicity (NZ born only)



Source: Refer to Figure 5.1 for further information

5.2.5 Differences in NZS Take-up by Education

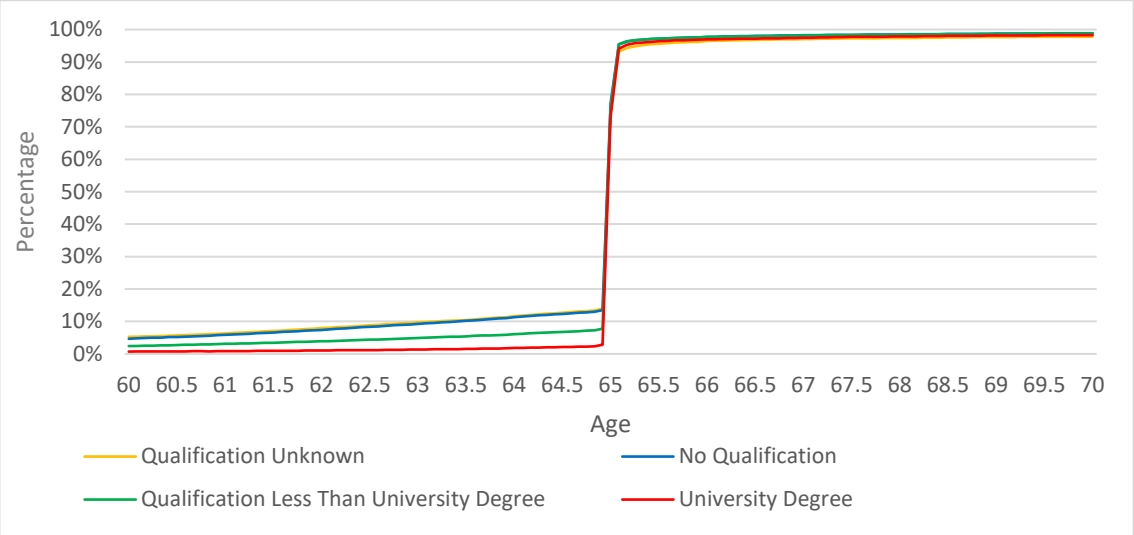
The NZS take-up rates for the four education groups differ before age 65 and are nearly identical after reaching age 65 (Figure 5.8). Before age 65, the Qualification Unknown and the No Qualification groups had the highest pre-65 take-up rates, and the University Degree group had the lowest take-up rates.[37] This suggests that pre-65 take-up rates decreased with higher educational levels. People with higher education may be less likely to claim the NZS together with their unqualified partners before age 65, due to their combination of higher incomes that is subject to means-testing.

Upon reaching age 65, the take-up rate is 74.2 percent for the Qualification Unknown group, 77.1 percent for the No Qualification group, 75.9 percent for the Qualification Less Than University Degree group, and 73.1 percent for the University Degree group. Three months later, the take-up rate is 95.2 percent for the Qualification Unknown group,

[37] The definition of educational subgroups can be found in Section 4.6.2.

96.7 percent for the No Qualification group, 96.9 percent for the Qualification Less Than University Degree group, and 95.8 percent for the University Degree group. At age 70, the take-up rate is 97.8 percent for the Qualification Unknown group, 98.9 percent for the No Qualification group, 98.8 percent for the Qualification Less Than University Degree group, and 98.3 percent for the University Degree group. This indicates that the University Degree group had relatively lower take-up rates than other groups after 65, except for the Qualification Unknown group. This may be due to the failure to meet the residency requirement for NZS, as there may be some people who come from overseas to pursue tertiary education in NZ or to work in NZ later in life with overseas university qualifications.

Figure 5.8 NZS take-up rates by education



Source: Refer to Figure 5.1 for further information

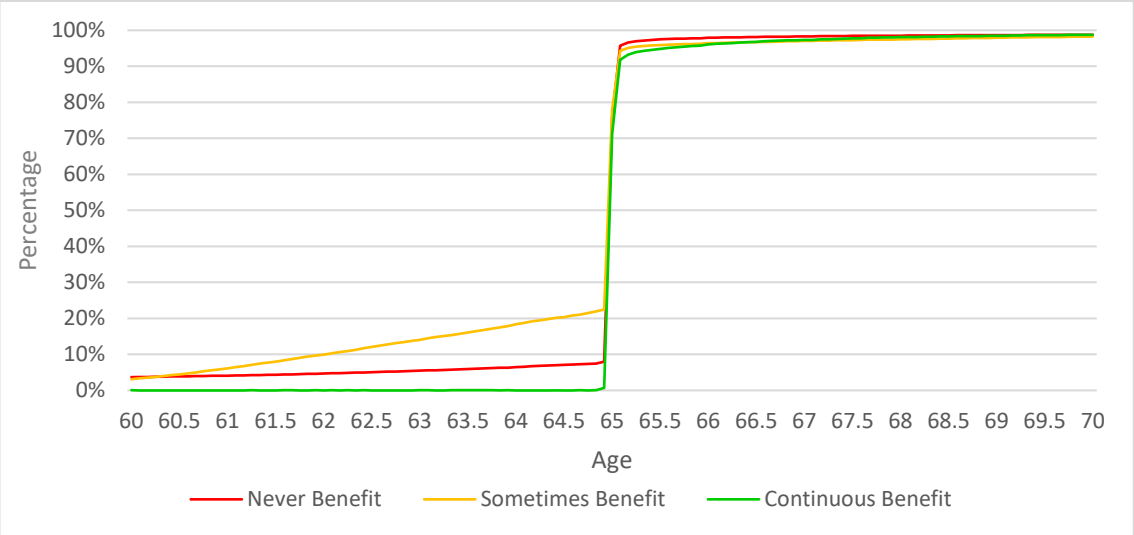
5.2.6 Differences in NZS Take-up by Benefit History

For the three benefit history groups, the differences in NZS take-up rates after age 65 are less than those of pre-65, as shown in Figure 5.9.[38] Before age 65, the Continuous Benefit group had zero take-up rates because a person cannot receive both main benefits and NZS at the same time. When comparing the Sometimes Benefit and the Never Benefit groups, one interesting aspect here is the 'early take-up of NZS'. The 'early take-up of NZS' for the Never Benefit group was generally lower than the Sometimes Benefit group. One explanation for this could be that there is little awareness of the possibility of receiving NZS prior to age 65 for the Never Benefit group, which is similar to the non-take-up

[38] The definition of benefit subgroups can be found in Section 4.6.1.

situation of food stamps in the United States (Coe, 1979). Another explanation could be that their higher pre-65 income results in their ineligibility under means-testing for NZS. In contrast, those with a benefit history may be more aware of this possibility through information from Work and Income, which is consistent with Dorsett and Heady (1991) and Zedlewski (1999), who found that beneficiaries would gain more information about other benefits than non-beneficiaries. However, after turning 65, the Never Benefit group had higher take-up rates than the Sometimes Benefit group. Part of the reason is that some people in the Sometimes Benefit group may not immediately transition from main benefits to NZS.

Figure 5.9 NZS take-up rates by benefit history



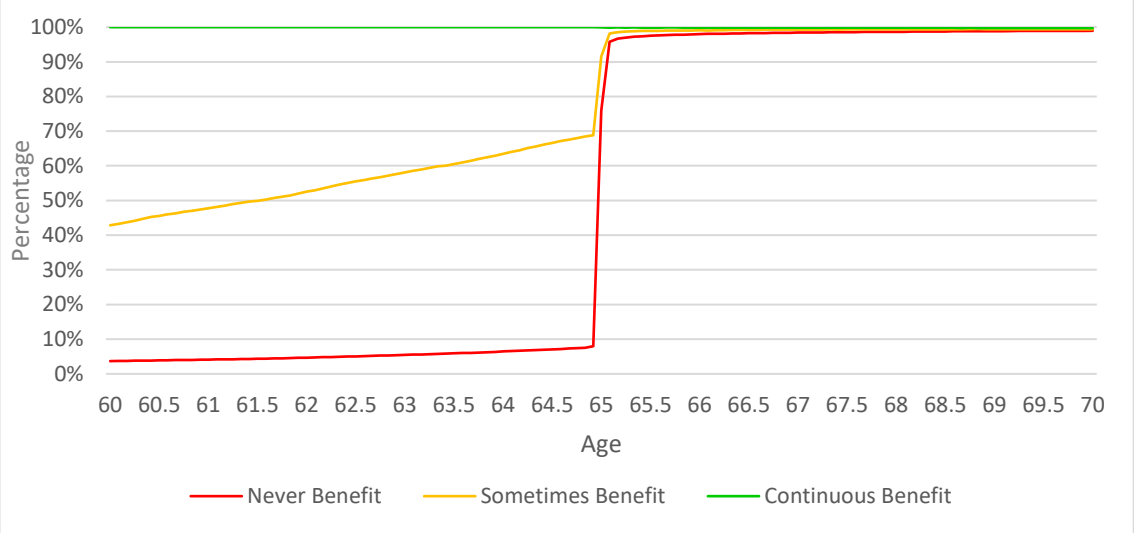
Source: Refer to Figure 5.1 for further information

The Never Benefit group had the highest take-up rates after age 65, followed by the Sometimes Benefit group, and the Continuous Benefit group. At age 65, the take-up rate is 75.9 percent for the Never Benefit group, 78.0 percent for the Sometimes Benefit group and 71.2 percent for the Continuous Benefit group. Three months later, the take-up rate is 97.0 percent for the Never Benefit group, 95.5 percent for the Sometimes Benefit group, and 93.9 percent for the Continuous Benefit group. At age 70, the rate is 98.8 for the Never Benefit group, 98.3 for the Sometimes Benefit group, and 98.7 for the Continuous Benefit group. Though the three groups' take-up rates kept rising as people age, some gaps existed among them. For example, the Never-Sometimes group gap is 1.5 percentage points three months after turning 65 and at age 66, 1.0 percentage points at age 68, and 0.5 percentage points at age 70. The Never-Continuous group gap is 3.1 percentage points three months after turning 65, 1.9 percentage points at age 66, 0.4 percentage points at age 68, and 0.1 percentage points at age 70.

It should be noted that even for individuals who received main benefits on a continuous basis every month before age 65, shifting directly from the means-tested main benefits to non-means-tested NZS, the take-up rate was still lower than the other two groups. This is surprising given that this group of people had mainly relied on the main benefits prior to age 65 and should have easily transitioned to NZS. One explanation is that they were still on main benefits even though they were pension eligible. If we redefine the post-65 'take-up rates' as those who either received NZS or the main benefit, the 'take-up rates' were almost 100 percent for the Continuous Benefit group over the ten-year period (Figure 5.10). 70.7 percent of the main benefits received by beneficiaries in the Continuous Benefit group three months after turning 65 were health-related, i.e., Sickness Benefit, Invalid's Benefit, or Supported Living Payment.

In general, most people who had a benefit history would transition to NZS after 65, because NZS is more generous than the main benefits (see Section 2.2 for NZS and main benefits rates). However, for those with health issues, it is possible they would choose to receive the main benefits, non-taxable supplementary benefits, and other non-monetised benefits at the same time, which may be more beneficial. This explains why some people remained on main benefits after 65 (see Appendix A 5.2 for the main benefits take-up rates). The redefined post-65 'take-up rates' is 98.7 percent for the Sometimes Benefit group three months after turning 65, 99.0 percent at age 66, 99.4 percent at ages 68 and 70. The 'take-up rates' for the Never Benefit group are similar to that shown in Figure 5.9, which indicates fewer of them were on the main benefits. Residency criteria should be the reason that prevents people in the Never Benefit group from receiving NZS.

Figure 5.10 NZS/main-benefit take-up rates by benefit history



Source: Refer to Figure 5.1 for further information

5.3 Nonparametric and Semiparametric Survival Analysis

According to Section 5.2, the take-up rates after 65 differ less for gender, birth cohorts, NZ-born ethnicity, education, and benefit history relative to the country of birth and ethnicity. Most of the differences were attributed to the residency requirements of NZS. However, even when excluding the residency condition that prevents people from receiving NZS, not everyone who is qualified for NZS after 65 appears to receive it. For example, Section 5.2.4 addressed the ethnic take-up issues, which ran contrary to the government's goal of ensuring that everyone who is eligible can and does receive NZS (WEAG, 2018). Despite the residency requirements, the hypothesis raised in sections 5.2.4 and 5.2.6 is that eligible people may not take up NZS after 65 is because they choose to remain on their main working-age benefits. This section uses nonparametric (the Kaplan-Meier estimator) and semiparametric (the Cox proportional hazards model) survival analysis to better capture the occurrence of not taking up NZS and the impact of personal characteristics, which could not be easily discerned in the previous section. In addition, this section tries to test whether the hypothesis of not fully taking-up NZS is due entirely to people remaining on the main benefits.

5.3.1 Hazard-based Duration Model

Hazard-based duration models are a type of analytical method for modelling data that has an end-of-duration occurrence, provided that the duration has lasted for a certain amount of time (Hensher & Mannering, 1994; Kiefer, 1988). This idea of conditional probability of duration termination addresses the dynamics of duration, i.e., that the likelihood of ending the duration is dependent on the amount of time that has passed since the duration began.

For decades, hazard-based models have been used widely in biometrics, economics, transport, and industrial engineering to investigate issues like life expectancy after the beginning of chronic diseases, duration of unemployment of an individual, or the length of time a commuter delays a trip departure to avoid traffic congestion (Bhat & Pinjari, 2007; Hensher & Mannering, 1994). This study uses hazard-based models to examine the duration of time for an individual to first take up NZS.

Let T be a nonnegative random variable representing the time to a failure event, with the cumulative distribution function of $F(t) = \Pr(T \leq t)$. The survival function $S(t)$ is the reverse of the cumulative distribution function of T,

$$S(t) = 1 - F(t) = \Pr(T > t) \tag{5.1}$$

The survival function indicates the probability of surviving beyond time t. $S(0) = 1$ when $t = 0$ and decreases towards zero as t goes to infinity.

The density function $f(t)$ can be obtained from $S(t)$,

$$f(t) = \frac{dF(t)}{dt} = \frac{d}{dt}\{1 - S(t)\} = -S'(t) \tag{5.2}$$

The hazard function $h(t)$, which is the likelihood of failure in a given interval, condition on an individual having survived to the start of that interval, divided by the interval width

$$h(t) = \lim_{\Delta t \to 0} \frac{\Pr(t+\Delta t > T > t | T > t)}{\Delta t} = \frac{f(t)}{S(t)} \tag{5.3}$$

The cumulative hazard function $H(t)$ is denoted as:

$$H(t) = \int_0^t h(u)du \tag{5.4}$$

and thus

$$H(t) = \int_0^t \frac{f(u)}{S(u)}du = -\int_0^t \frac{1}{S(u)}\left\{\frac{d}{du}S(u)\right\}du = -ln\{S(t)\} \tag{5.5}$$

The cumulative hazard function measures the accumulated rate of risk up to time t.

5.3.2 Nonparametric Analysis (The Kaplan-Meier Estimator)

The Kaplan-Meier estimator is a nonparametric estimate of the survival function, which calculates the probability of survival past time t (Kaplan & Meier, 1958). In this study, it calculates the probability of not taking up NZS in a month conditional on not previously receiving NZS before that month. For a dataset with observed failure times t_j, where j is the number of distinct failure times (taking up NZS) observed in the data, the Kaplan-Meier estimator at any time t is given by

$$\hat{S}(t) = \prod_{j|t_j \le t}\left(\frac{n_j - d_j}{n_j}\right) \tag{5.6}$$

where n_j is the number of individuals at risk at time t_j and d_j is the number taking up NZS at time t_j. One advantage of nonparametric analysis is that it's very flexible. The disadvantage is that it's not easy to incorporate covariates.

Each record in the dataset records a span during which an individual was under observation from t_0 to t_1. An outcome variable indicates whether a failure was observed, which in our case is the first take-up of NZS at the end of an observed period.

One important feature of duration data is censoring, which is defined as when a failure event occurs while an individual is not being observed. Two types of censoring are included in this study, left and right censoring. Left censoring in this study indicates individuals who have received NZS between the ages of 60 and 64. Right censoring indicates those who did not take up NZS over the entire observation period (i.e., by age 70).

With survival analysis, once a failure occurs, it can never be reversed. For example, death is an absorbing, non-reversible state. In our study, the failure is treated as the 'first' take-up of NZS. If people take up NZS once they reach age 65 but give up at a later time, this would be an issue of NZS take-up not being an 'absorbing state'. Even though we see some situations in our data where superannuitants give up this benefit, it's an extremely rare occurrence and is intuitively difficult to justify. Of the total cohort of 221,268 individuals, only 0.25 percent took up NZS once they reached age 65 but reportedly stopped receiving this benefit by age 70, which is a very rare occurrence. This may be indicative of errors in the data on NZS recipiency for some people. To reduce these indicative errors, these people are excluded from the survival analysis sections.

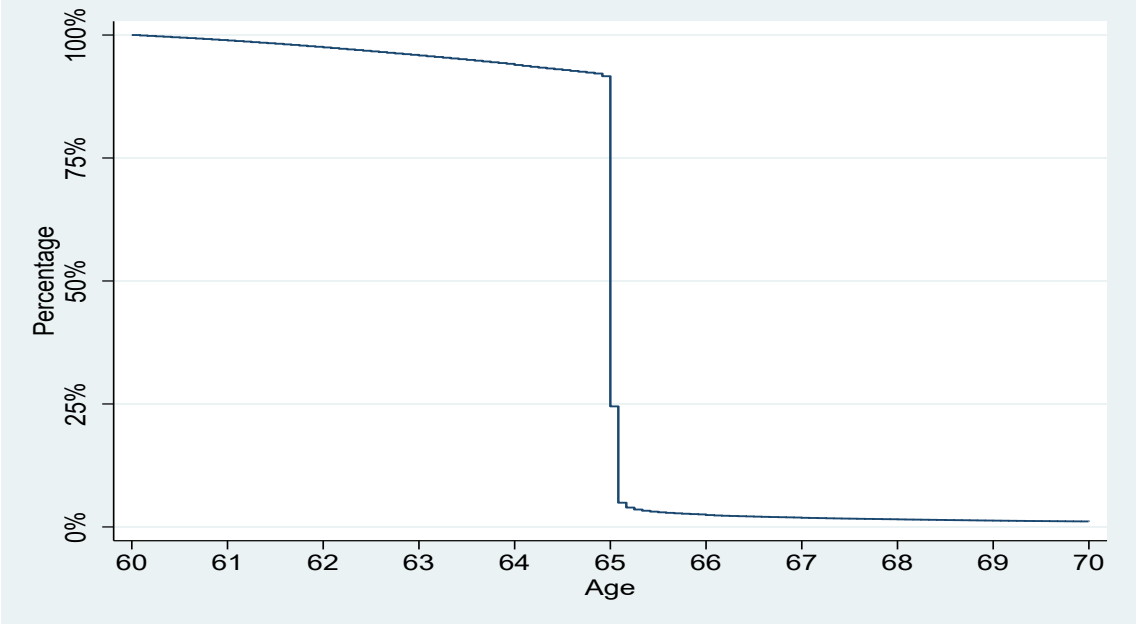
NZS Non-take-up between the Ages of 60 and 70

This section uses the Kaplan-Meier estimator to calculate the probability of not taking up NZS in a month conditional on not previously receiving NZS before that month, using a ten-year evaluation period between the ages of 60 and 70.

Figure 5.11 calculates the probability of NZS non-take-up in a month between the ages of 60 and 70 conditional on not previously receiving NZS before that month. Before age 65, the non-take-up of NZS is not 100 percent. This is likely due to some people receiving NZS prior to age 65 because they can be included in an eligible partner's NZS, but we are unable to verify this basis for recipiency because the IDI does not have information on couples. The non-take-up rate starts out at nearly 100 percent at 60, but it drops steadily, reaching 92.4 percent three months prior to turning 65. This non-take-up rate declines rapidly from 92.4 percent three months before 65 until reaching 3.5 percent three months after 65. The non-take-up rate drops to 2.4 percent at 66, and 1.1 percent at 70. That is, 1.1 percent of the total eligible population had not taken up NZS by their 70th

birthday. As NZS has such simple eligibility criteria (age of 65 and residency) and is not means-tested, we would assume a zero non-take-up rate once people become pension eligible. However, this is not the case. One possible explanation for these people not taking up NZS is that they failed to meet the residency requirements. This study tried to exclude those who appear to be ineligible for NZS from our sample cohort. However, due to data limitations, we can only ensure that our sample cohort meets five years of residency between the ages of 60 and 65. We cannot guarantee that all individuals have 10 years of residency since age 20. It is also possible that some individuals in our sample were neither NZ citizens nor permanent residents, which could not be identified in administrative data.

Figure 5.11 NZS non-take-up rates for total cohort



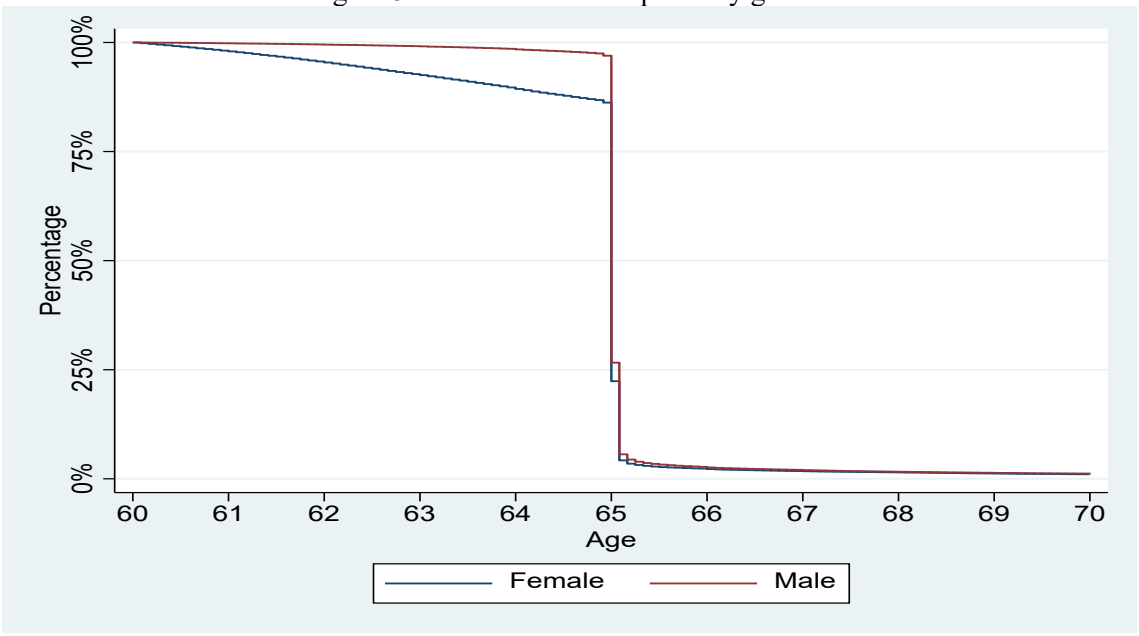
Source: Data generated by the author from the Integrated Data Infrastructure, using sample cohorts born between 1940 and 1947 with an evaluation period from 2000 to 2017 (between their 60th and 70th birthdays).

Before 65, females were more likely than males to take up NZS (see Figure 5.12), which is probably due to the proportion of younger females married to older males being higher than the proportion of younger males married to older females. It may also be because males are more likely than females to be employed and earning prior to 65 (Johnston, 2005), which makes them less likely to be included in their qualified partners' NZS. The non-take-up rate starts out at nearly 100 percent at 60 for both males and females. For males, this rate drops steadily, reaching 97.6 percent three months prior to turning 65. Then it declines rapidly from 97.6 percent three months before 65 until reaching 3.9 percent three months after 65. The non-take-up rate reaches 2.6 percent at 66, and 1.2 percent at 70. For females, this rate drops relatively faster than males', reaching 87.0

percent three months prior to turning 65. It then declines rapidly from 87.0 percent three months before 65 until reaching 3.2 percent three months after 65. The non-take-up rate drops to 2.2 percent at 66, and 1.0 percent at 70.

There appears to be some gender differences post-65, but these largely disappear as individuals age. The gender gap in NZS non-take-up rates narrows between three months after 65 and 70, decreasing from 0.8 to 0.2 percentage points. Males have slightly higher non-take-up rates after 65. Log-rank test is used to check whether there are statistical differences between the non-take-up of NZS between the two groups. We reject the hypothesis that the NZS non-take-up of the two groups is the same over the ten-year period. However, this doesn't rule out the possibility that they are identical for the post-65 period. Similar log-rank tests will be conducted for the post-65 period for all subgroups in the following section.

Figure 5.12 NZS non-take-up rate by gender



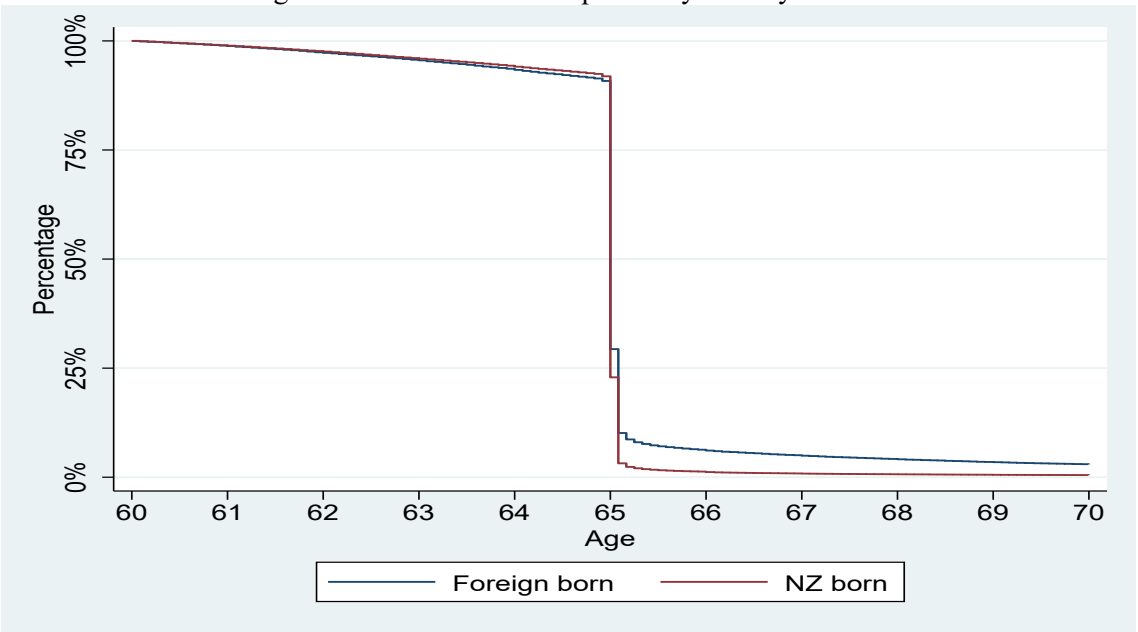
Source: Refer to Figure 5.11 for further information

Figure 5.13 shows that people born in foreign countries and NZ had similar NZS non-take-up rates before 65. After 65, those born in foreign countries had higher non-take-up rates than people born in NZ. But the non-take-up rates converge as people age. The non-take-up rate starts out at nearly 100 percent at 60 for both NZ-born and foreign-born individuals. For those born in foreign countries, this rate drops steadily, reaching 91.6 percent three months prior to turning 65. It then declines rapidly from 91.6 percent three months before 65 until reaching 8.0 percent three months after 65. The non-take-up rate reaches 6.1 percent at 66, and 3.0 percent at 70. For those born in NZ, this rate drops to

92.6 percent three months prior to turning 65. It then declines rapidly from 92.6 percent three months before 65 until reaching 2.1 percent three months after 65. The non-take-up rate drops to 1.2 percent at 66, and 0.5 percent at 70. This suggests that at the age of 70, 3.0 percent of foreign-born people were still not receiving NZS, which could be owing to a failure to meet NZS residency rules or the receipt of equivalent overseas pension income. As previously stated, we attempted to exclude foreign-born people who would not be able to achieve the residence requirements from our research (e.g., all individuals were observed living in NZ between ages 60 and 65). We were unable to eliminate all the individuals who might be ineligible for NZS due to data restrictions.

Between the ages of 65 and 70, the disparity in non-take-up rates converges between three months after 65 and 70, decreasing from 6.0 to 2.5 percentage points, which is probably due to foreign-born individuals gradually meeting NZS residency requirements. The log-rank test indicates that there is an overall difference between the two groups in terms of overall non-take-up of NZS.

Figure 5.13 NZS non-take-up rates by country of birth



Source: Refer to Figure 5.11 for further information

Figure 5.14 shows that the disparities in NZS non-take-up rates among ethnic groups are larger after 65 compares to pre-65 period.[39] There is an overall difference between the five groups in terms of overall non-take-up of NZS, using the log-rank test. The NZS non-

[39] This Chapter uses prioritized ethnicity instead of total response ethnicity (see Section 4.2.1) for the convenience to conduct Kaplan-Meier and Cox proportional estimation. The total percentage of all ethnic groups under prioritized response is 2.5% less than that under total response, see Appendix A 5.3 for details.

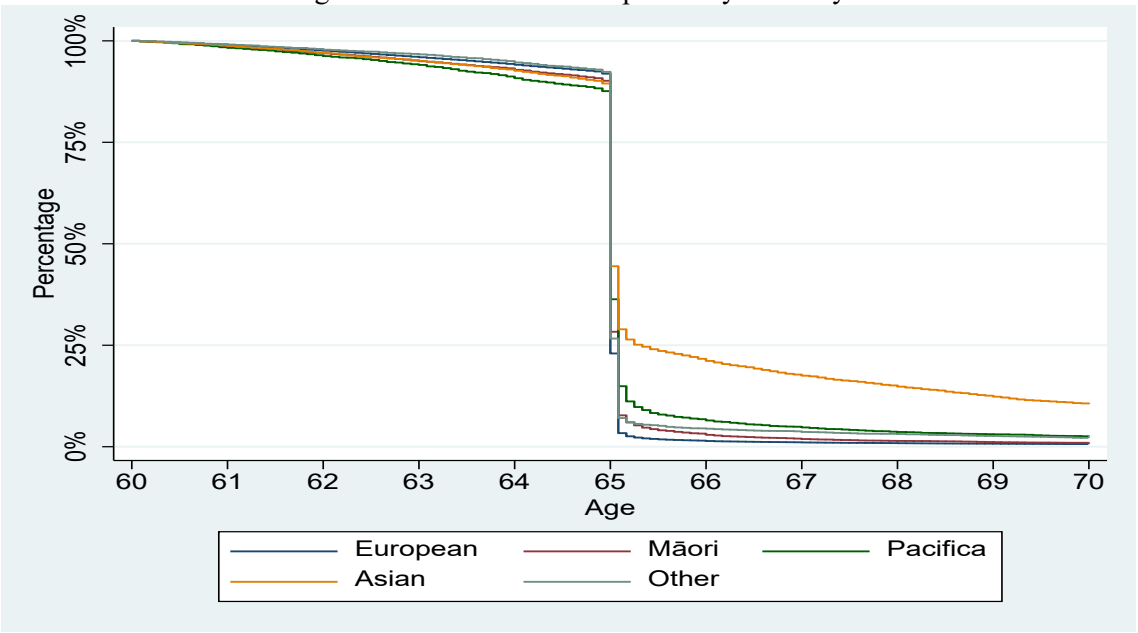
take-up rate starts out at nearly 100 percent at 60 for all ethnic groups. Three months prior to turning 65, this rate drops steadily, reaching 92.6 percent for Europeans, 91.0 percent for Māori, 88.6 percent for Pacifica, and 90.4 percent for Asians. At the 65th birthday month, all ethnicity groups experience a huge drop in NZS non-take-up rates. Three months after reaching 65, the NZS non-take-up rate is 2.3 percent for Europeans, 5.3 percent for Māori, 9.8 percent for Pacifica, and 25.1 percent for Asians. At age 66, it drops to 1.4 percent for Europeans, 2.9 percent for Māori, 6.5 percent for Pacifica, and 21.1 percent for Asians. At age 70, this rate reaches 0.7 percent for Europeans, 1.0 percent for Māori, 2.5 percent for Pacifica, and 10.5 percent for Asians. These non-take-up rates at age 70 may appear low, but there are big relative differences as compared to Europeans, with Māori rate half again as high as the European rate, and the Pacifica and Asian rates being nearly three times and fifteen times the European rate, respectively.

It indicates that minority groups are experiencing higher non-take-up rates than Europeans, which provides evidence of ethnic inequalities of pension take-up, which have been argued by (Ginn & Arber, 2001; Steventon & Sanchez, 2008; Vlachantoni et al., 2017). But the ethnic non-take-up rate gaps between the minority groups and Europeans narrow as people age. For example, the European-Māori gap is 3.0 percentage points three months after turning 65, and 0.3 percentage points at age 70. The European-Pacifica gap is 7.5 percentage points three months after turning 65, and 1.9 percentage points at age 70. The European-Asian gap is 22.9 percentage points three months after turning 65, and 9.8 percentage points at age 70.

Asian and Pacifica people had relatively higher non-take-up rates than Māori, which is likely due to their failure to meet NZS residency requirements, as about 90 percent of Asian and 95 percent of Pacifica people in our sample cohort were born in foreign countries.[40] However, this is not the case for Māori, because 96 percent of Māori in our sample cohort were born in NZ, residency is unlikely to be the reason that caused them to not take up NZS after 65. One of our hypotheses is that some of them continued receiving the main benefits instead of transitioning to NZS after being pension eligible, which will be illustrated in the following section.

[40] Refer to Section 5.2.4 for the details of NZ-born ethnicities.

Figure 5.14 NZS non-take-up rates by ethnicity



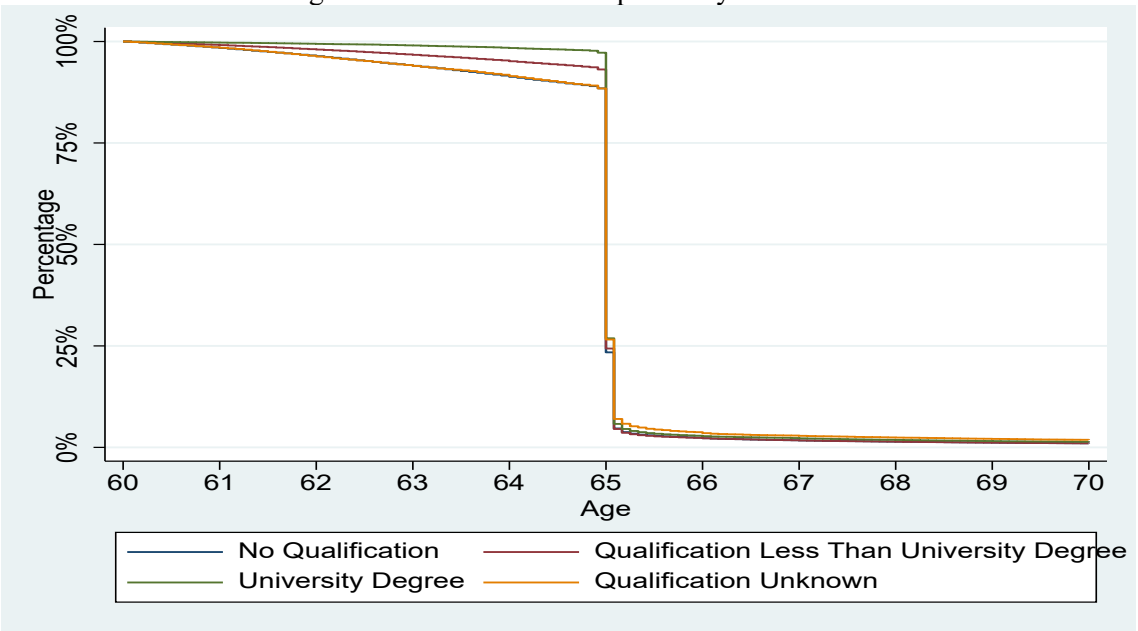
Source: Refer to Figure 5.11 for further information

Figure 5.15 presents the disparity of non-take-up rates among educational subgroups. There is an overall difference between the four groups in terms of overall non-take-up as a result of the log-rank test. Before 65, there are noticeable non-take-up differences between people with different educational attainments, but these gaps narrow after 65. The NZS non-take-up rate starts out at nearly 100 percent at 60 for all educational groups. Three months prior to turning 65, this rate drops steadily, reaching 89.3 percent for the No Qualification group, 93.8 percent for the Qualification Less Than University Degree group, and 97.8 percent for the University Degree group. Three months after reaching 65, the NZS non-take-up rate is 3.4 percent for the No Qualification group, 3.2 percent for the Qualification Less Than University Degree group, and 4.1 percent for the University Degree group. At age 66, the non-take-up rate is 2.3 percent for the No Qualification group, 2.3 percent for the Qualification Less Than University Degree group, and 2.8 percent for the University Degree group. At age 70, this rate reaches 1.0 percent for the No Qualification group, 1.0 percent for the Qualification Less Than University Degree group, and 1.4 percent for the University Degree group.

Figure 5.15 shows that the group with the highest education (the University Degree group) has higher non-take-up rates than the other groups, which may be attributed to the failure to meet NZS residency requirements as there may be some people who come from overseas to pursue tertiary education in NZ or to work in NZ later in life with overseas university qualifications. For example, the non-take-up rate gap for the No Qualification-Qualification Less Than University Degree is -0.2 percentage points three months after

reaching 65, and it reaches zero at age 70. The non-take-up rate gap for the No Qualification-University Degree is 0.7 percentage points three months after reaching 65, and it drops to 0.4 percentage points at age 70.

Figure 5.15 NZS non-take-up rates by education



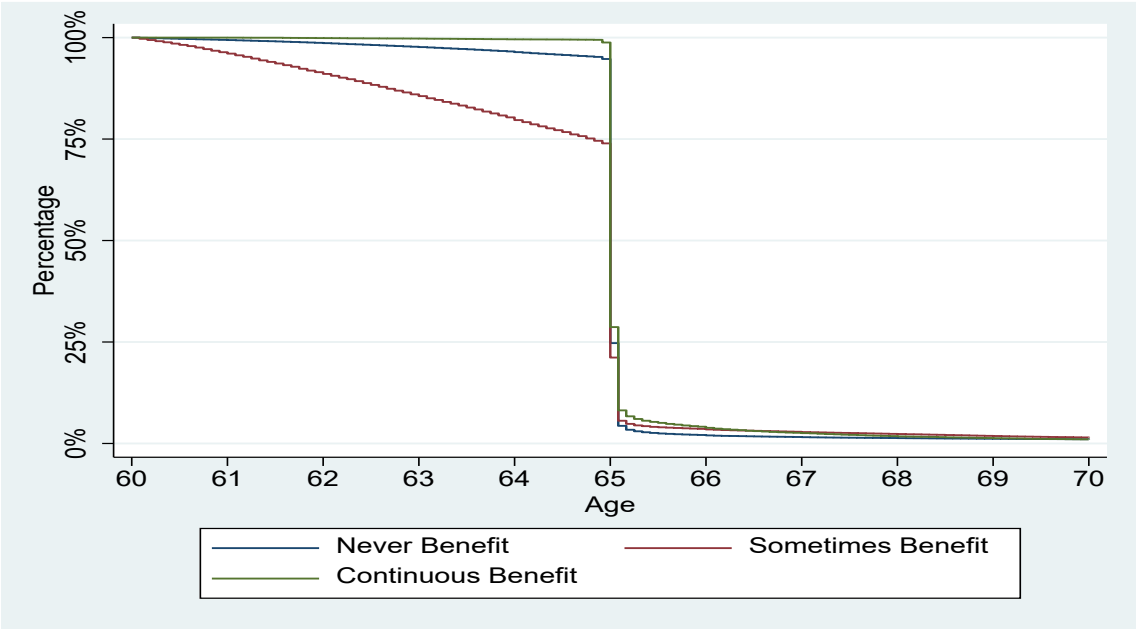
Source: Refer to Figure 5.11 for further information

People with different benefit histories have large non-take-up rate gaps before 65, with the Continuous Benefit group having 100 percent non-take-up rates because a person cannot receive both main benefits and NZS at the same time. However, the non-take-up rate gaps narrow significantly after the age of 65. The log-rank test shows that there is statistically difference between these three groups in overall non-take-up rates. The NZS non-take-up rate starts out at nearly 100 percent at 60 for all benefit history subgroups. Three months prior to turning 65, this rate drops steadily, reaching 95.4 percent for the Never Benefit group, 75.2 percent for the Sometimes Benefit group, and 99.5 percent for the Continuous Benefit group. Three months after reaching 65, the non-take-up rate declines rapidly to 3.0 percent for the Never Benefit group, 4.5 percent for the Sometimes Benefit group, and 6.0 percent for the Continuous Benefit group. At age 66, the rate is 2.0 percent for the Never Benefit group, 3.5 percent for the Sometimes Benefit group, and 3.9 percent for the Continuous Benefit group. At age 70, this rate drops to 1.0 percent for the Never Benefit group, 1.5 percent for the Sometimes Benefit group, and 1.0 percent for the Continuous Benefit group.

Though the three groups' non-take-up rates keep decreasing as people age, some gaps exist among them. For example, the Never-Sometimes group gap is 1.5 percentage points

three months after turning 65, and 0.4 percentage points at age 70. The Never-Continuous group gap is 3.0 percentage points three months after turning 65, and it reaches zero at age 70. It is surprising that the Continuous Benefit group had higher non-take-up rates than the other two groups after being pension eligible, as they are supposed to transition directly from the means-tested main benefits to non-means-tested NZS as NZS benefits are more generous than main benefits (see Section 2.2 for NZS and main benefits rates). Again, one of our hypotheses is that some of them still remained on the main benefits instead of transitioning to NZS, which will be illustrated in the following section.

Figure 5.16 NZS non-take-up rates by benefit history



Source: Refer to Figure 5.11 for further information

NZS/Main-benefit Non-take-up between the Ages of 65 and 70

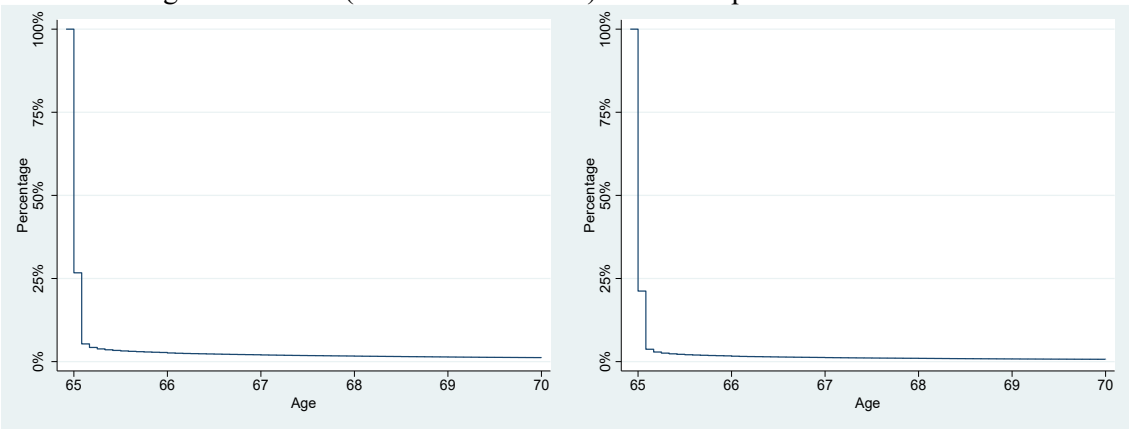
As the IDI does not have information on couples, we could not verify whether those who are under the age of 65 were categorically eligible for NZS. Including the pre-65 period in our analysis would increase the inaccuracy of the non-take-up estimation. As it is relatively easy to identify whether a person is categorically eligible for NZS after 65, the current and the following section will mainly focus on the non-take-up rates after 65.

To verify our hypothesis mentioned in the previous section that some of the non-take-up after being pension eligible is due to receiving main benefits, we redefine the post-65 'non-take-up rates' as NZS/main-benefits non-take-up rates. Under this hypothesis, we would expect the NZS/main-benefits non-take-up rate to be zero after being pension eligible, with the assumption that everyone in our sample cohort is categorically eligible for NZS.

Based on the above motivation, this section compares the probability of NZS non-take-up and NZS/main-benefits non-take-up over a five-year evaluation period between the ages of 65 and 70 for the subpopulation that had not received NZS prior to their 65th birthdays.[41]

Figure 5.17 estimates the probability of NZS (or NZS/main-benefits) non-take-up in a month between the ages 65 and 70 conditional on not previously receiving NZS before that month. The NZS non-take-up rate is 3.8 percent three months after reaching 65, 2.6 percent at 66, and 1.2 percent at 70. The NZS/main-benefits non-take-up rate is 2.6 percent three months after reaching 65, 1.6 percent at 66, and 0.7 percent at 70. That is, after considering those who remained on main benefits after being pension eligible, the non-take-up rates decline but still do not reach zero. There are still 0.7 percent of our sample cohort not taking up NZS/main-benefits by age 70. The decline in the NZS/main-benefits non-take-up rates is probably due to two possible reasons. Firstly, some people receive main benefits due to their failure to meet NZS residency requirements. Secondly, some people do remain on the main benefits after being pension eligible instead of directly transitioning to NZS. However, our expectation of zero non-take-up of general government benefits is not true for the total sample cohort, which may indicate some potential take-up issues.[42]

Figure 5.17 NZS (or NZS/main-benefits) non-take-up rates for total cohort



(a) NZS non-take-up rates (b) NZS/main-benefits non-take-up rates

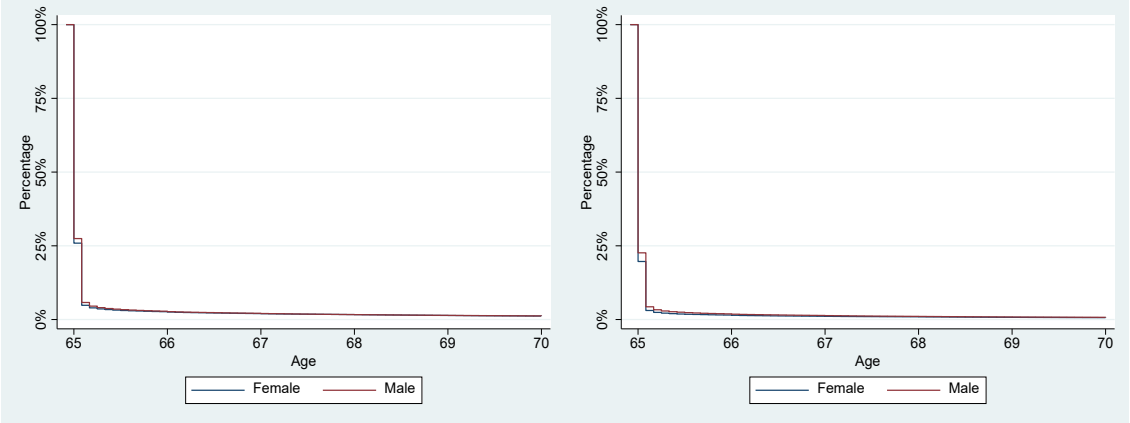
Source: Data generated by the author from Integrated Data Infrastructure, using sample cohorts born between 1940 and 1947 with an evaluation period from 2005 to 2017 (one month before their 65th birthdays to the 70th birthdays).

[41] The actual evaluation period for this section starts one month before reaching the 65th birthday. As survival analysis in Stata does not include the first observation period, including one month prior to the 65th birthday would allow us to evaluate the change right at the 65th birthday month.

[42] General government benefits in this and the following chapters mean either NZS or main-benefits.

The NZS/main-benefits non-take-up rates after 65 are lower than the NZS non-take-up rates by gender (Figure 5.18). For example, the NZS non-take-up rate is 3.6 percent three months after reaching 65, 2.5 percent at 66, and 1.2 percent at 70 for females. For males, the rates are 4.0, 2.7, and 1.2 percent, respectively. The NZS/main-benefits non-take-up rate is 2.2 percent three months after reaching 65, 1.4 percent at 66, and 0.6 percent at 70 for females. For males, the rates are 2.9, 1.8, and 0.8 percent, respectively. Even though NZS/main-benefits non-take-up rates are lower than NZS non-take-up rates, males still have higher non-take-up rates than females, which could be attributed to their higher income, which prevents them from receiving means-tested main benefits. Log-rank test shows that the non-take-up estimates of NZS (or NZS/main-benefits) for males and females are statistically different.

Figure 5.18 NZS (or NZS/main-benefits) non-take-up rates by gender



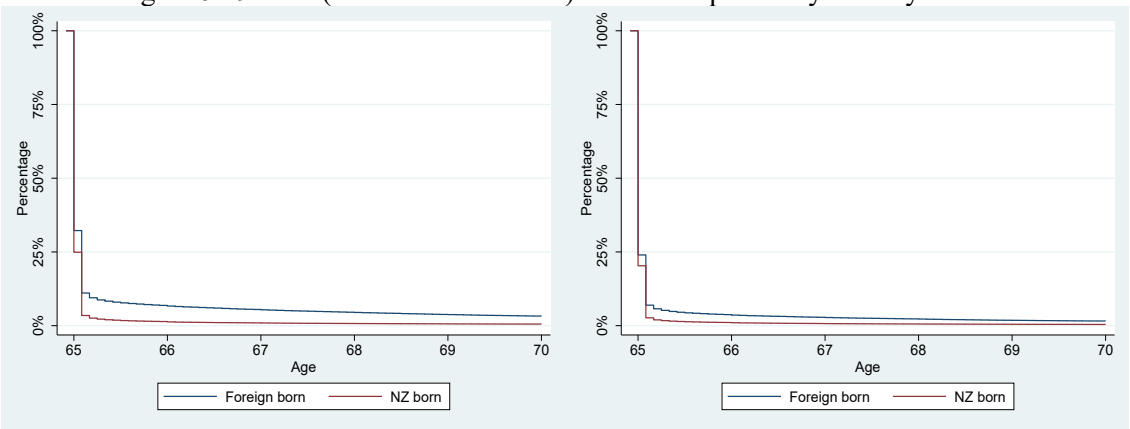
(a) NZS non-take-up rates (b) NZS/main-benefits non-take-up rates

Source: Refer to Figure 5.17 for further information

Figure 5.19 shows that the NZS/main-benefits non-take-up rates are lower than NZS non-take-up rates by country of birth. In addition, the NZS/main-benefits non-take-up rate gaps are smaller than that of NZS non-take-up rates. The NZS non-take-up rate is 8.7 percent three months after reaching 65, 6.7 percent at 66, and 3.2 percent at 70 for those born in foreign countries. For those born in NZ, NZS non-take-up rate is 2.2 percent three months after reaching 65, 1.3 percent at 66, and 0.5 percent at 70. The NZS/main-benefits non-take-up rate is 5.2 percent three months after reaching 65, 3.6 percent at 66, and 1.6 percent at 70 for those born in foreign countries. For those born in NZ, these rates are 1.7, 1.0, and 0.4 percent, respectively. These results indicate that those born in foreign countries were more likely to receive main benefits than those born in NZ after being pension eligible, which is probably due to foreign-born individuals' failure to meet NZS residency requirements. Instead, they received the main benefits instead.

A statistical test of log-rank test is followed to show that there is an overall difference between the two groups in terms of overall taking up of NZS (or NZS/main-benefits). The NZ-foreign born gap for NZS non-take-up is 6.5 percentage points three months after reaching 65, and it drops to 2.7 percentage points at age 70. These gaps are 3.5 and 1.1 percentage points for NZS/main-benefits non-take-up, respectively. This shows that the non-take-up rate gaps narrow after considering taking any general government benefits after being pension eligible.

Figure 5.19 NZS (or NZS/main-benefits) non-take-up rates by country of birth



(a) NZS non-take-up rates (b) NZS/main-benefits non-take-up rates

Source: Refer to Figure 5.17 for further information

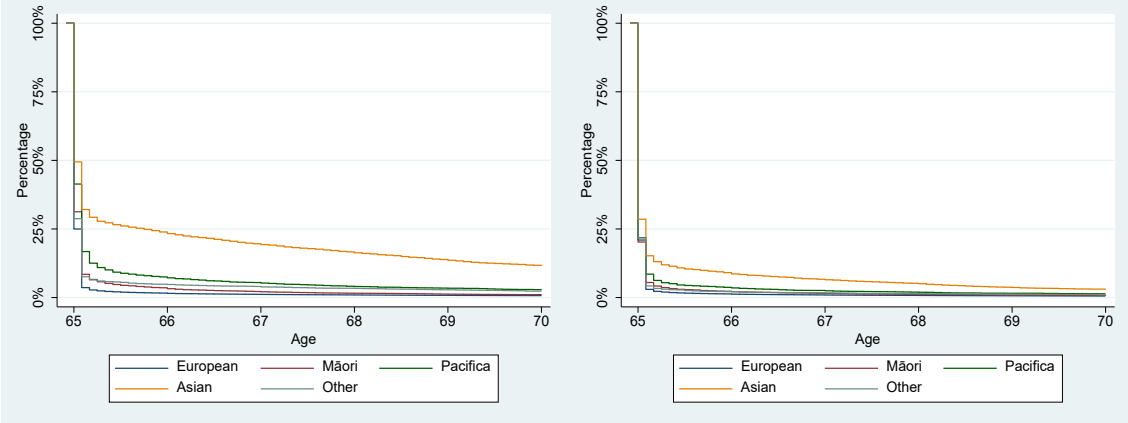
Figure 5.20 presents the disparities in NZS/main-benefits non-take-up rates among ethnic groups are lower than that of NZS non-take-up rates. Three months after reaching 65, NZS non-take-up rate is 2.4 percent for Europeans, 5.8 percent for Māori, 10.9 percent for Pacifica, and 27.8 percent for Asians. At age 66, it drops to 1.5 percent for Europeans, 3.2 percent for Māori, 7.2 percent for Pacifica, and 23.3 percent for Asians. At age 70, NZS non-take-up rate is 0.7 percent for Europeans, 1.1 percent for Māori, 2.8 percent for Pacifica, and 11.6 percent for Asians. The NZS/main-benefits non-take-up rate three months after reaching 65 is 2.0 percent for Europeans, 3.6 percent for Māori, 5.4 percent for Pacifica, and 11.9 percent for Asians. At age 66, it declines to 1.2 percent for Europeans, 2.2 percent for Māori, 3.5 percent for Pacifica, and 8.6 percent for Asians. At age 70, the NZS/main-benefits non-take-up rate reaches 0.6 percent for Europeans, 0.8 percent for Māori, 1.4 percent for Pacifica, and 3.0 percent for Asians. Even though considering general government benefits, minority groups still have higher non-take-up rates than Europeans, which provides solid evidence of ethnic inequalities of general government benefit take-up rates.

In general, the ethnic non-take-up rate gaps for NZS (or NZS/main-benefits) between minority groups and Europeans narrow as people age. And there is an overall difference between these groups in terms of overall NZS (or NZS/main-benefits) non-take-up by using log-rank test. For example, the European-Pacifica NZS non-take-up rate gap is 8.5 percentage points three months after turning 65, and it declines to 2.1 percentage points at age 70. The European-Asian NZS non-take-up rate gap is 25.4 percentage points three months after turning 65, and 10.9 percentage points at age 70. The European-Pacifica NZS/main-benefits non-take-up rate gap is 3.4 percentage points three months after turning 65, and 0.8 percentage points at age 70. The European-Asian NZS/main-benefits non-take-up rate gap is 9.9 percentage points three months after turning 65, and 2.4 percentage points at age 70. This is most likely due to Asian and Pacifica people receiving main benefits due to the failure to meet NZS residency criteria, as about 90 percent of Asian and 95 percent of Pacifica people in our sample cohort were born in foreign countries.[43]

However, this is not the case for Māori. The European-Māori NZS non-take-up rate gap is 3.3 percentage points three months after turning 65, and it drops to 0.4 percentage points at age 70. The European-Māori NZS/main-benefits non-take-up rate gap is 1.6 percentage points three months after turning 65, and 0.2 percentage points at age 70. As 96 percent of Māori in our sample cohort were born in NZ, they should not have a residency barrier to be able to qualify for NZS.[44] The results suggest that some Māori remained on working-age main benefits after being pension eligible, instead of directly transitioning to NZS. This supports our hypothesis that eligible people may not take up NZS after 65 because they choose to remain on main working-age benefits. However, once we include general government benefits, the non-take-up rate at 70 still does not reach zero, which further indicates a broader take-up issue.

[43] Refer to footnote 40 for further information.
[44] Refer to footnote 40 for further information.

Figure 5.20 NZS (or NZS/main-benefits) non-take-up rates by ethnicity



(a) NZS non-take-up rates (b) NZS/main-benefits non-take-up rates

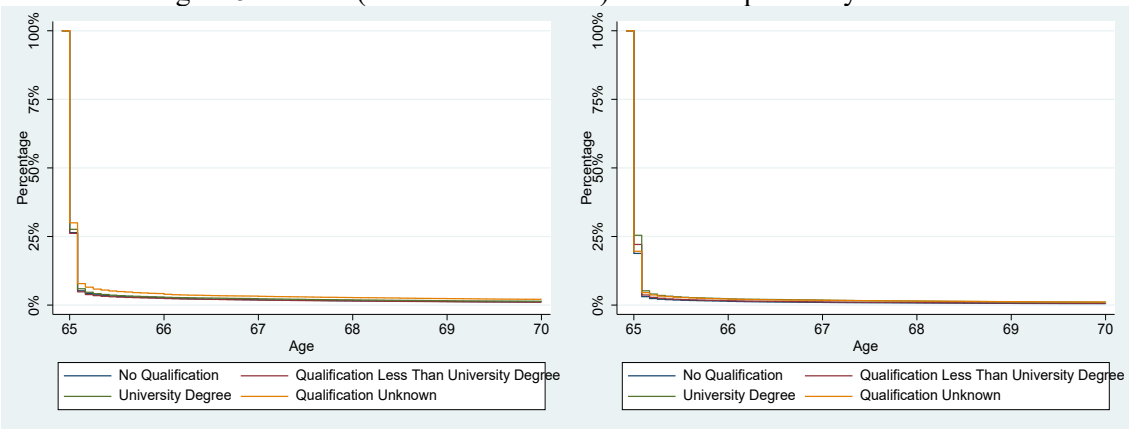
Source: Refer to Figure 5.17 for further information

Figure 5.21 shows the disparity of NZS (or NZS/main-benefits) non-take-up rates among educational subgroups. These overall NZS (or NZS/main-benefits) non-take-up rates are statistically different between each subgroup. Three months after reaching 65, the NZS non-take-up rate is 3.8 percent for the No Qualification group, 3.5 percent for the Qualification Less Than University Degree group, and 4.2 percent for the University Degree group. At age 66, this rate declines to 2.5 percent for the No Qualification group, 2.4 percent for the Qualification Less Than University Degree group, and 2.8 percent for the University Degree group. At age 70, this rate reaches 1.1 percent for the No Qualification group, 1.1 percent for the Qualification Less Than University Degree group, and 1.4 percent for the University Degree group. The NZS/main-benefits non-take-up rate three months after reaching 65 is 2.1 percent for the No Qualification group, 2.5 percent for the Qualification Less Than University Degree group, and 3.5 percent for the University Degree group. At age 66, it drops to 1.4 percent for the No Qualification group, 1.6 percent for the Qualification Less Than University Degree group, and 2.3 percent for the University Degree group. At age 70, this NZS/main-benefits non-take-up rate reaches 0.5 percent for the No Qualification group, 0.7 percent for the Qualification Less Than University Degree group, and 1.0 percent for the University Degree group.

The non-take-up gaps for NZS/main-benefits are bigger than that of NZS among educational subgroups. For example, the No Qualification-Qualification Less Than University Degree gap of NZS non-take-up is -0.3 percentage points three months after 65, and it reaches -0.1 percentage points by age 70. The No Qualification-University Degree gap of NZS non-take-up is 0.4 percentage points three months after 65, and 0.3 percentage points at 70. The No Qualification-Qualification Less Than University Degree

gap of NZS/main-benefits non-take-up is 0.4 percentage points three months after 65, and it reaches 0.1 percentage points by age 70. The No Qualification-University Degree gap of NZS/main-benefits non-take-up is 1.4 percentage points three months after 65, and 0.5 percentage points at 70. This indicates that people with higher educational attainments are less likely than those with lower educational attainment to receive general benefits, which might be due to their higher income which prevents them from receiving means-tested main benefits.

Figure 5.21 NZS (or NZS/main-benefits) non-take-up rates by education



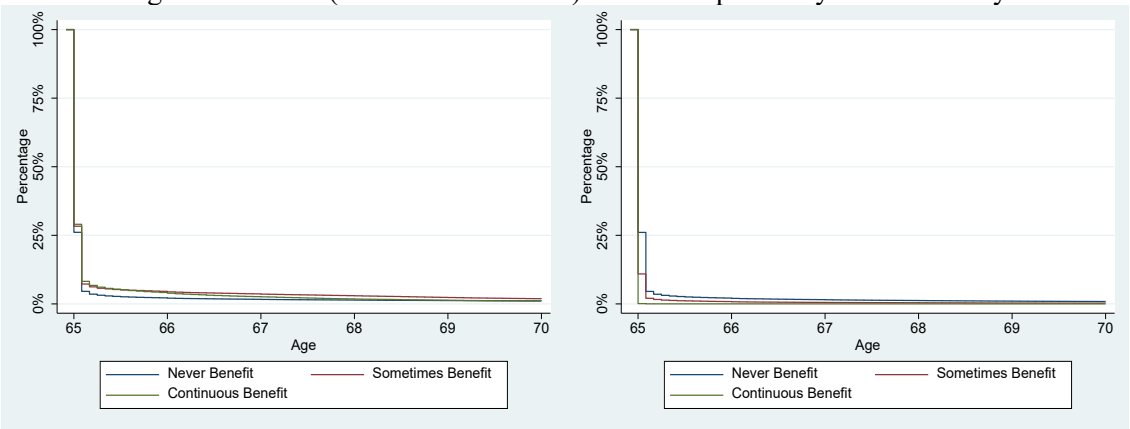
(a) NZS non-take-up rates (b) NZS/main-benefits non-take-up rates

Source: Refer to Figure 5.17 for further information

Figure 5.22 presents the disparities of NZS (or NZS/main-benefits) non-take-up rates by benefit history. Log-rank test shows that there is an overall difference between the three groups in terms of overall non-take-up of NZS (or NZS/main-benefits). Three months after reaching 65, the NZS non-take-up rate is 3.2 percent for the Never Benefit group, 5.7 percent for the Sometimes Benefit group, and 6.1 percent for the Continuous Benefit group. At age 66, this rate declines to 2.1 for the Never Benefit group, 4.4 for the Sometimes Benefit group, and 3.9 for the Continuous Benefit group. At age 70, this rate reaches 1.1 percent for the Never Benefit group, 1.9 percent for the Sometimes Benefit group, and 1.0 percent for the Continuous Benefit group. The NZS/main-benefits non-take-up rate three months after reaching 65 is 3.1 percent for the Never Benefit group, and 1.4 percent for the Sometimes Benefit group. At age 66, this rate drops to 2.0 percent for the Never Benefit group, and 0.8 percent for the Sometimes Benefit group. At age 70, this rate reaches 0.9 percent for the Never Benefit group, and 0.3 percent for the Sometimes Benefit group. The NZS/main-benefits non-take-up rate for the Continuous Benefit group is 0.1 percent at the 65th birthday, and it reaches almost zero three months after reaching 65.

The NZS non-take-up rate gaps between the three benefit history subgroups narrow as people age. For example, the Never-Sometimes NZS non-take-up gap is 2.6 percentage points three months after turning 65, and it drops to 0.8 percentage points at age 70. The Never-Continuous NZS non-take-up gap of is 2.9 percentage points three months after turning 65, and -0.1 percentage points at age 70. The Never-Sometimes NZS/main-benefits non-take-up gap is -1.8 percentage points three months after turning 65, and -0.6 percentage points at age 70. The Never-Continuous NZS/main-benefits non-take-up gap is -3.1 percentage points three months after turning 65, and -0.9 percentage points at age 70. This suggests that people with pre-65 benefit histories are more likely to receive main-benefits after 65. It also indicates that some people did not directly transition from the main benefits to NZS once they became pension eligible, which supports our hypothesis mentioned previously. We would expect that beneficiaries would be informed by Work and Income that they could be eligible for higher monthly payments from NZS after 65, as Dorsett and Heady (1991) and Zedlewski (1999) stated that the current beneficiaries would gain more information about other benefits. Especially if they were continuously on the main benefits, they should have directly transitioned from the main benefits to NZS. For this reason alone, they would be expected to have higher NZS take-up rates than the Never Benefit and Sometimes Benefit groups. However, this is not the case. After we consider general government benefits, the NZS/main-benefits non-take-up rate for the Continuous Benefit group does drop to zero after 65, which is as expected.

Figure 5.22 NZS (or NZS/main-benefits) non-take-up rates by benefit history



(a) NZS non-take-up rates (b) NZS/main-benefits non-take-up rates

Source: Refer to Figure 5.17 for further information

5.3.3 Semiparametric Analysis (The Cox Proportional Hazards Model)

The Kaplan-Meier estimator calculates the probability of not taking up NZS in a month conditional on not previously receiving NZS before that month, but it cannot control for

other variables. In addition, it cannot test whether the impact of a covariate is statistically significant or not. To better measure the hazard rate, i.e., the odds ratio of the taking up NZS, we use Cox proportional hazards model in this section.

Cox proportional hazards model is often used to model survival events (Cox, 1972). The model is given by

$$h(t|x_j) = h_0(t)\exp(x_j\beta_x) \tag{5.7}$$

where t is the time, x_j are covariates of individual characteristics (such as gender, country of birth, ethnicity, education, pre-65 benefit histories). β_x are regression coefficients which are to be estimated. $h_0(t)$ is the baseline hazard function, which is given no particular parameterization and can be left un-estimated. The evaluation period starts one month before turning the 65th birthday month, which is a total of 62 months when reaching the 70th birthday. The reason to include one month before 65th birthday month is that the survival analysis in Stata does not include the first evaluation period. As this study aims to estimate the take-up rates of NZS (or NZS/main-benefits) right at the month of being pension eligible, including one month prior to the 65th birthday would allow us to evaluate the change right at the 65th birthday month.

The model gives no assumptions about the shape of the hazard over time, but with the assumption that the shape is the same for everyone, i.e., proportionality.

Based on equations (5.5) and (5.7), the Cox proportional survivor function $S(t|x)$ can be written as

$$\begin{aligned} S(t|x) &= exp\{-H(t|x)\} \\ &= exp\{-\exp(x\beta_x H_0(t)\} \\ &= S_0(t)^{\exp(x\beta_x)} \end{aligned} \tag{5.8}$$

Cox Proportional Estimates

The Cox proportional hazard ratio estimates for taking up NZS (or NZS/main-benefits) are listed in Table 5.1 column 2 (column 3). Hazard rates in this study indicate the probability of taking up NZS (or NZS/main-benefits) in a given month, conditional on not having taken up these benefits previously. All the results listed in Table 5.1 are hazard

ratios. The hazard ratio is equivalent to an odds ratio used in logistic regression analysis (Deo, Deo, & Sundaram, 2021). It compares the hazard rate for one group relative to a reference group. If the estimated hazard ratio is one, it means there is no difference between the instantaneous take-up rates for the two groups (i.e., the two groups have equivalent hazard rates). If the estimated hazard ratio is less than one, it means that the probability of taking up NZS (or NZS/main-benefits) for the group in question is relatively lower than that of the reference group. If the estimated hazard ratio is greater than one, it means that the probability of taking up NZS (or NZS/main-benefits) for the group in question is higher than that of the reference group.

With all other variables held constant, the hazard ratio of 0.981 for males means that male probability of taking up NZS in a given month after age 65 is 98.1 percent of the female rate. In other words, the probability of taking up NZS in a given month after 65 is 1.9 percentage points lower for males compared to females. This difference is statistically significant, which suggests that females are more likely than males to take up NZS after being pension eligible, which contrasts the findings of Macpherson (1990) and Bardasi and Jenkins (2010), stating that females are less likely than males to receive pensions. When we re-ran the Cox proportional hazard model on taking up NZS/main-benefits. The hazard ratio is the same as that of taking up NZS, suggesting that the probability of taking up NZS/main-benefits after 65 is 1.9 percentage points lower for males compared to females. This indicates that females are more likely than males to take up any kind of general government benefits after 65.

The hazard ratio of 1.094 for NZ-born individuals means that the probability of taking up NZS in a given month after 65 for those born in NZ is 109.4 percent of that of individuals born in foreign countries, holding all other variables constant. In other words, the probability of taking up NZS in a given month after the age of 65 is 9.4 percentage points higher for NZ-born individuals compared to foreign-born ones. This difference is statistically significant, suggesting that people born in NZ are more likely to take up NZS than those born in foreign countries. This difference might be attributed to people born in NZ being more likely to qualify for NZS residency. This is the case even after excluding those who may not qualify for the residency (death and out-migration over the study period) and all individuals were observed living in NZ between ages 60 and 65 when constructing the sample cohort. When we re-ran the Cox proportional hazard model on taking up NZS/main-benefits, the probability of taking up NZS/main-benefits in a given month after 65 is 6.8 percentage points higher for those born in NZ compared to those

born in foreign countries. These results suggest that foreign-born individuals are more likely than NZ-born individuals to take up main benefits after being pension eligible, which might be due to those not qualifying for NZS based on residency criteria instead receiving main benefits.

Holding all other variables constant, the hazard ratios for minority groups are all less than one, indicating that the probability of taking up NZS in a given month after 65 for minority groups is lower compared to Europeans. For example, compared to Europeans, the probability of taking up NZS in a given month after age 65 is 9.2 percentage points lower for Māori, 15.3 percentage points lower for Pacifica, and 39.3 percentage points lower for Asians. These differences are all statistically different from zero at better than a 1% level. The lower take-up of Pacifica and Asian people might be due to their failure to qualify for NZS residency requirements, as about only 10 percent of Asians and 5 percent of Pacifica in our sample cohort were born in NZ.[45] Even though this study tried to ensure that everyone in our sample is qualified for NZS, due to data limitations, there may be some individuals who were still ineligible for NZS. However, this is unlikely to be the case for Māori, because 96 percent of them in our sample cohort were born in NZ.[46]

We re-ran the Cox proportional hazards model on an alternative outcome of taking up NZS/main-benefits after 65. The new hazard ratios on minority groups are all greater than the hazard ratios of taking up NZS, but still less than one. Again, all these differences are significantly different from zero at the 1% level. These new Cox proportional estimates suggest that ethnic minority groups are more likely than Europeans to receive main benefits after age 65. However, allowing individuals to receive either NZS or main benefits does not alter the conclusion that post-65 take-up rates for general government benefits are relatively lower for minority groups. Compared to Europeans, the probability of taking up NZS in a given month after age 65 is 39.3 percentage points lower for Asians and 15.3 percentage points lower for Pacifica, but the probability of taking up NZS/main-benefits in a given month after age 65 is 16.6 percentage points lower for Asians and 7.7 percentage points lower for Pacifica. This suggests that Asian and Pacifica people are more likely than Europeans to receive main benefits after age 65, which might be at least partially explained by them not meeting residency requirements for NZS. However, this is not the case for Māori. Compared to Europeans, the probability of taking up NZS in a given month after age 65 is 9.2 percentage points lower for Māori, but the probability of

[45] Refer to footnote 40 for further information.
[46] Refer to footnote 40 for further information.

taking up NZS/main-benefits in a given month after age 65 is 7.4 percentage points lower. As about 96 percent of Māori in our sample cohort were born in NZ, residency is unlikely to be the reason that caused this take-up issue. This further indicates a take-up issue for this ethnic group.[47]

These results indicate that under a universal public pension system without means-testing, take-up issue exists, which contradicts the findings of Van Oorschot (1991) who attributed non-take-up issues to means-tested benefits. On the other hand, this take-up issue is consistent with the ethnic inequalities in pension protection argued by (Vlachantoni et al., 2017) in the United Kingdom. One probable cause of the lower Māori take-up rate may be a lack of internet access or computer literacy. However, we were unable to investigate this due to data limitations.

The hazard ratio for the Qualification Less Than University group is greater than one, and the hazard ratio for the University Degree group is less than one, with other variables being constant. Compared to those with no qualifications, the probability of taking up NZS for people with qualifications less than university degrees in a given month after age 65 is 0.6 percentage points higher and 0.8 percentage points lower for those with university degrees. However, both estimates are not statistically significant, indicating no difference in the probability of taking up NZS between the groups with and without qualifications. When we re-ran the Cox proportional hazard model on taking up NZS/main-benefits, the probability of Qualification Less Than University group taking up NZS/main-benefits in a given month after age 65 is 0.2 percentage points higher compared to the No Qualification group (not statistically significant). This suggests that there is no difference in the probability of taking up NZS/main-benefits in a given month after age 65 between the No Qualification and the Qualification Less Than University group. The probability of University Degree group taking up NZS/main-benefits in a given month after age 65 is 1.6 percentage points lower compared to the No Qualification group (significantly different from zero at the 5% level). University Degree group appears to be less likely to take up general government benefits than the No Qualification group, which may be due to their relatively higher income, which prevents them from receiving means-tested main benefits.

The hazard ratios for the two benefit history groups are both less than one, indicating that the probability of taking up NZS in a given month after age 65 for people with pre-65

[47] Refer to footnote 40 for further information.

benefit histories is lower compared to those without a pre-65 benefit history. For example, the probability of taking up NZS for the Sometimes Benefit group in a given month after age 65 is 1.2 percentage points lower compared to the Never Benefit group. This is statistically different from zero at the 10% level. The probability of taking up NZS for the Continuous Benefit group in a given month after age 65 is 1.7 percentage points lower compared to the Never Benefit group. This is statistically different from zero at the 5% level. When we re-ran the Cox proportional hazard model on either taking up NZS or main benefits, the probability of taking up NZS/main-benefits for the Sometimes Benefit group in a given month after age 65 is 19.5 percentage points higher compared to the Never Benefit group. The probability of taking up NZS/main-benefits for the Continuous Benefit group in a given month after age 65 is 36.2 percentage points higher compared to the Never Benefit group. These estimations suggest that people with pre-65 benefit histories are more likely to take up general government benefits than those without pre-65 benefit histories. It also suggests that some people remain on main benefits instead of directly transitioning to NZS after being pension eligible. As mentioned previously, we would expect that beneficiaries would be informed by Work and Income that they may qualify for higher monthly payments from NZS after 65. Particularly if they were continuously on the main benefits, they should have transitioned from main benefits to NZS right after being pension eligible. For this reason alone, they would be expected to have higher NZS take-up rates than the Never Benefit and Sometimes Benefit groups. However, this is not the case.

As proportionality is one of the major assumptions of the Cox proportional hazard model, this study uses Schoenfeld and scaled Schoenfeld residuals to test the proportionality assumption.[48] We test the proportionality of the model as a whole as well as individual covariates with the null hypothesis of proportional hazards. However, the test is not significant. We rule out proportionality and infer that the proportional assumption has been violated. Even though the proportionality assumption is not met, it does provide us with some significant evidence of existing take-up issues for minority groups.

The Cox proportional estimates are not comparable with the Kaplan-Meier estimates for two reasons. First, Kaplan-Meier estimates evaluate the probability of survival rates (NZS or NZS/main-benefits non-take-up rates) at a time point, while Cox proportional hazard

[48] The Schoenfeld residual for covariate $x_u, u = 1, \dots, p$, and for observation j observed to fail is $r_{uj} = x_{uj} - \frac{\sum_{i \in R_j} x_{ui} \exp(x_i \hat{\beta}_x)}{\sum_{i \in R_j} \exp(x_i \hat{\beta}_x)}$, where r_{uj} is the difference between the covariate for the failed observation and the weighted average of the covariates.

model measure the risk of taking up NZS (or NZS/main-benefits) in a given month. Second, the methodology is different. The Kaplan-Meier survival estimator calculates the cumulative probability of NZS (or NZS/main-benefits) non-take-up in a given month conditional on not previously receiving NZS (or NZS/main-benefits) before that month without controlling for other covariates. Cox proportional hazard rate model calculates the hazard ratio of taking up NZS (or NZS/main-benefits) of a group relative to a reference group, controlling for other covariates.

Table 5.1 Cox proportional estimates on NZS (or NZS/main-benefits) take-up rates

	Hazard Ratio for Taking up NZS	**Hazard Ratio for Taking up NZS/Main-Benefit**
	2	3
Male	0.981***	0.981***
	(0.004)	(0.004)
NZ born	1.094***	1.068***
	(0.006)	(0.006)
Māori	0.908***	0.926***
	(0.009)	(0.009)
Pacifica	0.847***	0.923***
	(0.014)	(0.015)
Asian	0.607***	0.835***
	(0.008)	(0.011)
Other Ethnicities	0.922***	0.972**
	(0.013)	(0.014)
Qualification Less Than University Degree	1.006	1.002
	(0.005)	(0.005)
University Degree	0.992	0.984**
	(0.008)	(0.008)
Qualification Unknown	0.953***	0.969***
	(0.008)	(0.009)
Sometimes Benefit	0.988*	1.195***
	(0.007)	(0.008)
Continuous Benefit	0.983**	1.362***
	(0.008)	(0.011)
Number of Observations (n)	199,272	199,272
Number of Failures (n)	196,890	197,889
Number of Right Censoring (n)	2,382	1,383

Notes: 1. The left censoring cohort before the 65th birthday month is 21,438 (9.71%) for the estimation of NZS (or NZS/main-benefits) hazard ratio. The right censoring cohort is 2,382 (1.08%) for the estimation of NZS hazard ratio, and 1,383 (0.63%) for the estimation of NZS/main-benefits hazard ratio. 2. The evaluation period starts one month before turning the 65th birthday month, in order to evaluate the take-up rates of NZS (or NZS/main-benefits) right at the month of being pension eligible, as survival analysis in Stata does not include the first observation month. 3. * significant at 10%; ** significant at 5%; *** significant at 1%.

5.4 Conclusions and Policy Implications

5.4.1 Conclusions

This chapter demonstrated that the NZS take-up rate was relatively lower at the 65th birthday month compared to the following months. This could be owing to the transition period of the application process, in which people have to manually apply for NZS after becoming pension eligible. Furthermore, if individuals turn 65 on the last day of a month but receive their first payment at the beginning of the next month, this might look like a one-month delay in take-up even though receipt occurred immediately with the 65th birthday.

Three months after reaching 65, the NZS take-up rate for our entire sample cohort was 96.4 percent, and the rate reached 98.7 percent at age 70. These findings were far higher than the two prior studies (Dixon & Hyslop, 2008; Hurnard, 2005), which found that the maximum NZS take-up rates were around 95 percent and 92 percent following the age of eligibility for Superannuation, respectively. Our study did a better job of identifying an eligible population by excluding those who appear to be ineligible for NZS from our sample cohort. We removed individuals who emigrated permanently to other countries, as well as those who died over the observation period. However, due to data limitations, we can only ensure that our sample cohort meets five years of residency between the ages of 60 and 65. We cannot guarantee that all individuals have 10 years of residency since age 20. However, there were still people (approximately 7966 three months post-65 and 2876 at age 70) who were most likely eligible for NZS but did not receive these payments.

Not all subgroups had similar high take-up rates after age 65. Typically, those groups with relatively lower NZS take-up rates had a higher increase rate after turning 65. The NZS take-up rate gaps narrow over time. We believe that the major reason for some of these disparities in take-up rates was the failure to meet the NZS residency requirements, which require people to be NZ citizens or permanent residents and residing in NZ at least 10 years after the age of 20 and 5 years after the age of 50. People born overseas and people with Asian or Pacifica identities were less likely to meet the residency requirements.

Figure 5.11 calculates the probability of not taking up NZS in a month conditional on not previously receiving NZS before that month. It indicates that people are gradually taking up NZS after being pension eligible, which may be due to gradually meeting the residency requirements for NZS.

Meeting the residency requirements seems like one of the biggest obstacles to taking up NZS, especially for those who were born in foreign countries. For example, the probability of taking up NZS in a given month after 65 is 9.4 percentage points higher for NZ-born individuals compared to foreign-born ones. In our sample cohort, about 90 percent of Asians and 95 percent of Pacifica were born in foreign countries.[49] Compared to Europeans, the probability of taking up NZS in a given month after 65 is 15.3 percentage points lower for Pacifica and 39.3 percentage points lower for Asians. It indicates that even though we tried to rule out the possibility of people not meeting the

[49] Refer to footnote 40 for further information.

NZS residency criteria when constructing the sample cohort, there were still people who failed to meet them.

However, this group of people who failed to meet NZS residency requirements could have received main benefits. For example, the probability of taking up NZS/main-benefits in a given month after 65 is 6.8 percentage points higher for those born in NZ compared to those born in foreign countries, but the probability of taking up NZS in a given month after age 65 is 9.4 percentage points higher for NZ-born individuals compared to foreign-born ones. For Asians, the probability of taking up NZS/main-benefits in a given month after age 65 is 16.6 percentage points lower, but the probability of taking up NZS in a given month after age 65 is 39.3 percentage points lower. For Pacifica people, the probability of taking up NZS/main-benefits in a given month after age 65 is 7.7 percentage points lower, but the probability of taking up NZS in a given month after age 65 is 15.3 percentage points lower.

Our results suggest that ethnic minority groups are more likely than Europeans to receive main benefits after age 65. However, allowing individuals to receive either NZS or main benefits does not alter the conclusion that post-65 take-up rates for general government benefits remain relatively lower for minority groups. Particularly, the relatively lower probability of taking up general government benefits for Māori further indicates a take-up issue, which provides some evidence of the take-up issue of a universal public pension system without means-testing found in the existing literature, which only focuses on the means-tested benefits (Van Oorschot, 1991). Furthermore, it shows some ethnic inequalities in pension protection discussed by Vlachantoni et al. (2017).

Education attainments in general seem like to have little impact on the taking up of NZS (or NZS/main-benefits).

Our hypothesis of not fully taking up NZS because they remain on main benefits is partially true. For example, after considering general government benefits, the Kaplan-Meier NZS/main-benefits non-take-up rates are always lower than the NZS non-take-up rates. However, these redefined non-take-up rates do not reach zero for most of the subgroups after being pension eligible, except for people continuously receiving main benefits between the ages of 60 and 64. Cox proportional hazard estimates, at the same time, also provide some evidence of people remaining on the main benefits instead of transitioning to NZS right after being pension eligible. For example, compared to Europeans, the probability of taking up NZS in a given month after age 65 is 9.2

percentage points lower for Māori, but the probability of taking up NZS/main-benefits in a given month after age 65 is only 7.4 percentage points lower. For the Sometimes Benefit group, the probability of taking up NZS in a given month after age 65 is 1.2 percentage points lower and the probability of taking up NZS/main-benefits in a given month after age 65 is 19.5 percentage points higher compared to the Never Benefit group. For the Continuous Benefit group, the probability of taking up NZS in a given month after age 65 is 1.7 percentage points lower and the probability of taking up NZS/main-benefits in a given month after age 65 is 36.2 percentage points higher compared to the Never Benefit group. We would expect that beneficiaries would be informed by Work and Income that they could be eligible for higher monthly payments from NZS after 65. Especially if they were continuously on the main benefits, they should have directly transitioned from the main benefits to NZS. For this reason alone, they would be expected to have higher NZS take-up rates than the Never Benefit and Sometimes Benefit groups. However, this is not the case.

One possible explanation could be that some people who had received main benefits between the ages of 60 and 64 chose to remain on the main benefits when they were pension eligible. It's worth noting that, from Chapter 2, we know that NZS is often more generous than the main benefits. People who have pre-65 benefit history should directly transition from the main benefits to NZS. After further analysis, more than two-thirds of those receiving main benefits three months after turning 65 turned out to be health-related benefits. This suggests that total benefits (main benefits, non-taxable supplementary benefits and other non-monetary benefits) received by people with health issues might exceed the NZS amount, causing them to remain on the main benefits after being pension eligible. Once they did not qualify for all the other benefits, they would transition to NZS.

5.4.2 Policy Implications

Four policy implications are suggested based on the analysis of this chapter. First, the government should consider raising public awareness of applying for NZS, as mentioned by (Hernanz et al., 2004; Menefee et al., 1981) that knowledge and information is an important factor that affects the non-take-up rates. This could be done by collaborating with employers to inform their employees who are nearing retirement about NZS and by advertising in local communities or social media, such as making videos explaining the key features of NZS. This is because some people who did not receive main benefits before age 65 may be unaware of NZS payments and eligibility criteria, as well as the possibility of including their non-qualified partners.

Second, it may be easy to determine residency eligibility for the vast majority of people because of the information held in linked administrative data. The government needs to explore the feasibility and practicalities of adopting an auto-enrol process where individuals can automatically receive NZS as soon as they become eligible, as suggested by (Currie, 2004; Hernanz et al., 2004; Van Oorschot, 1991) that will increase the take-up rates. In such a way, it does not only reduce the application and administrative costs for both individuals and government agencies, but also improve the eventual take-up rates among the eligible population, especially given the lower initial rates amongst Māori where it clearly cannot be eligibility issues that are constraining uptake. If not adopting the auto-enrol process, the government may either consider providing more assistance to people with computer literacy issues, such as professional assistance with the online application process. The most important thing is to ensure that everyone who is qualified for NZS can and does get this public pension.

Third, the government may need to develop a multilingual website for NZS, as well as the application process, which has been suggested by (Hernanz et al., 2004; Van Oorschot, 1991) to solve the language barrier that some Pacifica and Asian people face.

Fourth, the government may need to produce regular estimates of NZS take-up rates using administrative data, as Hernanz et al. (2004) suggested. In this way, the efficiency of the current pension system could be monitored, as well as to spot the non-take-up issues. Policymakers can make better decisions to improve the NZS take-up rates.

5.5 Appendix 5

Appendix A 5.1: Percentages of NZS take-up rates by year of birth, %, age and gender

	60	61	62	63	64	65	66	67	68	69	70
Males	0.528	0.678	0.932	1.278	1.895	73.399	97.205	97.762	98.124	98.354	98.498
Females	5.857	7.319	9.172	11.315	13.623	78.178	97.780	98.245	98.485	98.705	98.838
Males											
Birth Year											
1940	0.504	0.731	1.110	1.488	2.219	72.257	96.393	97.125	97.528	97.856	98.108
1941	0.530	0.747	1.084	1.421	2.168	72.802	96.603	97.254	97.808	98.241	98.338
1942	0.536	0.682	0.949	1.315	2.118	71.227	96.665	97.347	97.907	98.223	98.418
1943	0.493	0.592	0.838	1.109	1.725	72.344	97.141	97.609	98.127	98.447	98.644
1944	0.521	0.589	0.838	1.155	1.540	73.687	97.554	97.962	98.347	98.528	98.573
1945	0.557	0.750	0.943	1.158	1.801	75.257	97.449	98.027	98.370	98.413	98.628
1946	0.613	0.748	0.959	1.380	1.898	71.952	97.757	98.332	98.485	98.696	98.715
1947	0.485	0.593	0.809	1.222	1.797	76.622	97.754	98.131	98.221	98.347	98.473
Females											
Birth Year											
1940	9.275	10.918	13.382	16.329	19.155	77.874	96.667	97.391	97.802	98.116	98.333
1941	7.446	9.603	11.900	14.567	16.817	78.636	97.240	97.843	98.191	98.631	98.817
1942	6.553	8.372	10.658	12.896	15.299	76.283	97.435	97.971	98.321	98.624	98.834
1943	6.216	7.865	10.136	12.073	14.009	77.193	97.490	98.016	98.303	98.566	98.781
1944	5.771	6.978	8.734	10.665	12.640	78.165	98.069	98.486	98.661	98.859	98.947
1945	4.821	6.218	7.758	9.358	11.545	79.279	97.934	98.319	98.643	98.805	98.845
1946	4.570	5.666	6.836	8.787	11.276	76.686	98.347	98.774	98.904	98.960	99.053
1947	3.629	4.660	6.088	8.169	10.542	80.636	98.573	98.796	98.796	98.899	98.951

Source: Refer to Table 4.1 for further information

Notes: The first row indicates the birthday month, e.g., the average NZS take-up rate for males at their 65th birthday month is 73.399 percent.

Appendix A 5.2: Main benefits take-up rates by gender, %, year of birth

	60	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**
Males	0.127	0.134	0.139	0.147	0.153	0.155	0.008	0.007	0.006	0.005	0.004
Females	0.193	0.193	0.190	0.188	0.186	0.183	0.009	0.007	0.006	0.005	0.004
Males											
1940	0.169	0.184	0.193	0.205	0.210	0.206	0.014	0.011	0.009	0.009	0.007
1941	0.159	0.169	0.177	0.182	0.184	0.178	0.010	0.008	0.007	0.006	0.005
1942	0.148	0.159	0.164	0.168	0.171	0.169	0.010	0.009	0.007	0.005	0.005
1943	0.141	0.147	0.147	0.151	0.153	0.150	0.009	0.007	0.006	0.005	0.005
1944	0.127	0.129	0.135	0.134	0.136	0.148	0.008	0.006	0.005	0.005	0.005
1945	0.110	0.115	0.118	0.122	0.134	0.145	0.008	0.006	0.006	0.005	0.004
1946	0.094	0.097	0.100	0.116	0.131	0.133	0.006	0.004	0.004	0.003	0.003
1947	0.091	0.095	0.109	0.121	0.128	0.131	0.005	0.004	0.004	0.003	0.003
Females											
1940	0.235	0.247	0.245	0.239	0.233	0.224	0.016	0.013	0.010	0.008	0.007
1941	0.235	0.232	0.228	0.221	0.213	0.203	0.015	0.010	0.009	0.007	0.006
1942	0.230	0.233	0.224	0.220	0.213	0.205	0.013	0.010	0.008	0.007	0.005
1943	0.210	0.209	0.204	0.197	0.188	0.188	0.011	0.008	0.007	0.006	0.005
1944	0.197	0.192	0.188	0.181	0.176	0.180	0.007	0.006	0.005	0.005	0.004
1945	0.177	0.174	0.169	0.163	0.170	0.172	0.009	0.006	0.005	0.004	0.004
1946	0.155	0.153	0.150	0.156	0.162	0.164	0.005	0.004	0.004	0.003	0.003
1947	0.136	0.137	0.147	0.150	0.152	0.151	0.004	0.004	0.004	0.003	0.002

Source: Refer to Table 4.1 for further information

Appendix A 5.3: Percentage of ethnicity under prioritised and total response ethnic groups

Ethnicity	Total Response, %	Prioritised Response, %
European	87.1	84.8
Māori	6.6	6.5
Pacifica	2.5	2.4
Asian	3.6	3.6
Other	2.7	2.7
total	102.5	100.0

Source: Refer to Table 4.1 for further information

6 Income

6.1 Introduction

New Zealand Superannuation (NZS) is often thought of as an immediate 'replacement' for lost work income (earnings and self-employment income) when individuals turn pension age and retire.[50] Is this an accurate perception? This chapter depicts the change in mean monthly income for the sample cohorts over a ten-year observation period. Specifically, it focuses on the impact of NZS on a person's overall income and clarifies whether NZS is an immediate replacement for lost work income at pension age.

As mentioned in Chapter 3, there is no up-to-date empirical literature on the change in mean monthly income upon reaching pension age. This study attempts to fill that gap by providing new insights into the impact of NZS. First, the annual composition of income between the ages of 60 and 69 is presented and discussed in Section 6.2. It summarises the proportion of people with various sources of income, including work income, Social Welfare benefits, and other non-labour/non-benefit income. Section 6.3 tracks the mean monthly income five years before and after being pension eligible by subgroups, such as gender, country of birth, ethnicity, education, pre-65 benefit history, and age-60 quartiles. It introduces the idea of 'enhancement effect' that NZS has on average personal income, which contradicts the traditional thought of work income replacement. The empirical findings on total income and work income are discussed in Section 6.4. A brief conclusion and discussion are provided in Section 6.4.4.

6.2 Annual Composition of Income

Table 6.1 provides an overview of the composition of income for individuals aged 60 to 69. It is divided into two sections: Panel A and Panel B. Panel A displays the annual percentages of individuals following their 60th through 69th birthdays who did not have any work income. Panel B depicts the proportion of people who had various sources of income, such as work income, Social Welfare benefits, and other non-labour/non-benefit income.

[50] Retirement in this study means the cessation of all labour market work.

Table 6.1 Indicators of income from employment, Social Welfare benefits and other Income, %, aged 60 to 69[1]

	60	61	62	63	64	65	66	67	68	69
A. Percentages of individuals with no work income[2]										
Male	23.801	25.472	27.513	29.819	32.379	36.401	43.600	48.373	52.929	57.582
Female	35.334	37.748	40.595	43.573	46.776	50.922	57.145	61.427	65.604	69.443
B. Percentages of individuals with different income sources										
Male										
Work income only	45.206	44.786	44.001	42.768	40.879	0.730	0.479	0.356	0.277	0.221
Main benefits/NZS only	9.689	10.492	11.475	12.495	13.805	30.337	37.838	42.960	47.809	52.692
Other income only[3]	5.387	5.378	5.417	5.464	5.301	0.104	0.072	0.057	0.046	0.038
Either above two income sources[4]	29.997	28.858	27.556	26.531	25.811	48.178	42.529	38.709	35.047	31.444
All income sources	1.081	0.995	1.033	1.015	1.116	19.875	18.374	17.280	16.228	15.019
No income	8.641	9.491	10.519	11.728	13.089	0.777	0.710	0.638	0.595	0.587
Female										
Work income only	39.655	38.440	36.919	35.145	32.898	0.438	0.291	0.221	0.173	0.151
Main benefits/NZS only	18.101	19.587	21.506	23.514	25.779	47.855	54.237	58.708	63.056	67.057
Other income only	2.472	2.439	2.413	2.362	2.266	0.031	0.017	0.015	0.017	0.013
Either above two income sources	23.758	22.612	21.320	20.163	19.190	40.188	35.073	31.508	27.904	24.586
All income sources	1.347	1.320	1.289	1.264	1.300	10.753	9.765	8.998	8.355	7.721
No income	14.667	15.601	16.551	17.552	18.567	0.735	0.617	0.550	0.494	0.471

Source: Refer to Table 4.1 for further information

Notes: 1. All the percentages in this table were the averages over the year (e.g., the average percentage of males who did not have work income over age 60 was 23.801). 2. Work income indicates work-related income, including earnings and self-employment income. 3. Other income indicates income from interest, dividends, estate, or trust, overseas, shareholder, rent, etc. 4. It means an individual received at least two types of income from work income, main benefits/NZS, or other income.

Panel A of Table 6.1 shows that the percentages of individuals who did not earn any work income during the corresponding year rose from ages 60 to 69 for both males and females. In the year after turning 60, 23.8 percent of males and 35.3 percent of females had no recorded work income. In the year after turning 69, these rates rose to 57.6 percent for males and 69.4 percent for females. Recalling that NZS is generally received only after turning 65, there is evidence of relatively faster growth in this rate after the 65th birthday. Especially from age 65 to 66, the size of the increase was the greatest, with 7.2 percentage points for males and 6.2 percentage points for females. The rates in Panel A were lower than the findings of Dixon and Hyslop (2008) because this study excluded those who may not qualify for the residency criteria (death and migration over the study period) when constructing the sample cohort, whereas Dixon and Hyslop (2008) did not.

Panel B of Table 6.1 indicates the percentages of people under and over the age of 65 who had no income, income from only one source, or income from two or more sources (six income source groups in total). Due to the dramatic changes that occurred at the age of 65, the pre- and post-65 income composition was entirely different. Before turning 65, work income was the primary source of income for both males (over two-fifths) and females (almost two-fifths). The rates immediately dropped below 1.0 percent after being pension eligible.

The number of people who depended solely on Social Welfare benefits, i.e., main benefits or NZS, steadily increased before 65, and it had a particularly big jump at 65. The massive rises (16.5 and 22.1 percentage points for males and females, respectively) were entirely due to NZS claimants. The proportion of individuals who only earned other income, which is non-labour or non-benefit income, remained relatively stable for both males (around 5.4 percent) and females (about 2.4 percent) before turning 65. After 65, these rates nearly reached zero.

The proportions of people who had income from two sources had a slight decline before turning 65 for both genders. These rates almost doubled at the age of 65. The rises were attributed to the addition of NZS as a new income source for those who only had one income source before 65. Approximately 1.0 percent of individuals had all sources of income for both genders before the age of 65. Again, due to the inclusion of NZS as a new income source, the rates had substantial rises at 65, with males increasing by 18.8 percentage points and females increasing by 9.5 percentage points. However, the proportion of people receiving income from two or more sources gradually declined after

peaking at 65, due to people leaving the labour market. For those without income, the rates rose steadily between the ages of 60 and 64, reaching 13.1 percent for males and 18.6 percent for females at age 64. At 65, these rates fell below 1.0 percent due to the claimant of NZS.

One of the obvious concerns here is the high proportion with zero annual income reported before the age of 65. It is possible that people received income but did not have it recorded in the Inland Revenue Department (IRD). Most importantly, it's critical to remember that this refers to zero personal income, not zero family or household income. For example, a person may live in a high-income household but report receiving zero personal income. However, due to data limitations, the household level income could not be analysed because income data for households is not regularly available in the Integrated Data Infrastructure IDI. Another point to note is that Table 6.1 illustrates the average percentages for the entire cohort. It does not capture the variations in the composition of income across birth cohorts.

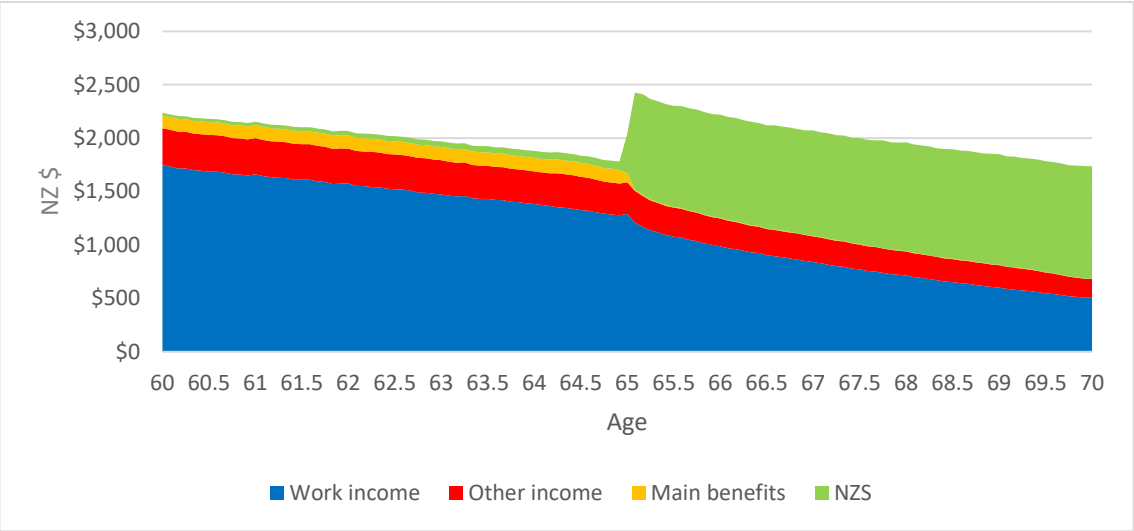
6.3 Mean Monthly Income

The previous section summarises the proportion of income from various sources on an annual basis. This section presents a more detailed breakdown of mean monthly personal income across ages 60 to 69. Mean monthly personal income is calculated by adding monthly earnings, main benefits, NZS from Employee Monthly Schedule (EMS), and imputed monthly income from Individual Income Tax Return (IR3), which was mentioned in Section 4.2.2.[51] Four income groups are categorized in the current section, work income (shown in blue in the graph), other income (shown in red in the graph), main benefits (shown in orange in the graph), and NZS (shown in green in the graph).

The presence of NZS prior to 65 is because, as has already been mentioned, individuals aged under 65 but married to someone over 65 may still apply for NZS, which is subject to means-testing. Main benefits income almost ceased after turning 65 because most beneficiaries transitioned to NZS. Work income appeared to have a temporary boost at age 65, creating a discontinuity in the decrease in work income.

[51] The annualised IR3 income is converted into imputed monthly income by dividing it by 12.

Figure 6.1 Mean monthly income for total cohort



Source: Refer to Figure 5.1 for further information

Figure 6.1 contradicts the typical view of NZS as an immediate replacement for work income lost due to the retirement of a person, which is not what happens around age 65. There is an immediate increase in total income at age 65 due entirely to NZS. The increase is substantial, and it lasts for some time. For example, there is a 24.9 percent rise, on average, in overall income from the year before 65 to the year following 65. This demonstrates that NZS actually is an immediate 'income enhancement' programme rather than an immediate 'income replacement' programme. Income from non-benefit sources continues to decline over the five years both before and after 65. Despite a substantial drop in work income, total income from all sources is only slightly lower at the 70th birthday ($1,736.30) than that at age 64 ($1,837.03). It turns out that NZS more than replaced the post-65 reduction in other income.

Before the age of 65, work income is the primary source of income for the average person, while NZS progressively becomes the primary source after 65, which supports Department for Work and Pensions's (2014) finding that pension is the primary source of post-retirement income. Changes in the amount of work income generally follow a specific pattern: work income falls before 65, has a small spike at the 65th birthday month, and then starts to decline at a faster rate after 65. The little spike upon reaching 65 is the effect of earnings and it might indicate the 'retirement' effect, though New Zealand (NZ) does not have a mandatory retirement age.[52] This retirement impact could be caused by a lump sum or redundancy payment at age 65. Some employers pay employees a lump sum payment that has been specified in the employment agreement, such as long service leave,

[52] Refer to Human Rights Act 1993, Ministry of Justice.

retirement package and non-taxable allowances.[53] A redundancy payment is made when there is job separation, which could be initiated by either or both parties. All unused annual leave and salary, as well as any other entitlements up to the end date are payable. 17.6 percent of the overall cohort sample had earnings in the month of their 65th birthdays higher than the previous month, with conditional average earnings at the 65th birthday month being 2.9 times that of the total cohort. By looking at the changes in the employer ID status, 1.9 percent of the total cohort entirely discontinued their employment one month after their 65th birthday.[54] Their conditional average earnings in the month of reaching 65 were 4.7 times that of the overall cohort. Upon reaching 65, 2.9 percent of the total cohort either switched employers or reduced the number of jobs held. Their conditional average earnings at the 65th birthday were 4.1 times that of the total cohort. This suggests that people leaving their employer either receive a lump sum or redundancy payment upon retiring 65, resulting in the discontinuity of the work income at age 65. However, the retirement effect cannot be directly observed in the IDI. We can only see the total compensation change at the 65th birthday month.

The size of the jump in NZS is nearly the same for all subgroups, including gender, race, education, and pre-65 benefit history, due to the universal characteristic of NZS. But the extent and length of the income enhancement effects NZS created differ across subgroups, as illustrated in the following sections.

6.3.1 Mean Monthly Income by Source: Gender

Figure 6.2 presents the mean monthly income of males and females. Three major differences should be highlighted. First, males had higher work income and other income than females, demonstrating the possibility of a gender pay gap and higher hours of work (Gough, 2001; Paci, Joshi, Makepeace, Dolton, & Waldfogel, 1996). The explanation for the gender pay gap may be largely due to the difference in human capital (Choudhury, 1993; Light & Ureta, 1995; Mincer & Polachek, 1974; Polachek, 1981). Moreover, males were more likely to hold senior positions than females (Bertrand & Hallock, 2001; Gough, 2001; Paci et al., 1996). Finally, females were more likely than males to choose part-time work due to caring duties (Dex, 1987). The income gap between males and females narrows as people age, resulting from the relatively rapid decline in male labour-force

[53] Source: Ministry of Business, Innovation & Employment
[54] This rate does not include those who have totally stopped working for others but started their own business.

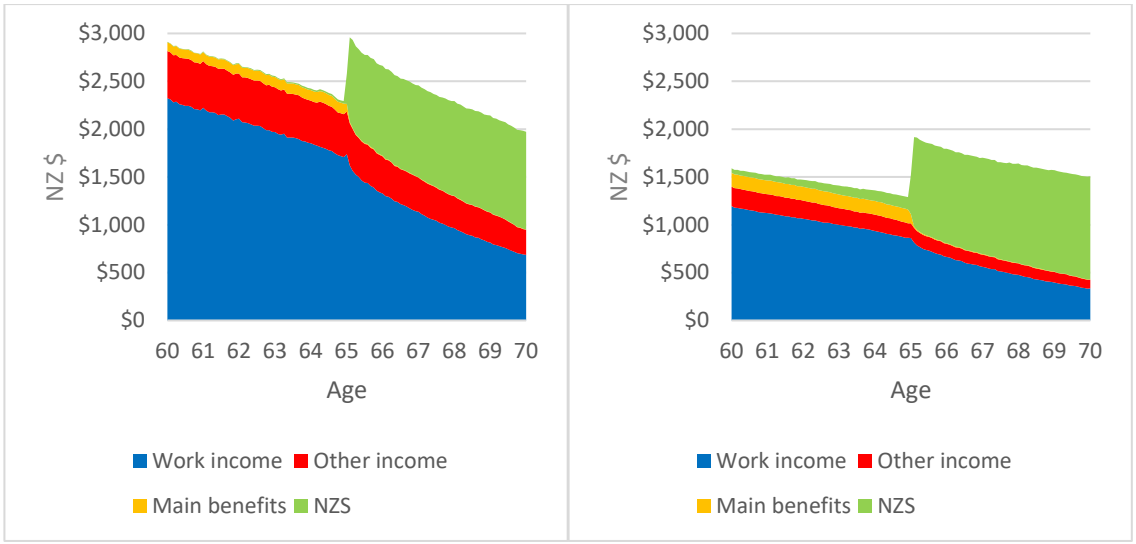
participation, not largely due to the difference in pension coverage that Even and Macpherson (1990) argued.

Second, females were more likely to earn a main benefit before turning 65. This is due to females' lower-income, making it easier for them to meet the means-testing requirements for main benefits.

Third, on average, NZS for females is higher than males after age 65 and it keeps increasing until age 70. There are three possible explanations for this. First, females had relatively higher NZS take-up rates than males (see Section 5.2.1). Second, single women may make up a greater portion of the females who took up NZS than single men after age 65, and a single person's NZS rate is higher than a married person's, as discussed in Section 2.2.2. Third, the proportion of younger women married to older men is higher. They first claimed the NZS together with their older husbands at a lower rate, with one of them qualifying for NZS and the other not (but were subject to means-test). After they reached age 65, they claimed NZS together with their husbands at a higher rate, with both of them qualifying for NZS.

NZS has a relatively greater impact on females' average income than males' because males had higher pre-65 total income than females, which is similar to what Dixon and Hyslop (2008) found. Males' average income rose by 17.3 percent from age 64 to 65. Females, on the other hand, saw a 37.9 percent rise, which is more than double of males'. At the 70th birthday month, males' average income was 16.7 percent lower compared to age 64, indicating the disappearance of the NZS enhancement effect. However, females still had a rise of 13.9 percent in total income compared to age 64 while reaching age 70. It shows that the enhancement effect that NZS has on females is not only greater, but also lasts longer than that of males.

Figure 6.2 Mean monthly income by gender



(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

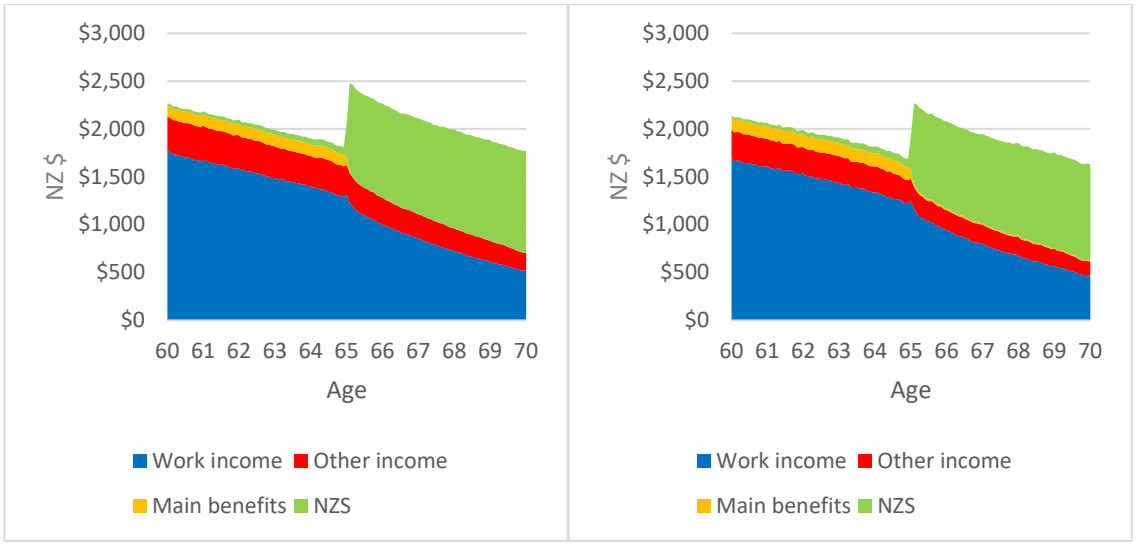
6.3.2 Mean Monthly Income by Source: Country of Birth

The average income for individuals who were born in NZ and foreign countries is shown in Figure 6.3. Except for the main benefits, income from the other three sources was relatively higher for NZ-born individuals than foreign-born individuals. Over the ten-year observation period, individuals born in NZ earned an average of 6.0 percent more work income and 25.3 percent more other income than those born in foreign countries. However, the average main benefits NZ-born people received before 65 were 10.5 percent less than foreign-born people. After turning 65, main benefits almost disappeared for NZ-born people but still existed for foreign-born people. NZ-born people got 6.8 percent more NZS than foreign-born people, which is most likely due to a higher take-up of NZS. This may explain why foreign-born individuals still received main benefits after 65, as they failed to meet NZS residency criteria and instead ended up receiving main benefits as a substitute.

NZ-born individuals had a larger increase in their income upon eligibility for NZS at age 65 compared to foreign-born. When comparing average incomes a year before and after the age of 65, people born in NZ saw a 25.7 percent rise in total income, while people born overseas saw a 22.3 percent increase. The NZS enhancement effects fade away at the age of 70 for both groups.

Appendix A 6.1 contains mean monthly income figures for both genders.

Figure 6.3 Mean monthly income by country of birth



(a) NZ born (b) Foreign born

Source: Refer to Figure 5.1 for further information

6.3.3 Mean Monthly Income by Source: Ethnicity

This section explores the differential impact of NZS on total across NZ's four major ethnic groups: European, Māori, Pacifica, and Asian. The graphs show that income inequality exists among the minority groups among the elderly (Brown, 2016; Choi, 1997; Heisig et al., 2018; Kalb & Scutella, 2004). In general, the claiming of NZS enhances average income by more than 24.0 percent for all four ethnic groups compared to the year before becoming pension eligible. However, by their 70th birthday, this impact is quite different across these groups. The European subgroup was the only group found that NZS replaced all other incomes within five years after being pension eligible. The other three subgroups all experienced sustained enhancement of income for the whole five year. In other words, their average income at the 70th birthday was still higher than that at age 64. Especially for Asians, the enhancement effect fades only halfway. Appendix A 6.2 shows the mean monthly income for ethnic groups by gender.

European

Of all ethnic groups, Europeans had the highest average monthly income. The composition of income is typical (Figure 6.4 (a)) of the entire sample. Before age 65, work income is the primary source of income, with other income coming in second. The share of the main benefits to overall income is small, about 5.2 percent before 65 and nearly zero after 65. NZS is barely received before age 65. After reaching 65, the proportion of income sourced from NZS gradually rises with a concurrent decline in work

income and other income. Between the ages of 64 and 65, there is a 24.5 percent rise in overall income. However, the NZS enhancement effect fades away at age 70, leaving the income 6.9 percent lower than that at age 64, which is largely due to the decline in work income.

Māori

The average income profile for Māori (Figure 6.4 (b)) is relatively flatter than that of Europeans. Before age 65, work income is the primary source of income. Main benefits come in second, accounting for 14.1 percent of overall income. Other income comes in third, accounting for 5.4 percent of overall income. After age 65, NZS gradually becomes the primary income source. The rate of decline in work income is flatter than that of Europeans. The NZS enhancement effect at age 65 results in a 24.3 percent rise in overall income compared to age 64. This effect lasts for more than five years, resulting in a 3.0 percent higher total income at their 70th birthday relative to the age of 64.

Pacifica

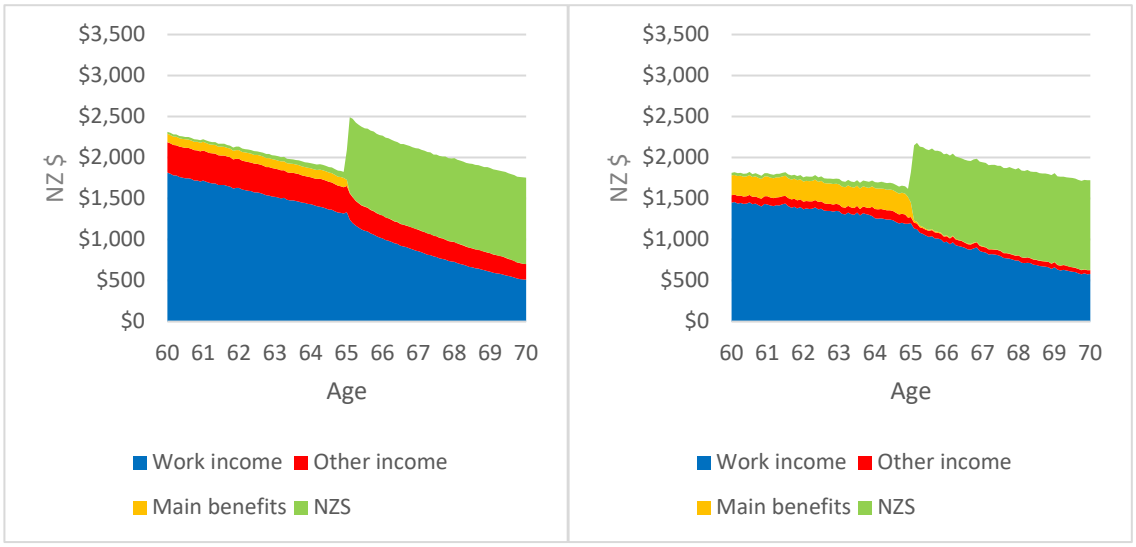
Pacifica had a lower average income than Europeans and Māori (Figure 6.4 (c)). Income from other sources is minimal over the ten-year observation period. Prior to 65, work income and main benefits are the primary income sources. NZS almost immediately becomes the major income source after reaching 65. The net rise in NZS is relatively lower compared to other ethnic groups since Pacifica had the highest pre-65 main benefits, leading NZS to substitute for main benefits after turning 65. The NZS enhancement effect at age 65 reveals a 24.5 percent rise in overall income compared to age 64. It lasts for five years and results in a 6.3 percent higher overall income at the 70th birthday compared to age 64.

Asian

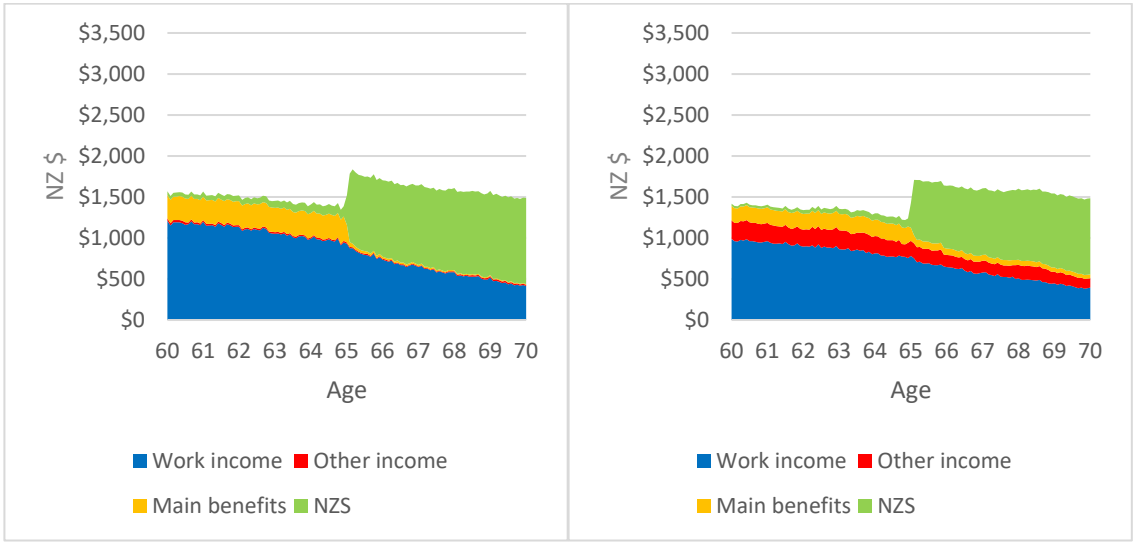
As shown in Figure 6.4 (d), Asians had the lowest work income and NZS, resulting in the lowest overall income among the four ethnic groups. But the proportion of other income is higher than that of Māori and Pacifica. This may be because of the large proportion of Asian migrants who make a living through non-labour work or overseas income. Another point worth noting is that Asians had the highest main benefits and the lowest NZS after 65. This may be due to the failure to meet the NZS residency requirements, causing them to apply for main benefits instead. NZS rose as people age, resulting from the increase in take-up rates (see Section 5.2.4). Of all the four main ethnic groups, Asians had the greatest NZS enhancement impact, with a rise in overall income of 32.1 percent from age

64 to 65 and 17.8 percent at the 70th birthday compared to age 64. That is, the NZS enhancement effect fades just halfway after five years of being pension eligible.

Figure 6.4 Mean monthly income by ethnicity



(a) European (b) Māori



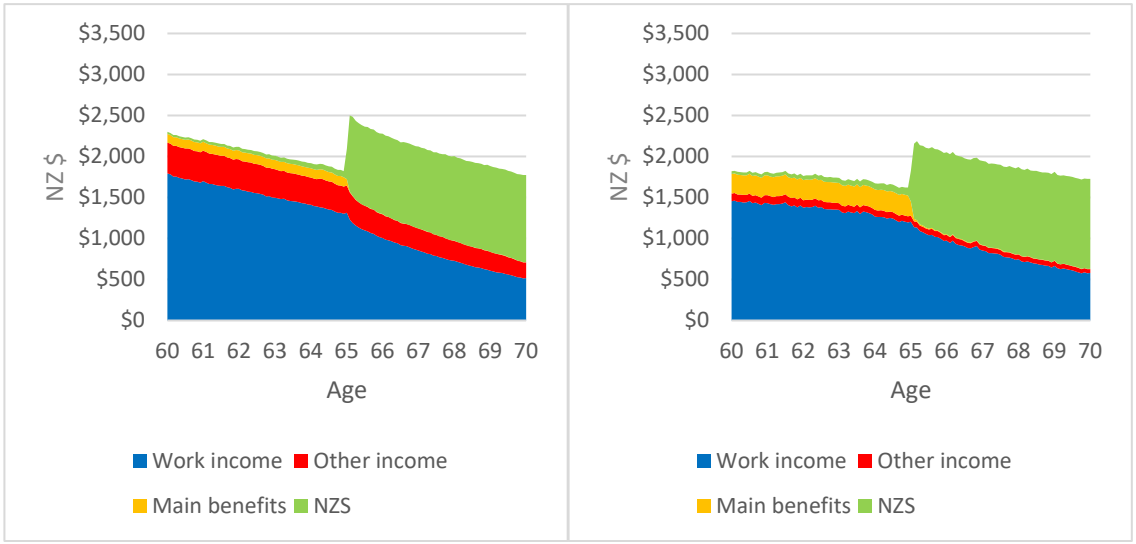
(c) Pacifica (d) Asian

Source: Refer to Figure 5.1 for further information

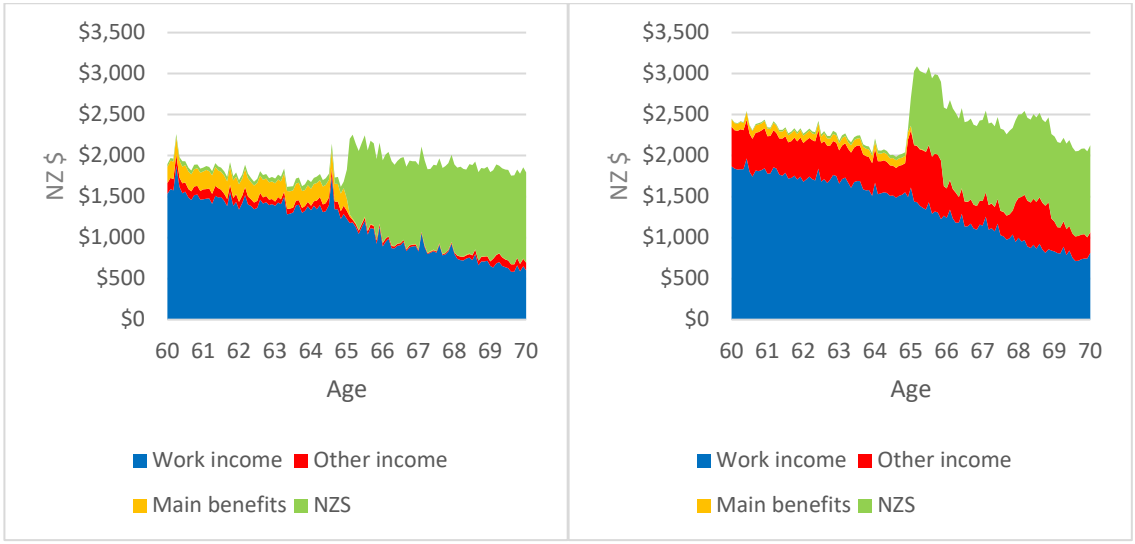
Taking into account the impact of country of birth on the average income of different ethnic groups, the average income of NZ-born individuals for the four ethnic groups is also analysed. The NZ-born ethnic groups consisted of 79 percent of the overall European group, 96 percent of the overall Māori group, 5 percent of the overall Pacifica group, and 10 percent of the overall Asian group. As the sample sizes of NZ-born Pacifica and Asian groups were very small, the average monthly income figures were noisy.

The income for Europeans and Māori born in NZ is similar to the total ethnic group (Figure 6.5 (a), (b)). The average income of NZ-born Pacifica is higher than that of the total Pacifica group (Figure 6.5 (c)). NZ-born Asians had a completely different income structure than the Asian group as a whole, as seen in Figure 6.5 (d). Over the ten years, the average proportion of other income is 33.5 percent of work income, the highest among the four ethnic groups. Moreover, the average income reaches the highest of the four groups after NZS commenced, resulting in the greatest enhancement impact. The rise in overall income from age 64 to age 65 is 25.5 percent for NZ-born Europeans, 26.5 percent for NZ-born Māori, 20.6 percent for NZ-born Pacifica, and 42.2 percent for NZ-born Asians. Except for NZ-born Europeans, the other three subgroups all experience a more than five-year NZS enhancement impact. For Pacifica and Asians born overseas, the mean monthly income should be lower than that of the total ethnic group, as shown in Figure 6.4. Appendix A 6.3 shows the mean monthly income for NZ-born ethnicity groups by gender.

Figure 6.5 Mean monthly income by ethnicity (NZ-born only)



(a) European (b) Māori



(c) Pacifica (d) Asian

Source: Refer to Figure 5.1 for further information

6.3.4 Mean Monthly Income by Source: Education

This section focuses on the differences in mean income profiles across four education subgroups.[55] It demonstrates that education has a significant impact on individual's income under the publicly-funded pension system, with higher education leading to higher work income and other income, similar to the situation with private pensions and other retirement incomes (Crystal et al., 1992). At the same time, higher education is also negatively associated with the receipt of pre-65 main benefits and the NZS enhancement effect.

The Qualification Unknown group (Figure 6.6 (d)) and the No Qualification group (Figure 6.6 (a)) had the lowest average income of the four subgroups due to the lowest work income and other income. They did, correspondingly, have the highest main benefits prior to 65. This may be attributed to their lower education which hindered them from obtaining higher-paying jobs. As a result, it makes it easier for them to meet the means-testing requirements for main benefits. The Qualification Less Than University Degree group (Figure 6.6 (b)) had higher work income and other income than the No Qualification group, but lower pre-65 main benefits. The University Degree group had the highest average income (Figure 6.6 (c)), including work income and other income, indicating that education has a positive effect on an individual's income.

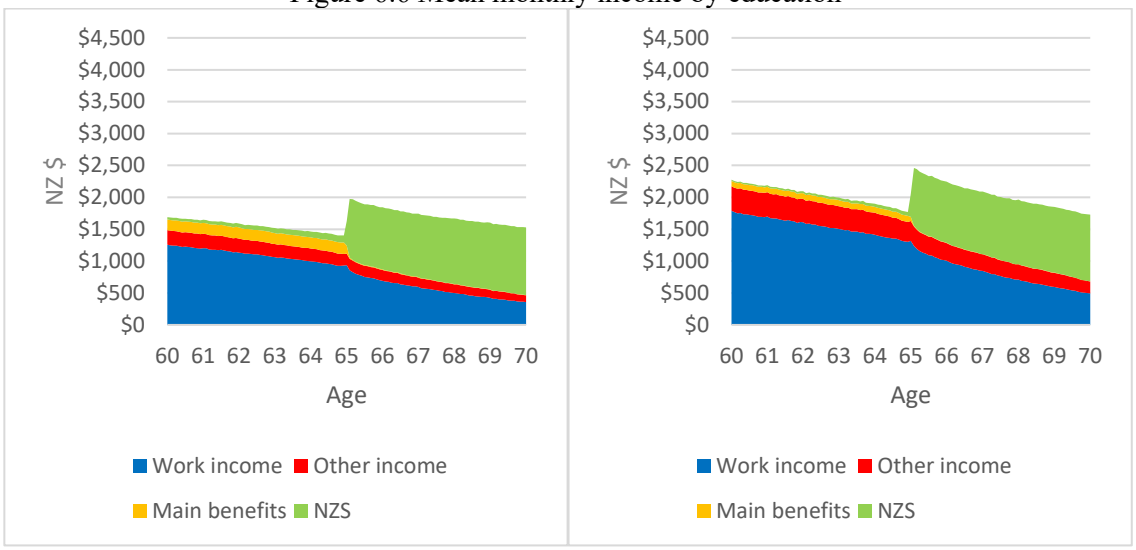
On the other hand, the increase in education has a negative impact on the NZS enhancement effect for the four subgroups. For example, the rise in average income from

[55] The definition of educational subgroups can be found in Section 4.6.2.

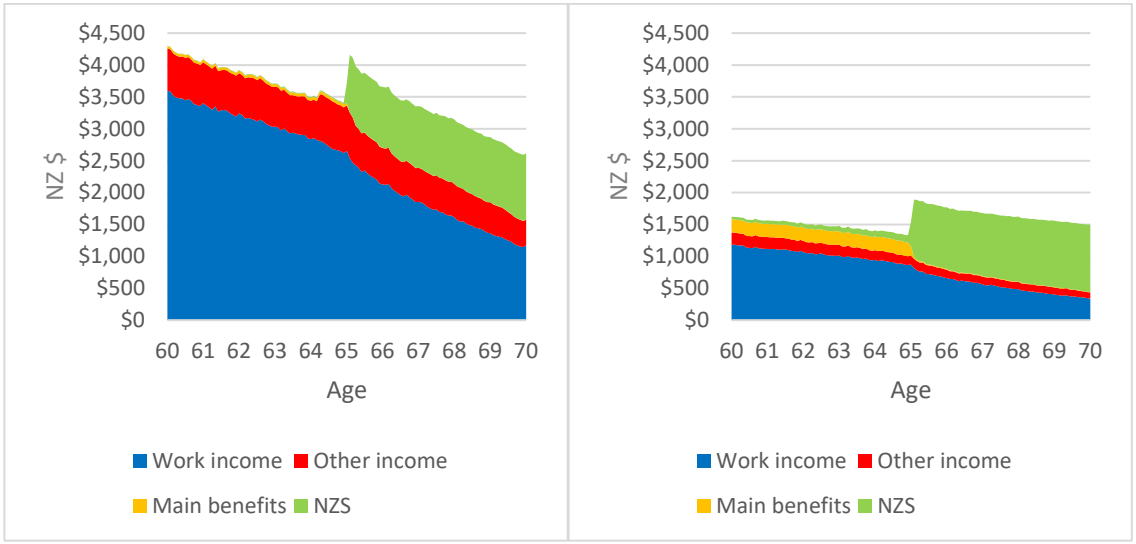
age 64 to 65 is 31.4 percent for the No Qualification group, 26.5 percent for the Qualification Less Than University Degree group, and 10.5 percent for the University Degree group. However, this is expected because people with university degrees had the highest mean income at age 70, which is likely augmented by higher accumulated savings. Except for the No Qualification and Qualification Unknown groups, the NZS enhancement effects fade out over a five-year period after 65.

Appendix A 6.4 shows the mean monthly income for education groups by gender.

Figure 6.6 Mean monthly income by education



(a) No Qualification (b) Qualification Less Than University Degree



(c) University Degree (d) Qualification Unknown

Source: Refer to Figure 5.1 for further information

6.3.5 Mean Monthly Income by Source: Benefit History

This section provides analyses of the impact of NZS on people with varying benefit history between the ages of 60 and 64, including the Sometimes Benefit, the Continuous Benefit, and the Never Benefit groups.[56] It shows that benefit history has a significant impact on individuals' income. Particularly for those who had a pre-65 benefit history, NZS does not just enhance their average income at the pension eligible age, but also replaces their pre-65 main benefits. Mean monthly income figures of benefit history groups relating to both genders are listed in Appendix A 6.5.

Sometimes Benefit

Figure 6.7 (a) depicts the changes in average income for people who sometimes received main benefits between the ages of 60 and 64. Work income gradually decreases as individuals age. The main benefits, which account for 25.7 percent of the overall income, play an important role in supporting people's lives before age 65. For most people, NZS kicks in at the age of 65, resulting in a peak in average income one month after the 65th birthday, as NZS immediately becomes the primary source of income.

The NZS enhancement effect results in a 36.1 percent rise in overall income between the ages of 64 to 65. It lasts more than five years after 65, with an 11.4 percent rise in income at the 70th birthday compared to age 64. This implies that, for those who had sometimes earned main benefits between the ages of 60 and 64, NZS acts as a more-than-complete substitution of the main benefits, potentially making their post-65 standard of living higher than it was pre-65.

Continuous Benefit

For individuals who had continuously received main benefits each month between the ages of 60 and 64, work income and other income are minimal (Figure 6.7 (b)) for the entire observation period. Before reaching 65, the monthly main benefits have little variability at an average rate of $804.17 and serve as the primary source of income. After being eligible for pension, NZS immediately becomes the main source of income. The average dollar increase from age 64 to 65 for this group is the smallest, with an absolute value of $260.86. This is because the main benefits mostly ceased at age 65 and NZS totally replaced them.

[56] The definition of benefit subgroups can be found in Section 4.6.1.

The NZS enhancement effect results in a 30.1 percent rise in overall income from age 64 to age 65. This effect continues to grow, reaching a 40.9 percent rise at the age of 70. The enhancement effect does not fade out over the five years after 65. Instead, it has a 10.8 percentage-point rise. This extraordinary impact has not been seen in any other subgroups, providing us with a new perspective on the impact of NZS on average income. NZS completely replaces the main benefits at age 65 and has a significant enhancement effect on this group.

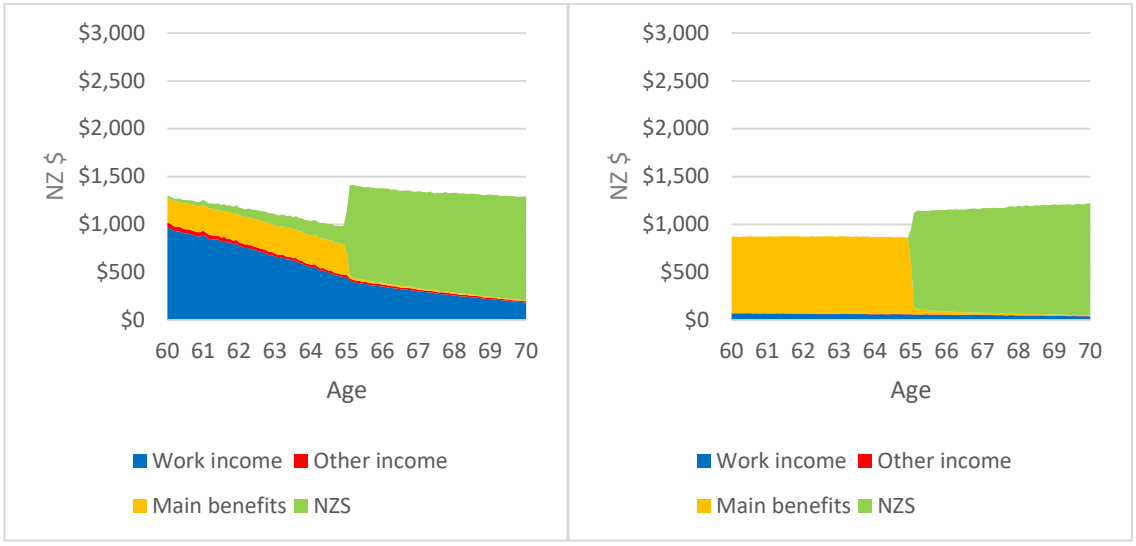
Another interesting point worth noting is the increasing amount of NZS as individuals age, which could be attributed to the rise in NZS take-up rates (see Section 5.2.6). People gradually transition from main benefits to NZS, as NZS has a more generous amount than main benefits, without counting supplemental benefits and other non-monetary benefits.

Never Benefit

By definition, the Never Benefit group received no main benefits before 65. After 65, minimal level of main-benefits was received (Figure 6.7 (c)). Work income is the primary source of income before 65, with other income coming an important second (unlike the other two groups). As people age, work income and other income fall relatively faster than it does for the other two benefit history subgroups.

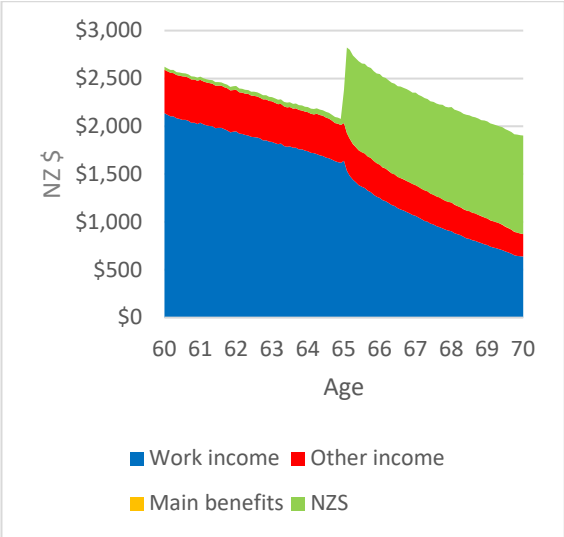
The NZS enhancement impact is relatively lower for the other two subgroups, with a 23.4 percent rise from age 64 to 65. It fades out before age 70, resulting in an 11.4 percent lower income at the 70th birthday compared to age 64.

Figure 6.7 Mean monthly income by benefit history



(a) Sometimes Benefit

(b) Continuous Benefit



(c) Never Benefit

Source: Refer to Figure 5.1 for further information

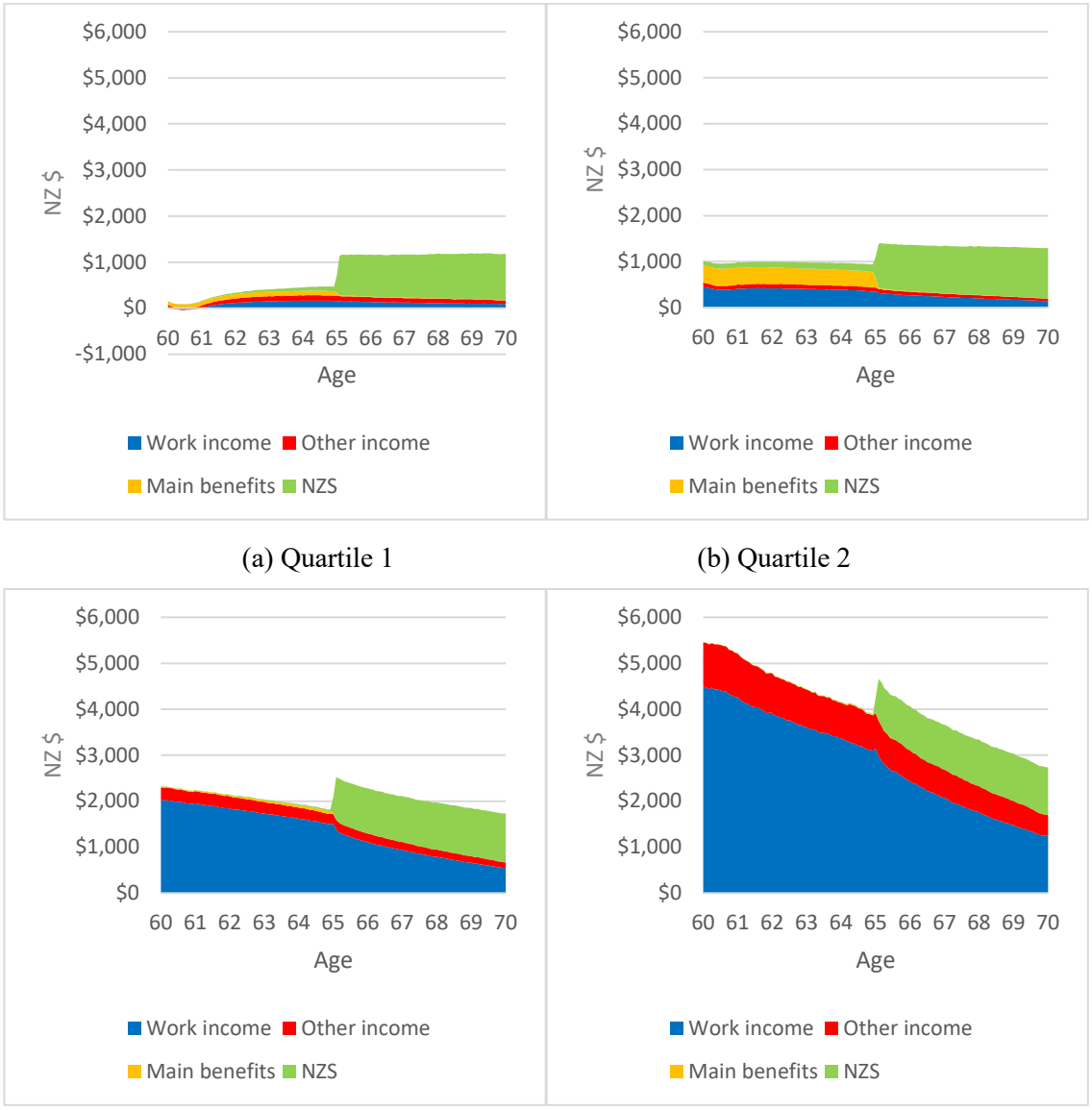
6.3.6 Mean Monthly Income by Source: Age-60 Quartiles

The differences in average income by age-60 income quartiles are examined in this section. Figure 6.8 shows a large variation in work income, other income, and main benefits among the four groups. Individuals in the lower quartiles were more likely to be on a main benefit because they were more likely to be eligible for the benefit requirements. The first quartile had lower main benefits than the second quartile maybe because they were ineligible for social welfare assistance due to their partners' income. As compared to the lower quartiles, the upper quartiles had higher work income and other income.

The NZS enhancement effect declines as pre-65 income increases. For example, from age 64 to age 65, the NZS enhancement effect is 141.0 percent for the first quartile group, 41.7 percent for the second quartile group, 26.3 percent for the third quartile group, and 6.8 percent for the fourth quartile group. The enhancement effect lasts over five years after 65 for the lower quartile groups but fades out for the upper quartile groups.

In contrast to the findings of LaRochelle-Côté et al. (2008) in Canada, those in the lower-income quartiles (quartiles 1 and 2) experienced a significant income enhancement effect when they reached pension age. However, people in the higher-quartile income experienced the largest decline in income through retirement, which is in line with the findings of LaRochelle-Côté et al. (2008).

Figure 6.8 Mean monthly income by age 60 quartiles



(a) Quartile 1 (b) Quartile 2

(c) Quartile 3 (d) Quartile 4

Source: Refer to Figure 5.1 for further information

Any similar breakdown could be done with these administrative data by any available characteristic of the population.

6.4 Empirical Results Using Regression Analysis

The figures in the previous section depicted the changes in mean monthly incomes for various subgroups over the study period. They did not, however, calculate the precise numerical values of these changes nor statistically test their significance, holding other factors constant. Particularly, we want to know the different changes in total and work income over the observation period, including the pre- and post-65 time trends, the temporary bump at the 65th birthday, and the permanent effect of being pension eligible.

In addition, we want to know how long the NZS enhancement effect will last, which is closely related to both the permanent effect of being pension eligible and the post-65 declining trend in work income.

6.4.1 Regression Method

The monthly income patterns illustrated in the previous section show a discontinuity at the month in which the person first becomes age eligible for NZS. We want to measure the causal effects of being pension eligible on total income, comparing the income of those with and without the presence of the NZS system. We want to know what the other components of income would look like, especially work income, if NZS was removed. This counterfactual situation, of course, is unobservable. We can't 're-run the experiment' and observe what these income patterns are between ages 60 and 70 for everyone in our birth cohorts in the absence of NZS. If we could, the causal effects would be the simple differences between these income patterns with and without NZS. This would result in a number of interesting questions. For example, would the observed changes in work income around the 65th birthday be the same with and without NZS? Would the relatively more rapid decline in work income after the 65th birthday persist without this public pension system?

We suspect that this sharp discontinuity around the month in which the individual turns 65 does provide some evidence of the possible behavioural effects of this provision of NZS income. It is the precision of the timing of these changes in these circumstances that is particularly compelling. It cannot be ruled out, however, that something else around the 65th birthday could be causing some of the observed changes in income (e.g., a cultural convention that age 65 is the typical, expected age of retirement).

The monthly data we have can pinpoint the differences in income one month before and after being pension eligible. They show us that turning 65 does have an impact on all sources of income. They are suggestive of the possible impacts of NZS on people's incomes. However, it is unclear whether the discontinuity results solely from pension eligibility or something else specific to turning age 65.

Ordinary Least Squares (OLS) regression is used in this study. The basic estimation is as follows:

$$y_{it} = \alpha + \beta_1 t + \beta_2 t\_Post65_t + \gamma_1 Perm_t + \gamma_2 Temp_t + \boldsymbol{\lambda X} + \varepsilon_{it} \qquad (6.1)$$

where i indicates individual, t indicates time from 1 to 121 corresponding to months between individuals' 60th to 70th birthdays, for example $t = 61$ is individuals' 65th birthday month. y_{it} is the outcome variable of interest (total income or work income). β_1 captures the linear time trend before 65; β_2 captures the change of time trend after 65, with $t\_Post65 = t - 61$ if $t > 61$; 0 otherwise. That is, the time trend after 65 is the sum of $\beta_1 + \beta_2$. γ_1 captures the permanent intercept shift in becoming pension eligible with $Perm = 1$ if $t > 61$; 0 otherwise. γ_2 captures the temporary boost in (work) income in the month in which the individual turns 65, with $Temp = 1$ if $t = 61$, 0 otherwise. $\boldsymbol{X}$ represents a vector of individual characteristics (such as pre-65 benefit history, gender, country of birth, ethnicity, education, and birth cohorts) and the macro environment (unemployment rate) that may affect the income, and ε_{it} is the disturbance term.

Any other expansion can be made on the basis of equation (6.1), such as adding interactions between different subgroups with the time trends, and temporary and permanent effects. Further, the duration of the NZS enhancement effects after 65 can be predicted using the estimated permanent effects divided by the time trend after 65. In other words, this is the estimated month where income received after turning 65 declines to the point where it matches the income in the month immediately prior to becoming eligible for NZS.

The inclusion of individual fixed effects would have little impact on the estimated coefficients on the key independent variables in this study. If fixed effects are correlated with other covariates, they are crucial controls to include because omitting them would bias the estimated coefficients on these other covariates. This isn't possible in this study since the four key features of this regression specification (two linear time trends, a temporary effect, and a permanent effect) are all due to the same ageing process that confronts all individuals in our cohorts. The experimentation with the inclusion of these individual fixed effects confirmed this fact.

6.4.2 Empirical Results on Total Income

The regression findings for the relevant coefficients on total income are reported in Column 1 of Table 6.2. All of the coefficients are statistically different from zero at the 1% level. The time trend estimates show that total income declines monthly on average by $7.08 before 65. This rate of decline accelerates after age 65, with an additional $3.51 drop in income each month, leading to an overall decline of $10.60.

People's average total income rises permanently by $564.99 when most people become eligible for NZS for the first time. The temporary boost in total income at the 65th birthday month is $252.69, which may include the partial effect of being pension eligible and the bump in work income that resulted from a lump sum or redundancy payment. Using the division of the permanent rise and the post-65 drop rate in total income, the NZS enhancement effect is anticipated to fade away by the age of 69.44, which is less than five years after being pension eligible. Males are estimated to earn an average of $823.94 more total income than females over the entire sample period, which indicates a gender gap around pension age (Ginn & Arber, 1994; Johnson et al., 1999; Woods, 1988). A NZ-born person earns an average of $133.83 more total income than someone born in a foreign country between the ages 60 and 70.

When compared to people with some European identity, having some Māori identity increases total income by $95.26, having some Pacifica identity increases total income by $54.76, while having some Asian identity decreases total income by $445.64, controlling for education and pre-65 benefit history. Based on unadjusted statistics, Māori and Pacifica people would be expected to have lower incomes than Europeans, on average, due to their relatively lower educational levels and higher possibility of having benefit histories (Rashbrooke, Rashbrooke, & Chin, 2021; Robson, Cormack, & Cram, 2000; Treasury, 2018). After excluding the controls for education and pre-65 benefit history, Māori and Pacifica pick up the impact of these factors, and the effects reverse, resulting in a decline in total income of $216.78 for Māori and $474.19 for Pacifica (see column 3 of Table 6.2). This suggests that the relatively lower incomes of Māori and Pacifica people between the ages of 60 and 70 are completely explained by their education levels, benefit histories, and other factors controlled for in this regression.

The differences in educational attainment are significant in determining individuals' total income, which is in line with the findings of (Chen, 1991; Crystal & Shea, 1990; O'Rand, 1996). The total monthly income for people with qualifications less than a university degree is $255.40 more than those with no qualifications. People with university degrees have an average of $1,614.86 more total income than those without any qualifications. The estimated effects support the argument in Section 6.3.4 that education has a significant impact on a person's total income.

Compared to those who did not receive a main benefit between the ages 60 and 64, having sometimes received a main benefit reduces total income by $835.40, and having

continuously received main benefits reduces total income by $993.20. This suggests that having a pre-65 benefit history generally lowers total income. Furthermore, continuously receiving main benefits before 65 results in even lower income than other people, which may be due to their absence from the labour market.

An one percentage-point increase in the unemployment rate reduces total monthly income by $20.51. The later birth cohorts have higher personal total income than the earlier birth cohorts, which may be due to the rise in females' labour force participation rate (LFPR) (Johnston, 2005).

Table 6.2 OLS estimation of total/work income

	With Control of Education and Benefit History		Without Control of Education and Benefit History	
	Coefficients for Total Income	**Coefficients for Work Income**	**Coefficients for Total Income**	**Coefficients for Work Income**
	1	2	3	4
t	-7.084***	-7.558***	-7.087***	-7.561***
	(0.188)	(0.086)	(0.188)	(0.086)
t_Post65	-3.512***	-3.472***	-3.511***	-3.472***
	(0.283)	(0.120)	(0.283)	(0.12)
Perm	564.987***	-160.700***	564.925***	-160.757***
	(6.597)	(2.985)	(6.597)	(2.985)
Temp	252.694***	4.165	252.656***	4.130
	(7.512)	(4.290)	(7.512)	(4.290)
Other Control Variables				
Male	823.941***	660.820***	939.831***	767.018***
	(8.817)	(6.872)	(9.788)	(7.617)
NZ born	133.832***	53.207***	37.994***	-26.238***
	(11.926)	(9.415)	(12.006)	(9.796)
Māori	95.259***	216.433***	-216.783***	-81.391***
	(12.271)	(11.093)	(13.509)	(12.475)
Pacifica	54.763***	147.992***	-474.189***	-345.495***
	(16.873)	(15.579)	(18.584)	(18.091)
Asian	-445.641***	-367.330***	-567.686***	-491.127***
	(26.782)	(19.972)	(27.732)	(21.186)
Other Ethnicities	-77.894***	-104.420***	-113.221***	-143.229***
	(31.240)	(23.144)	(32.630)	(24.357)
Qualification Less Than University Degree	255.403***	195.909***	-	-
	(7.779)	(6.398)	-	-
University Degree	1,614.855***	1,323.084***	-	-
	(30.615)	(22.096)	-	-
Qualification Unknown	3.810	10.168***	-	-
	(10.074)	(8.849)	-	-
Unemployment Rate	-20.508***	-2.834***	-20.281***	-2.626***
	(2.339)	(1.251)	(2.340)	(1.253)
Sometimes Benefit	-835.401***	-755.951***	-	-
	(6.352)	(5.620)	-	-
Continuous Benefit	-993.196***	-1,157.681***	-	-
	(6.248)	(5.155)	-	-
Cohort 1941	57.469***	47.008***	91.376***	77.872***
	(16.413)	(13.244)	(17.194)	(14.060)
Cohort 1942	102.700***	80.354***	151.916***	126.169***
	(16.622)	(13.739)	(17.410)	(14.556)
Cohort 1943	143.849***	107.460***	232.396***	189.727***
	(17.062)	(13.768)	(17.900)	(14.652)
Cohort 1944	175.124***	143.637***	278.457***	240.621***
	(17.312)	(13.822)	(18.159)	(14.720)
Cohort 1945	226.768***	183.594***	361.011***	309.305***
	(16.433)	(13.510)	(17.246)	(14.382)
Cohort 1946	273.461***	226.150***	436.087***	377.737***
	(19.113)	(13.620)	(20.100)	(14.452)
Cohort 1947	298.745***	249.679***	484.544***	422.095***
	(16.234)	(13.199)	(17.034)	(14.069)
Constant	1,602.047***	1,259.447***	1,612.189***	1,207.142***
	(24.523)	(14.069)	(22.474)	(13.561)
Monthly Observations (n x t)	26,773,428	26,773,428	26,773,428	26,773,428
Number of Individuals (n)	221,268	221,268	221,268	221,268
R-square	0.051	0.100	0.021	0.049

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Numbers in parentheses are adjusted standard errors controlling for person-level clustering.

Interaction with Gender

To allow the key features of the income profile over ages 60 to 70 to vary between men and women, Table 6.3 provides the corresponding results. In this specification, the interactions of time trends, and temporary and permanent effects on gender are included. All the estimated coefficients are statistically different from zero at the 1% level, except for the coefficients of those having unknown qualifications. The regression estimates show that females' monthly total income, on average, drops by $4.55 before 65, with an additional $1.79 drop each month after 65. Males, on the other hand, have a faster drop rate than females for the entire study period. For example, the average decline in total income before 65 is $9.73, and the average decline after 65 is $15.04. This shows that males' monthly decline in total income is more than twice faster than that of females. This could be attributed to males leaving the labour market at a faster rate than females. In addition, males have a bigger temporary bump at the 65th birthday month than females, with $48.48 more than females' $228.92. However, males have a smaller permanent impact of being pension eligible than females, with females having a $583.82 rise and males having $38.49 less. This supports the findings of Dixon and Hyslop (2008), which stated that after being pension eligible, females's income had a bigger increase than males'.

The enhancement effect of NZS for males is projected to fade away by the age of 68.02, terminating within our study period. Females, however, have a longer duration of enhancement effect, which would last to age 72.68. This could be due to females' higher permanent income shift at pension age and a slower decline in work income after 65.

Table 6.3 OLS estimation of total/work income, interaction with gender

	Coefficients for Total Income	**Coefficients for Work Income**
t	-4.549***	-5.320***
	(0.115)	(0.072)
t_Post65	-1.785***	-2.254***
	(0.148)	(0.107)
Perm	583.824***	-108.380***
	(4.519)	(2.678)
Temp	228.921***	-5.304
	(5.106)	(3.535)
Male t*	-5.177***	-4.570***
	(0.411)	(0.170)
Male t_Post65*	-3.524***	-2.486***
	(0.580)	(0.243)
Male Perm*	-38.492***	-106.820***
	(12.816)	(6.047)
Male Temp*	48.483***	19.292*
	(15.677)	(8.702)
Other Control Variables		
Male	1,211.703***	1,030.018***
	(14.015)	(10.511)
NZ born	133.831***	53.206***
	(11.926)	(9.415)
Māori	95.259***	216.433***
	(12.271)	(11.093)
Pacifica	54.763***	147.992***
	(16.873)	(15.579)
Asian	-445.641***	-367.330***
	(26.782)	(19.972)
Other Ethnicities	-77.894***	-104.421***
	(31.240)	(23.144)
Qualification Less Than University Degree	255.403***	195.909***
	(7.779)	(6.398)
University Degree	1,614.855***	1,323.084***
	(30.615)	(22.096)
Qualification Unknown	3.810	10.168***
	(10.074)	(8.849)
Unemployment Rate	-20.415***	-2.742***
	(2.337)	(1.245)
Sometimes Benefit	-835.401***	-755.951***
	(6.352)	(5.620)
Continuous Benefit	-993.196***	-1,157.681***
	(6.248)	(5.155)
Cohort 1941	57.466***	47.005***
	(16.413)	(13.244)
Cohort 1942	102.689***	80.343***
	(16.622)	(13.739)
Cohort 1943	143.828***	107.439***
	(17.062)	(13.768)
Cohort 1944	175.092***	143.605***
	(17.312)	(13.822)
Cohort 1945	226.722***	183.549***
	(16.434)	(13.510)
Cohort 1946	273.402***	226.092***
	(19.113)	(13.620)
Cohort 1947	298.676***	249.610***
	(16.235)	(13.200)
Constant	1,411.676***	1,078.176***
	(21.715)	(14.080)
Monthly Observations (n x t)	26,773,428	26,773,428
Number of Individuals (n)	221,268	221,268
R-square	0.052	0.102

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Numbers in parentheses are adjusted standard errors controlling for person-level clustering.

Interaction with Country of Birth

The time trend for those born in foreign countries, as shown in Table 6.4, is an average drop of $6.83 before 65, with an extra $2.85 drop each month after 65. People born in NZ have relatively similar time trends to those born in other countries, with a $7.17 drop before 65 and a $10.90 drop after 65. People born in NZ have bigger permanent and temporary impacts than those born in other countries. For example, foreign-born individuals see a $485.94 permanent rise in total income as a result of being pension eligible. This effect further increases by $105.45 for those born in NZ. Though people born in NZ have a higher permanent effect than those born in foreign countries, they also have a higher average income, resulting in a similar enhancement effect generated by NZS. That is, the NZS enhancement effects for both groups disappear before age 70 (age 69.52 for NZ-born and age 69.18 for foreign-born). In terms of the temporary boost at the 65^{th} birthday month, foreign-born people see a $207.06 rise, while NZ-born have an additional $60.88 rise. This is most likely due to the higher NZS take-up rates among NZ-born individuals, as illustrated in Section 5.2.3.

Table 6.4 OLS estimation of total/work income, interaction with country of birth

	Coefficients for Total Income	Coefficients for Work Income
t	-6.831***	-7.492***
	(0.255)	(0.164)
t_Post 65	-2.847***	-3.311***
	(0.335)	(0.233)
Perm	485.937***	-165.688***
	(10.753)	(5.674)
Temp	207.057***	3.411
	(12.839)	(9.477)
NZ born t*	-0.339**	-0.089
	(0.359)	(0.191)
NZ born t_Post 65*	-0.886***	-0.215*
	(0.493)	(0.272)
NZ born Perm*	105.452***	6.660
	(13.167)	(6.669)
NZ born Temp*	60.879***	1.007
	(15.918)	(10.609)
Other Control Variables		
Male	823.941***	660.820***
	(8.817)	(6.872)
NZ born	115.134***	58.567***
	(15.769)	(13.182)
Māori	95.259***	216.433***
	(12.271)	(11.093)
Pacifica	54.763***	147.992***
	(16.873)	(15.579)
Asian	-445.641***	-367.330***
	(26.782)	(19.972)
Other Ethnicities	-77.894***	-104.420***
	(31.240)	(23.144)
Qualification Less Than University Degree	255.403***	195.909***
	(7.779)	(6.398)
University Degree	1,614.855***	1,323.084***
	(30.615)	(22.096)
Qualification Unknown	3.810	10.168***
	(10.074)	(8.849)
Unemployment Rate	-20.421***	-2.842***
	(2.333)	(1.251)
Sometimes Benefit	-835.401***	-755.951***
	(6.352)	(5.620)
Continuous Benefit	-993.196***	-1,157.681***
	(6.248)	(5.155)
Cohort 1941	57.466***	47.009***
	(16.413)	(13.244)
Cohort 1942	102.689***	80.355***
	(16.622)	(13.739)
Cohort 1943	143.829***	107.462***
	(17.062)	(13.768)
Cohort 1944	175.094***	143.640***
	(17.312)	(13.822)
Cohort 1945	226.724***	183.599***
	(16.433)	(13.510)
Cohort 1946	273.406***	226.155***
	(19.116)	(13.620)
Cohort 1947	298.680***	249.685***
	(16.234)	(13.199)
Constant	1,615.723***	1,255.461***
	(22.956)	(15.688)
Monthly Observations (n x t)	26,773,428	26,773,428
Number of Individuals (n)	221,268	221,268
R-square	0.051	0.100

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Numbers in parentheses are adjusted standard errors controlling for person-level clustering.

Interaction with Ethnicity

The total income for those with some European identity falls by an average of $7.73 each month before 65, and by an average of $11.29 after 65, as shown in Table 6.5. The monthly time trends are flatter for people with some Māori, Pacifica, and Asian ethnic identities. For example, the pre-65 declines in total income are about $3.00 for people with either Māori, Pacifica, or Asian identity. The post-65 decline is $7.24 for people with some Māori identity, $5.11 for people with some Pacifica identity, and $3.34 for people with some Asian identity.

After being pension eligible, people with some European identity see the largest permanent rise in total income of $580.20 among the major ethnic groups. This effect is reduced if people had some other ethnic identities, $102.15 less for those with some Māori identity, $179.17 less for those with some Pacifica identity, and $142.21 less for those with some Asian identity. This provides additional evidence that the minority groups' relatively lower total income is due to a lower take-up of NZS under a publicly-funded and non-means-tested pension, rather than private and state pensions as Department for Work and Pensions (2014) attributed. However, as people with some European identity have the highest average income, their NZS enhancement effect disappears right before age 70, at the age of 69.28. Other groups, on the other hand, all have a more than five-year NZS enhancement effect after being pension eligible. Because people with some Asian identity had the lowest average income, their NZS enhancement effect is the longest, terminating at age 75.94. Similar to the permanent impact, the temporary bump at the 65th birthday month for people with some European identity is $266.37. This effect, again, is reduced by $101.10 if people had some Māori identity, by $122.21 if people had some Pacifica identity, and by $97.59 if people had some Asian identity.

Table 6.5 OLS estimation of total/work income, interaction with ethnicities

	Coefficients for Total Income	Coefficients for Work Income
t	-7.731***	-8.067***
	(0.216)	(0.096)
t_Post 65	-3.562***	-3.447***
	(0.326)	(0.135)
Perm	580.203***	-168.830***
	(7.303)	(3.342)
Temp	266.370***	6.762
	(8.358)	(4.820)
Māori t*	5.005***	3.757***
	(0.585)	(0.247)
Māori t_Post 65*	-0.950***	-1.397***
	(0.694)	(0.374)
Pacifica t*	4.662***	3.458***
	(0.372)	(0.323)
Pacifica t_Post 65*	1.523***	0.690*
	(0.540)	(0.465)
Asian t*	5.203***	4.295***
	(0.548)	(0.311)
Asian t_Post 65*	2.754***	1.452***
	(0.822)	(0.469)
Other Ethnicities t*	0.542	0.877***
	(0.778)	(0.536)
Other Ethnicities t_Post65*	-0.954*	-0.102
	(1.355)	(0.808)
Māori Perm*	-102.146***	30.011***
	(25.426)	(9.696)
Pacifica Perm*	-179.165***	49.255***
	(14.132)	(12.122)
Asian Perm*	-142.207***	113.154***
	(30.684)	(10.642)
Other Ethnicities Perm*	45.328**	36.266***
	(32.359)	(19.491)
Māori Temp*	-101.095***	-24.897
	(26.643)	(13.134)
Pacifica Temp*	-122.208**	-25.077
	(21.592)	(19.925)
Asian Temp*	-97.594**	4.624
	(43.098)	(19.595)
Other Ethnicities Temp*	-17.172	-18.608
	(42.510)	(20.309)
Other Control Variables		
Male	823.941***	660.820***
	(8.817)	(6.872)
NZ born	133.832***	53.207***
	(11.926)	(9.415)
Māori	-144.173***	-6.298
	(17.397)	(15.104)
Pacifica	-162.829***	-97.618***
	(22.597)	(21.301)
Asian	-733.369***	-707.446***
	(35.537)	(25.213)
Other Ethnicities	-118.856***	-174.178***
	(41.551)	(34.523)
Qualification Less Than University Degree	255.403***	195.909***
	(7.779)	(6.398)
University Degree	1,614.855***	1,323.084***
	(30.615)	(22.096)
Qualification Unknown	3.810	10.168***
	(10.074)	(8.849)
Unemployment Rate	-20.596***	-3.002***
	(2.344)	(1.250)
Sometimes Benefit	-835.401***	-755.951***
	(6.352)	(5.62)
Continuous Benefit	-993.196***	-1157.681***
	(6.248)	(5.155)

Table 6.5 Continued

Cohort 1941	57.473***	47.015***
	(16.413)	(13.244)
Cohort 1942	102.710***	80.374***
	(16.622)	(13.739)
Cohort 1943	143.870***	107.499***
	(17.062)	(13.768)
Cohort 1944	175.154***	143.694***
	(17.312)	(13.822)
Cohort 1945	226.812***	183.678***
	(16.433)	(13.510)
Cohort 1946	273.517***	226.257***
	(19.110)	(13.620)
Cohort 1947	298.812***	249.805***
	(16.235)	(13.199)
Constant	1,634.990***	1,294.888***
	(25.248)	(14.197)
Monthly Observations (n x t)	26,773,428	26,773,428
Number of Individuals (n)	221,268	221,268
R-square	0.051	0.100

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Numbers in parentheses are adjusted standard errors controlling for person-level clustering.

Interaction with Education

Table 6.6 shows that the monthly drop in total income before 65 for the No Qualification group is $4.70, with an additional $2.13 drop after 65. For the Qualification Less Than University Degree Group, the pre-65 monthly drop in total income is $7.73, and the post-65 monthly drop in total income is $11.25. The declining trend in the University Degree group is the steepest of the four education subgroups. The pre-65 monthly reduction in total income for the University Degree group is $13.89, and the post-65 monthly reduction in total income is $23.49. This suggests that having a higher level of education accelerates the monthly decline in total income, both before and after 65.

The temporary effect at the 65th birthday month also rises with higher education level. The No Qualification group receives a temporary increase of $231.22 on their 65th birthday month. This effect rises by $27.07 for the Qualification Less Than University Degree group, and by $111.39 for the University Degree group. However, the temporary effect for the Qualification Less Than University group is not statistically significant.

The permanent effect after being pension eligible, however, is nearly the same for people with any qualification, which is largely due to the universal characteristic of NZS. The permanent effect of being pension eligible for the No Qualification group is $529.66. This effect rises by $65.34 for the Qualification Less Than University Degree group, and by $66.34 for the University Degree group. Within five years of becoming pension eligible for those with any qualifications, the NZS enhancement effects fade away. The NZS enhancement effects, on the other hand, last more than a year after age 70 for those with no qualifications. The difference in the duration of the NZS enhancement effects may be

owing to the difference in average income, with higher average income groups experiencing shorter enhancement effects and lower average income groups experiencing longer enhancement effects.

Table 6.6 OLS estimation of total/work income, interaction with education

	Coefficients for Total Income	**Coefficients for Work Income**
t	-4.701***	-5.562***
	(0.172)	(0.112)
t_Post65	-2.128***	-2.140***
	(0.232)	(0.163)
Perm	529.661***	-135.993***
	(7.091)	(3.863)
Temp	231.216***	8.110
	(7.984)	(5.636)
Qualification Less Than University Degree t*	-3.029***	-2.180***
	(0.237)	(0.16)
Qualification Less Than University Degree t_Post65*	-1.396***	-1.691***
	(0.336)	(0.233)
University Degree t*	-9.193***	-9.496***
	(1.668)	(0.471)
University Degree t_Post65*	-7.464***	-5.030***
	(2.334)	(0.662)
Qualification Unknown t*	0.280	0.471***
	(0.302)	(0.249)
Qualification Unknown t_Post65*	0.711**	-0.047
	(0.448)	(0.351)
Qualification Less Than University Degree Perm*	65.337***	-32.493***
	(9.977)	(5.759)
University Degree Perm*	66.344***	-98.378***
	(45.455)	(16.315)
Qualification Unknown Perm*	-26.782**	13.303*
	(12.265)	(8.136)
Qualification Less Than University Degree Temp*	27.074	-3.109
	(11.682)	(8.410)
University Degree Temp*	111.391***	-12.057
	(57.096)	(22.935)
Qualification Unknown Temp*	-33.647	-12.783
	(12.979)	(11.013)
Other Control Variables		
Male	823.941***	660.820***
	(8.817)	(6.872)
NZ born	133.833***	53.207***
	(11.926)	(9.415)
Māori	95.259***	216.433***
	(12.271)	(11.093)
Pacifica	54.764***	147.992***
	(16.873)	(15.579)
Asian	-445.640***	-367.329***
	(26.782)	(19.972)
Other Ethnicities	-77.894***	-104.420***
	(31.240)	(23.144)
Qualification Less Than University Degree	428.660***	370.609***
	(11.632)	(9.663)
University Degree	2,254.710***	2,027.295***
	(45.634)	(31.925)
Qualification Unknown	-10.448	-24.323***
	(15.933)	(14.428)
Unemployment Rate	-21.217***	-3.368***
	(2.199)	(1.245)
Sometimes Benefit	-835.402***	-755.951***
	(6.352)	(5.620)
Continuous Benefit	-993.196***	-1,157.681***
	(6.248)	(5.155)
Cohort 1941	57.496***	47.028***
	(16.413)	(13.244)
Cohort 1942	102.785***	80.418***
	(16.621)	(13.739)

Table 6.6 Continued

Cohort 1943	144.013***	107.583***
	(17.06)	(13.768)
Cohort 1944	175.366***	143.820***
	(17.308)	(13.823)
Cohort 1945	227.121***	183.861***
	(16.425)	(13.510)
Cohort 1946	273.911***	226.489***
	(19.182)	(13.620)
Cohort 1947	299.278***	250.081***
	(16.219)	(13.199)
Constant	1,456.724***	1,107.747***
	(21.642)	(14.501)
Monthly Observations (n x t)	26,773,428	26,773,428
Number of Individuals (n)	221,268	221,268
R-square	0.052	0.102

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Numbers in parentheses are adjusted standard errors controlling for person-level clustering.

Interaction with Benefit History

The rate of decline in total income before and after 65 is considerably different for the three benefit history groups, as shown in Table 6.7. Before 65, the Never Benefit group's total income decreases by $8.39 per month. After 65, there is an additional $5.78 reduction. When compared to the Never Benefit group, the time trend for the Sometimes Benefit group is flatter, with a pre-65 monthly drop of $5.18 and a post-65 monthly drop of $1.62. This is the first subgroup in our study that has the post-65 declining trend flatter than the pre-65 period, which may be due to the slower decline in work income after 65. The time trend before 65 for the Continuous Benefit group is completely offset, indicating an almost flat trend. This may be because this group of people had fully relied on the means-tested main benefits before 65, resulting in them having very little work income to lose. The net post-65 time trend for the Continuous Benefit group even results in a $1.75 rise each month. This is totally different from the regression results we found for the other subgroups, with other subgroups often having decreased total income as people age. This astonishing phenomenon has never been depicted before.

The total income for the Never Benefit group rises by a significant amount of $293.79 right at the month of reaching 65. This effect is offset by $126.65 if a person was in the Sometimes Benefit group, and by $210.84 if a person was in the Continuous Benefit group. The permanent effect of being pension eligible is $634.31 for the Never Benefit group. When pre-65 benefit history is considered, the situation is totally different. For example, the Sometimes Benefit group sees a permanent rise of $423.56 in total income. NZS substitutes all pre-65 main benefits and a portion of pre-65 work income for the Sometimes Benefit group. The Continuous Benefit group sees a permanent rise of

$273.38 in total income. For them, NZS not only substitutes almost all pre-65 main benefits, but also generates extra gain.

The Never Benefit group's NZS enhancement effect terminates at the age of 68.73 with the decline in work income after 65, faster than the other two benefit groups. The Sometimes Benefit group has a much longer NZS enhancement effect, which would terminate at age 86.80. The Continuous Benefit group, surprisingly, has a NZS enhancement effect that is never expected to end, as they experience a monthly rise of $1.75 in total income after 65. In other words, their NZS enhancement effects may last till their death.

Table 6.7 OLS estimation of total/work income, interaction with benefit history

	Coefficients for Total Income	Coefficients for Work Income
t	-8.391***	-8.236***
	(0.256)	(0.111)
t_Post65	-5.784***	-5.828***
	(0.377)	(0.157)
Perm	634.306***	-203.539***
	(8.742)	(3.915)
Temp	293.792***	6.491
	(10.201)	(5.712)
Sometimes Benefit t*	3.211***	-0.393***
	(0.297)	(0.181)
Sometimes Benefit t_Post65*	9.345***	10.847***
	(0.404)	(0.235)
Continuous Benefit t*	8.391***	8.086***
	(0.263)	(0.114)
Continuous Benefit t_Post65*	7.530***	5.722***
	(0.369)	(0.165)
Sometimes Benefit Perm*	-210.748***	143.427***
	(9.518)	(5.715)
Continuous Benefit Perm*	-360.923***	203.872***
	(8.645)	(4.159)
Sometimes Benefit Temp*	-126.651***	-10.397
	(11.404)	(7.278)
Continuous Benefit Temp*	-210.844***	-4.713
	(10.690)	(5.859)
Other Control Variables		
Male	823.940***	660.820***
	(8.817)	(6.872)
NZ born	133.833***	53.208***
	(11.926)	(9.415)
Māori	95.260***	216.434***
	(12.271)	(11.093)
Pacifica	54.764***	147.993***
	(16.873)	(15.579)
Asian	-445.640***	-367.329***
	(26.782)	(19.972)
Other Ethnicities	-77.893***	-104.420***
	(31.240)	(23.144)
Qualification Less Than University Degree	255.404***	195.909***
	(7.779)	(6.398)
University Degree	1,614.855***	1,323.085***
	(30.615)	(22.096)
Qualification Unknown	3.809	10.168***
	(10.074)	(8.849)
Unemployment Rate	-21.669***	-3.676***
	(2.289)	(1.245)
Sometimes Benefit	-1,067.072***	-967.092***
	(11.841)	(9.807)
Continuous Benefit	-1,438.200***	-1,838.498***
	(10.369)	(7.203)
Cohort 1941	57.513***	47.040***
	(16.413)	(13.244)
Cohort 1942	102.839***	80.455***
	(16.622)	(13.739)
Cohort 1943	144.118***	107.655***
	(17.061)	(13.769)
Cohort 1944	175.521***	143.925***
	(17.310)	(13.823)
Cohort 1945	227.347***	184.015***
	(16.429)	(13.511)
Cohort 1946	274.198***	226.685***
	(19.139)	(13.621)
Cohort 1947	299.619***	250.313***
	(16.228)	(13.201)
Constant	1,686.874***	1,361.562***
	(25.54)	(14.295)

Table 6.7 Continued

Monthly Observations (n x t)	26,773,428	26,773,428
Number of Individuals (n)	221,268	221,268
R-square	0.051	0.103

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Numbers in parentheses are adjusted standard errors controlling for person-level clustering.

6.4.3 Empirical Results on Work Income

Similar to the effects on total income, column 3 of Table 6.2 illustrates the regression findings on work income. Work income demonstrates a similar time trend as total income, both before ($7.56 drop) and after ($11.03 drop) the age of 65. This is because work income makes up the largest proportion of total income before 65. Work income sees a $4.17 temporary bump at the 65th birthday month. However, the effect is not statistically significant. That is to say, the significant temporary rise in total income (Section 6.4.2) is most likely due to the partial effect of receiving NZS instead of the bump in work income resulting from the lump sum or redundancy payment. After being pension eligible, work income drops by an average of $160.70. That is, people chose to exit the labour market or reduce their earnings due to the pure income effect generated by NZS, resulting in a decline in work income. Males earn an average of $660.82 more work income than females ,which demonstrates a gender pay gap (Gough, 2001; Paci et al., 1996). People born in NZ earn an average of $53.21 more work income than those born in other countries.

When compared to people with some European identity, having some Māori identity increases work income by $216.43, having some Pacifica identity increases work income by $147.99, while having some Asian identity reduces work income by $367.33, controlling for education and pre-65 benefit history. Based on unadjusted statistics, Māori and Pacifica people would be expected to have lower work income than Europeans, on average, because they had relatively lower educational levels and were more likely to receive benefit (The Treasury, 2018). Removing the controls for education and benefit history, people with some Māori and Pacifica identities pick up the impact of these variables, resulting in a decline in work income of $81.39 for having some Māori identity, and $345.50 for having some Pacifica identity (see column 4 of Table 6.2).

Work income, like total income, shows a positive relationship with educational attainment. People with qualifications less than a university degree earn an average of $195.91 more than those with no qualifications. People with university degrees have an average of $1,323.08 more work income than those without any qualifications.

Compared to those who did not receive a main benefit between the ages 60 and 64, having sometimes received a main benefit lowers work income by $755.95, and having continuously received main benefits lowers work income by $1,157.68.

Work income is lowered by $2.83 for every percentage point increase in the unemployment rate. The later birth cohorts have a similar but smaller impact on the work income than total income, with later birth cohorts earning higher work income than the earlier birth cohorts.

Interaction with Gender

Table 6.3 demonstrates that the time trends of work income move in the same direction as total income for both males and females. Males, in general, exhibit faster decline rates than females both pre- and post-65. For example, females have a $5.32 monthly drop before 65, and a $7.57 monthly drop after 65 in work income. Males, on the other hand, have a $9.89 monthly drop before 65, and a $14.63 monthly drop after 65. Unlike the overall cohort, females have a temporary drop of $5.30 in work income at the 65th birthday month. This effect, however, is not statistically significant. Males, on the other hand, have a $13.99 temporary boost in work income at the 65th birthday month, and this effect is statistically different from zero at the 10% level. This indicates that males may have received some lump sum or redundancy payment at the month of being pension eligible. The permanent effect of being pension eligible for females is -$108.38. Males have a greater permanent impact of -$215.20, which is largely due to their faster withdrawal from the labour market.

Interaction with Country of Birth

The time trends in work income vary little (less than $1.00 for pre- and post-65) among those born in foreign countries and those born in NZ, as indicated in Table 6.4. However, the hypothesis that both the pre- and post-65 time trends are the same for people born in NZ and foreign countries is rejected. For people born in foreign countries, work income has a permanent drop of $165.69 after being pension eligible, and a temporary rise of $3.41 in the month of reaching 65, which is not statistically significant. For people born in NZ, work income has a permanent drop of $159.03 after being pension eligible, and a temporary rise of $4.42 in the month of reaching 65. The hypothesis that the temporary effects for the two groups are both equal to zero at the same could not be rejected. These findings indicate that country of birth has a smaller impact on the time trends, and temporary and permanent effects on work income.

Interaction with Ethnicity

The time trends in work income for different ethnic groups follow a similar pattern but differ slightly from total income (Table 6.5). When compared to other ethnic identities, having some European identity normally results in the greatest drop in work income over the entire period. For example, the pre-65 monthly drops in work income are $8.07 for people with some European identity, $4.31 for people with some Māori identity, $4.61 for people with some Pacifica identity, and $3.77 for people with some Asian identity. The post-65 monthly drops are steeper, with $11.51 for people with some European identity, $9.15 for people with some Māori identity, $7.37 for people with some Pacifica identity, and $5.77 for people with some Asian identity.

People with some European identity experience a permanent loss of $168.83 in work income after being pension eligible. This effect is lessened if a person has some other ethnic identity, by $30.01 for Māori, $49.26 for Pacifica, and $113.15 for Asians. The temporary impact at the 65th birthday month is not significant for all ethnic groups. The hypothesis that all the temporary effects of these five ethnic groups are all zero at the same time could not be rejected when using the F test.

Interaction with Education

Table 6.6 shows that the monthly decline in work income for the educational subgroups differs less from total income, with people having university degrees experiencing the fastest drop in work income both pre- and post-65. The pre-65 monthly drop in work income is $5.56 for the No Qualification group, $7.74 for the Qualification Less Than University Degree group, and $15.06 for the University Degree group. The post-65 monthly drops are steeper, with $7.70 for the No Qualification group, $11.57 for the Qualification Less Than University Degree group, and $22.23 for the University Degree group. The temporary boosts at the 65th birthday month are all not statistically different from zero, with $8.11 for the No Qualification group, $5.00 for the Qualification Less Than University Degree group, and $3.95 for the University Degree group. The hypothesis that all the temporary effects of these four educational groups are zero at the same time could not be rejected using the F test. The permanent effect of being pension eligible is -$135.99 for the No Qualification group, -$168.49 for the Qualification Less Than University Degree group, and -$234.37 for the University Degree group. This indicates that having a higher education level results in a greater loss in work income while being pension eligible.

Interaction with Benefit History

Unlike other subgroups, the time trends in work income for the benefit history subgroups don't entirely follow the pattern of total income (Table 6.7). The time trend in work income for the Never Benefit group is similar to that of the total income, with an $8.24 pre-65 monthly drop and a $14.06 post-65 monthly drop. The pre-65 drop in work income for the Sometimes Benefit group is a little bit faster than the Never Benefit group, with $8.63 per month. The post-65 monthly drop, however, is only $3.61, leading to a relatively gradual decline after being pension eligible. The Continuous Benefit group's work income time trend is almost flat for the entire observation period, with both pre- (insignificant) and post-65 (significant at the 5% level) declines less than $1.00. This is because this group had little work income over the entire period.

Like other subgroups, the temporary effects at the 65th birthday month are all insignificant. Similarly, we could not reject the hypothesis that all the temporary effects of the three benefit history groups are zero at the same time. The permanent effect of being pension eligible is a loss of $203.54 for the Never Benefit group. When pre-65 benefit history is taken into account, the situation is considerably different. For example, the Sometimes Benefit group sees a $60.11 drop in work income, and the Continuous Benefit group only sees a $0.33 drop in work income. In other words, the Continuous Benefit group has no significant change in work income after being pension eligible. This suggests that though being pension eligible normally has a negative impact on work income for other groups, it has little impact on the Continuous Benefit group, which is consistent with our previous analysis that it may be due to their nearly zero work income over the entire study period.

6.4.4 Conclusions

This chapter investigated the changes in people's mean monthly income levels over a ten-year observation period, including the four key features (pre- and post-65 time trends, and temporary and permanent effects) around pension age. It introduced the idea of NZS as an 'income enhancement effect' rather than the typical view of an immediate replacement of lost work income.

OLS regressions were used to estimate the effects on both total and work income. Table 6.8 summarises the key features of total monthly income. The average monthly decline in total income is $7.08 before 65 and $10.60 after 65 for the entire sample group. The temporary rise in total income at the 65th birthday month is $252.69. After being pension

eligible, the permanent intercept shift in total income is $564.99, which is greater than the temporary effect. As discussed in Section 6.4.3, this temporary effect is most likely due to the partial effect of receiving NZS rather than the bump in work income resulting from the lump sum or redundancy payments.

Males have a faster rate of decline in total monthly income compared to females over the entire observation period, which may be due to their faster exit from the labour market. Before 65, the monthly decline in total income is $9.73 for males, and $4.55 for females. After 65, the monthly decline in total income is $15.04 for males, and $6.33 for females. This faster decline for males is not entirely due to their higher incomes. The monthly percentage decline in post-65 relative to pre-65 is also higher for males, with a 54.57 percent compared to a 39.12 percent for females. Males have a greater temporary rise at the 65th birthday than females, with an additional $48.48. The permanent effect is $545.33 for males and $583.82 for females. The greater permanent effect for females could be due to two possible reasons. First, females had relatively higher NZS take-up rates than males. Second, single females may make up a greater portion of the females who took up NZS than single males after age 65.

People born in NZ have slightly faster declines in total income than those born in foreign countries, both before and after 65. Due to the relatively higher NZS take-up rates, people born in NZ have higher temporary and permanent effects than those born in foreign countries. The temporary rise at the 65th birthday month is $267.94 for people born in NZ, and $207.06 for people born in foreign countries. The permanent rise after being pension eligible is $591.39 for people born in NZ, and $485.94 for people born in foreign countries.

People with some European identity have faster monthly declines in total income than people with some Māori, Pacifica, or Asian identities. Again, due to the relatively higher NZS take-up rates, people with some European identity have greater temporary and permanent effects than people with other ethnic identities. For example, the temporary rise at the 65th birthday is $266.37 for people with some European identity, $165.28 for people with some Māori identity, $144.16 for people with some Pacifica identity, and $168.78 for people with some Asian identity. The permanent effect after being pension eligible is $580.20 for people with some European identity, $478.06 for people with some Māori identity, $401.04 for people with some Pacifica identity, and $438.00 for people with some Asian identity.

Higher educational attainments result in faster monthly declines in total income over our study period. The temporary boost at the 65th birthday month, on the other hand, increases with higher educational levels. For example, the temporary effect is $231.22 for people with no qualifications, $258.29 for people with qualifications less than university degrees, and $342.61 for people with university degrees. The permanent intercept shift after being pension eligible, however, only differs between those with or without qualifications. That is, the permanent effect is $529.66 for people with no qualifications, and around $595.00 for people with any qualifications.

The Never Benefit group displays very typical time trends, and temporary and permanent effects among all the other groups. The four key features, however, are totally different for people with pre-65 benefit histories. Before 65, the monthly decline in total income for the Sometimes Benefit group is $5.18. After 65, the rate is $1.62, which is smaller than the pre-65 trend. The pre-65 monthly decline in total income for the Continuous Benefit group is zero. This flat trend suggests that this group of people are more likely to rely only on the main benefits before 65. After 65, the Continuous Benefit group doesn't see a decline in total income like the other groups, but instead sees a rise of $1.75 each month, which is largely due to the increase in NZS take-up rates over the sample period.

In addition, having pre-65 benefit histories tends to reduce the temporary and permanent effects of being pension eligible, because the role of NZS is essentially a substitute for pre-65 main benefits and the net amount adds to their total income. If the pre-65 benefit amount is high, the temporary and permanent effects of receiving NZS will be small. For example, the temporary effect for the Sometimes Benefit group is $167.14, and the permanent effect is $423.56. The Continuous Benefit group, on average, has higher pre-65 main benefits than people in the Sometimes Benefit group. Their temporary effect at the 65th month is $82.95, which is about half that of the Sometimes Benefit group. Their permanent effect is $273.38, which is almost two-thirds that of the Sometimes Benefit group.

Table 6.9 provides the four key features related to work income. The time trends in work income for the entire sample cohort are almost the same as those of the total income, owing to work income making up the largest proportion of total income for most groups before 65. The temporary boost is $4.17, which could be the lump sum or redundancy payments paid to individuals at the month of reaching 65. However, this effect is not statistically different from zero. Being pension eligible generally decreases the work

income for most groups. The permanent drop in work income for the entire sample is $160.70, which is most likely due to the exit from the labour market.

Males exhibit faster monthly declines than females in work income over the entire study period. The temporary effect at the 65th birthday month is $13.99 for males, and it is significant at the 10% level. This indicates that males may have received some lump sum or redundancy payment at the month of being pension eligible. Females, on the other hand, have a statistically insignificant temporary effect of -$5.30. After 65, the permanent intercept drop is $215.20 for males, and $108.38 for females. The higher permanent effect of males indicates that males are more likely to reduce their work income after pension age.

People born in NZ and those born in foreign countries have nearly identical time trends both before and after 65. The temporary effects at the 65th birthday month are less than $5 dollars, which are not statistically different from zero. After being pension eligible, people born in NZ have a slightly lower permanent drop in work income than those born in foreign countries. The permanent drop in work income is $159.03 for people born in NZ, and $165.69 for those born in foreign countries.

Similar to the patterns in total income, people with some European identity exhibit faster monthly declines in work income than people with Māori, Pacifica, or Asian identities. All the temporary effects when turning 65 are less than $20.00 and are not statistically different from zero. People with some European identity have the lowest permanent drop in work income than people with other ethnic identities, which may be due to their relatively higher NZS take-up rates. The permanent drop in work income is $168.83 for people with some European identity, $138.82 for people with some Māori identity, $119.58 for people with some Pacifica identity, and only $55.68 for people with some Asian identity.

Monthly work income declines faster with the rise in educational attainments over the entire observation period. All the temporary effects of reaching 65 are not statistically different from zero. The permanent drop in work income also increases with higher educational levels. For example, the permanent drop in work income after being pension eligible is $136.00 for people with no qualifications, $168.49 for people with qualifications less than university degrees, and $234.37 for people with university degrees. The relatively higher permanent drop in work income for the University Degree

group is most likely due to the cessation of their higher-paying jobs after being pension eligible.

Because work income accounts for the largest proportion of total income, the Never Benefit group's work income time trends are nearly identical to those of total income. The monthly decline in work income for the Sometimes Benefit group is $8.63 before 65, and $3.61 after 65. The Continuous Benefit group has nearly flat time trends both before and after 65, because they have almost no work income to lose over the entire period. The temporary effects are not statistically different from zero for the three groups. The permanent drop in work income after 65 is $203.54 for the Never Benefit group, $60.11 for the Sometimes Benefit group, and $0.33 (which is not statistically different from zero) for the Continuous Benefit group. People with pre-65 benefit histories have a less permanent drop in work income than those without benefit histories, which could be mostly attributed to their relatively lower work income before 65.

Regarding the question that was raised at the beginning of this chapter, NZS does not appear to be an immediate replacement for lost work income at age 65. Instead, NZS generates a substantial enhancement effect at age 65, and it lasts for several years. The predicted duration of the NZS enhancement effects for different subgroups is provided in Table 6.10. Two major factors could affect the length of the NZS enhancement effect. First, the magnitude of the permanent rise in total income after being pension eligible. Second, the decline rate in work income after 65. In other words, groups with a higher permanent rise in total income and a lower decline in work income after 65 would experience longer enhancement effects.

The average NZS enhancement effect for the entire sample group is predicated to last slightly less than five years, terminating at age 69.44. Males (terminate at age 68.02) have a shorter NZS enhancement effect than females (terminate at age 72.68) by 4.66 years, because they have a lower permanent effect and a higher post-65 decline rate in work income. People born in NZ and those born in foreign countries have a similar duration of the enhancement effect, which would terminate before 70.

The enhancement effect is estimated to terminate at age 69.28 for people with some European identity. However, it would last more than five years for people with Māori (terminate at age 70.50), Pacifica (terminate at age 71.54), and Asian (terminate at age 75.94) identities, which may be due to the relatively lower post-65 decline rate in work income.

The duration of the NZS enhancement effect declines with higher educational attainments, which could be attributed to a relatively higher post-65 decline rate in work income. For example, the forecasted terminating age is 71.46 for people with no qualifications, 69.41 for people with qualifications less than university degrees, and 67.11 for people with university degrees.

Having pre-65 benefit history increases the length of the duration of the enhancement effect. The Never Benefit group has a less than five-year enhancement effect, which is predicted to terminate at age 68.73. The Sometimes Benefit group, on the other hand, has a 21.80-year enhancement effect that is estimated to terminate at age 86.80. Though the Sometimes Benefit group has a relatively lower permanent rise in total income than the Never Benefit group, their post-65 decline in work income is much lower. Specifically, the Continuous Benefit group has a NZS enhancement effect that is never expected to end due to a $1.75 monthly rise in total income after 65. It seems like their NZS enhancement effect may persist until their death.

Table 6.8 Key features on patterns of total monthly income from ages 60 to 70

	Pre-65 Linear Time Trend	**Temporary Rise at the 65th Birthday**	**Permanent Intercept Shift after the 65th Birthday**	**Post-65 Linear Time Trend**
	1	2	3	4
Full Sample	-7.084***	252.694***	564.987***	-10.598***
By Gender				
Males	-9.726***	277.404***	545.332***	-15.035***
Females	-4.549***	228.921***	583.824***	-6.334***
By Country of Birth				
NZ Born	-7.170**	267.936***	591.389***	-10.903***
Foreign Born	-6.831***	207.057***	485.937***	-9.679***
By Ethnicity				
Europeans	-7.731***	266.370***	580.203***	-11.293***
Māori	-2.726***	165.275***	478.057***	-7.238***
Pacifica	-3.069***	144.162***	401.038***	-5.108***
Asian	-2.528***	168.776***	437.996***	-3.336***
Other Ethnicities	-7.189***	249.198***	625.531***	-15.874***
By Education				
No Qualification	-4.701***	231.216***	529.661***	-6.829***
Qualification Less Than University Degree	-7.729***	258.290***	594.998***	-11.253***
University Degree	-13.893***	342.607***	596.004***	-23.485***
Qualification Unknown	-4.420***	197.569***	502.879***	-5.837***
By Benefit History				
Never Benefit	-8.391***	293.792***	634.306***	-14.175***
Sometimes Benefit	-5.180***	167.141***	423.558***	-1.619***
Continuous Benefit	0.000	82.948***	273.383***	1.746***

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. This is a summary of OLS estimates on total income from Table 6.2 to Table 6.7.

Table 6.9 Key features on patterns of work monthly income from ages 60 to 70

	Pre-65 Linear Time Trend	**Temporary Rise at the 65th Birthday**	**Permanent Intercept Shift after the 65th Birthday**	**Post-65 Linear Time Trend**
	1	2	3	4
Full Sample	-7.558***	4.165	-160.700***	-11.031***
By Gender				
Males	-9.890***	13.988*	-215.200***	-14.630***
Females	-5.320***	-5.304	-108.380***	-7.574***
By Country of Birth				
NZ Born	-7.580***	4.418	-159.028***	-11.106***
Foreign Born	-7.491***	3.411	-165.688***	-10.803***
By Ethnicity				
Europeans	-8.067***	6.762	-168.830***	-11.514***
Māori	-4.310***	-18.135	-138.819***	-9.154***
Pacifica	-4.609***	-18.315	-119.575***	-7.366***
Asian	-3.772***	11.386	-55.676***	-5.767***
Other Ethnicities	-7.190***	-11.845	-132.564***	-15.359***
By Education				
No Qualification	-5.562***	8.110	-135.993***	-7.702***
Qualification Less Than University Degree	-7.742***	5.000	-168.486***	-11.573***
University Degree	-15.058***	-3.947	-234.371***	-22.228***
Qualification Unknown	-5.091***	-4.673	-122.690***	-7.278***
By Benefit History				
Never Benefit	-8.235***	6.491	-203.539***	-14.063***
Sometimes Benefit	-8.628***	-3.906	-60.112***	-3.609***
Continuous Benefit	-0.149	1.778	0.333	-0.255**

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. This is a summary of OLS estimates on work income from Table 6.2 to Table 6.7.

Table 6.10 Duration of NZS enhancement effects

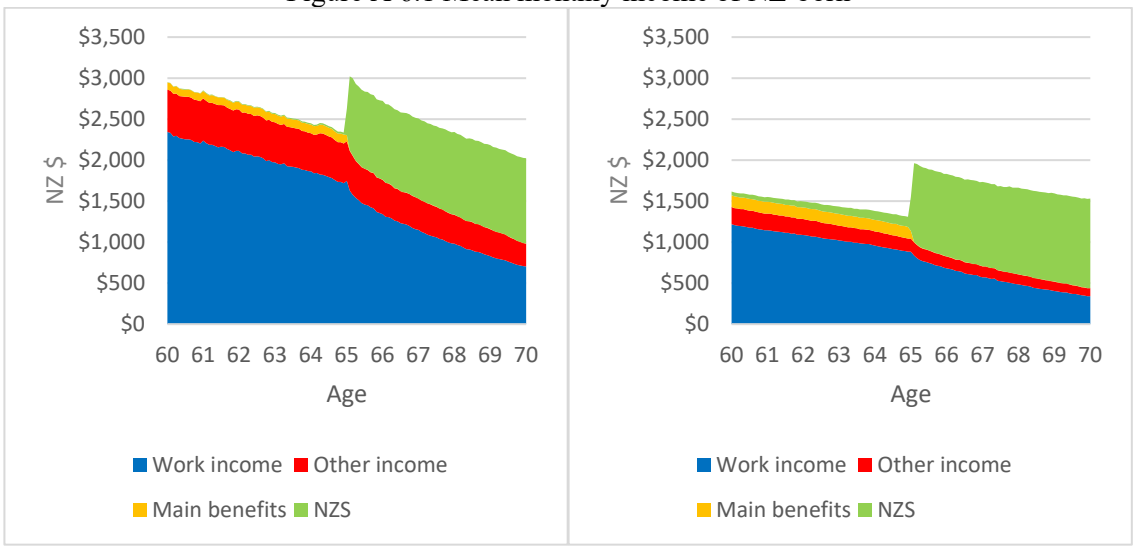
	Does NZS Enhancement Effects Terminate Before Age 70?	**Predicted Age When NZS Enhancement Effects Terminate**
Full Sample	Yes	69.44
By Gender		
Males	Yes	68.02
Females	No	72.68
By Country of Birth		
NZ Born	Yes	69.52
Foreign Born	Yes	69.18
By Ethnicity		
Europeans	Yes	69.28
Māori	No	70.50
Pacifica	No	71.54
Asian	No	75.94
Other Ethnicities	Yes	68.28
By Education		
No Qualification	No	71.46
Qualification Less Than University Degree	Yes	69.41
University Degree	Yes	67.11
Qualification Unknown	No	72.18
By Benefit History		
Never Benefit	Yes	68.73
Sometimes Benefit	No	86.80
Continuous Benefit	No	Unpredictable

Notes: Predicted age when NZS enhancement effects terminate is the sum of age 65 and the duration of the NZS enhancement effects. The duration of the NZS enhancement effects after 65 is predicted using the estimated permanent effects divided by the time trend after 65.

6.5 Appendix 6

Appendix A 6.1: Mean monthly income by country of birth and gender

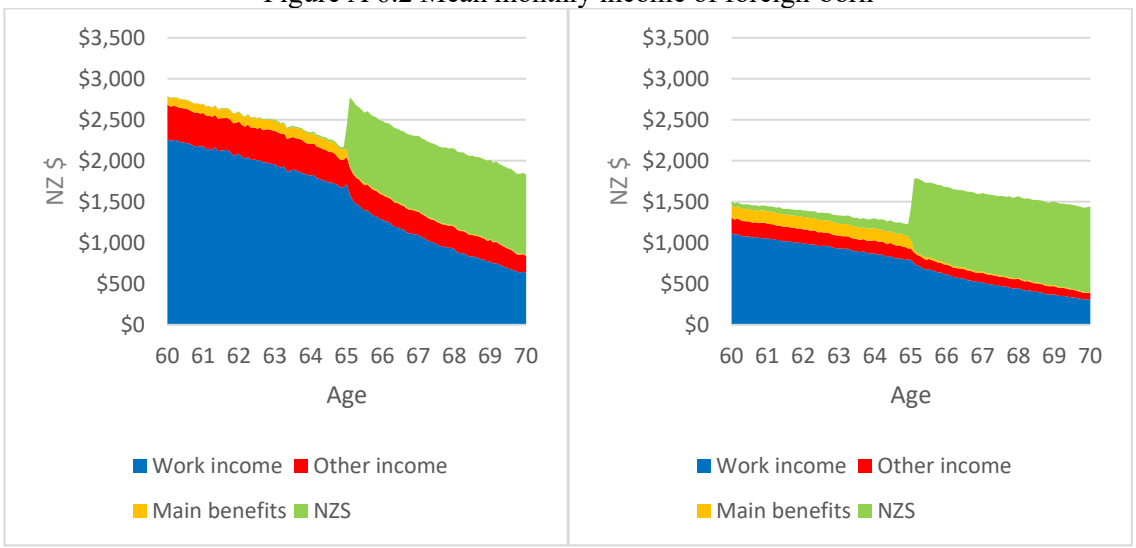
Figure A 6.1 Mean monthly income of NZ-born



(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

Figure A 6.2 Mean monthly income of foreign-born

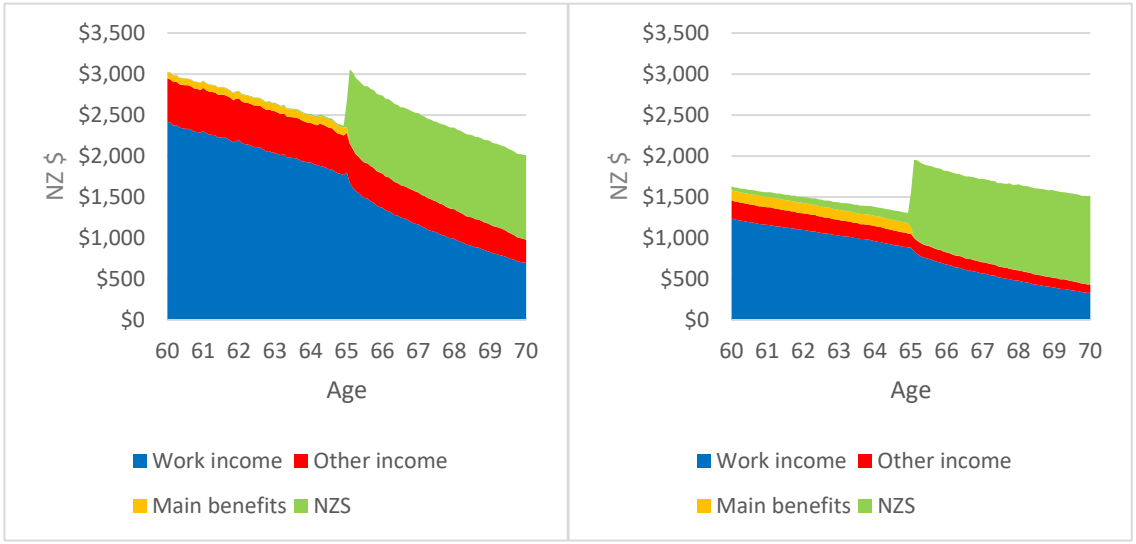


(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

Appendix A 6.2: Mean monthly income by ethnicity and gender

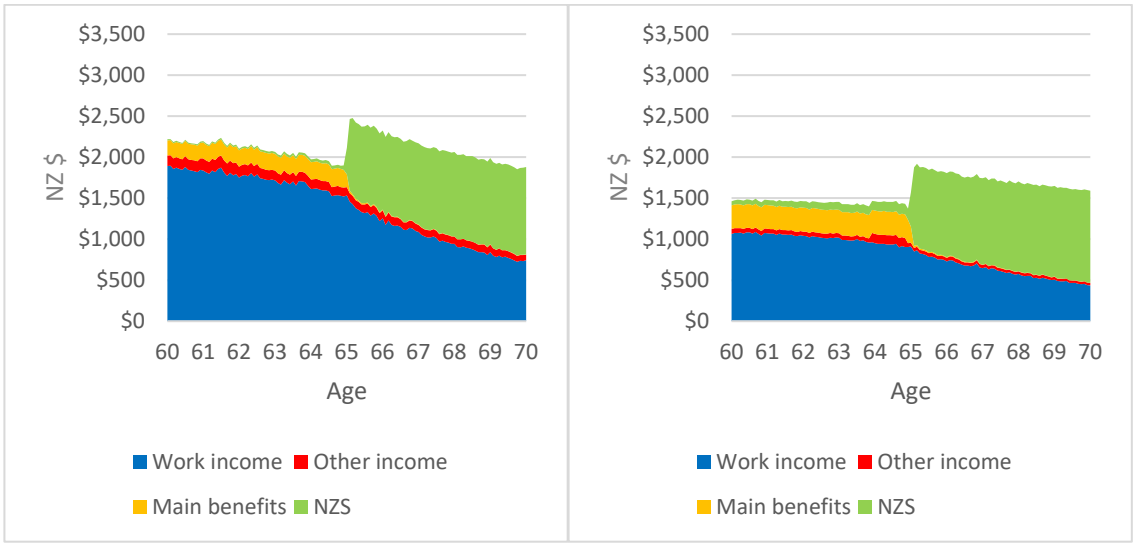
Figure A 6.3 Mean monthly income of European



(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

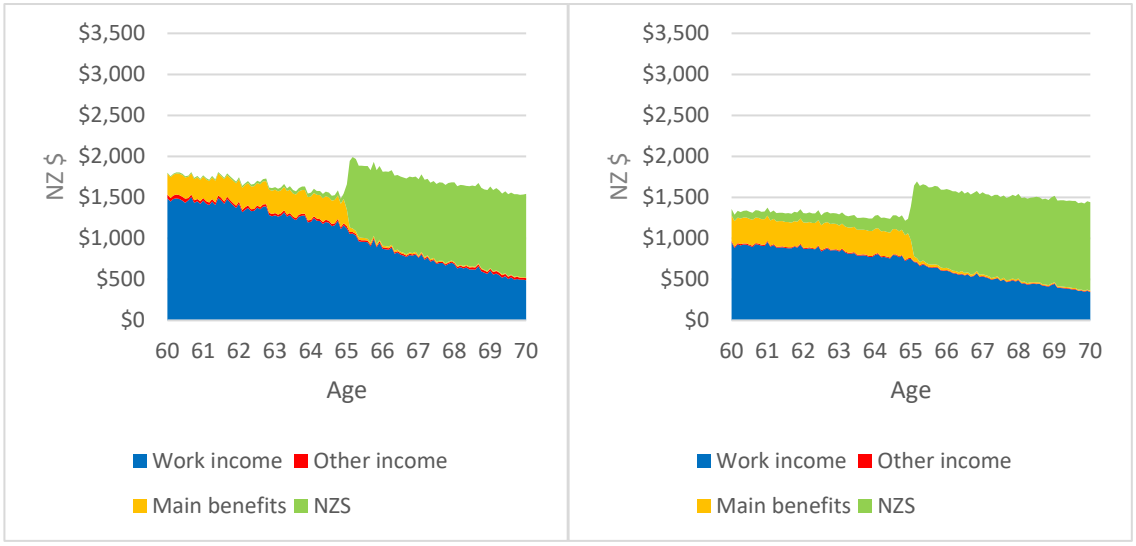
Figure A 6.4 Mean monthly income of Māori



(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

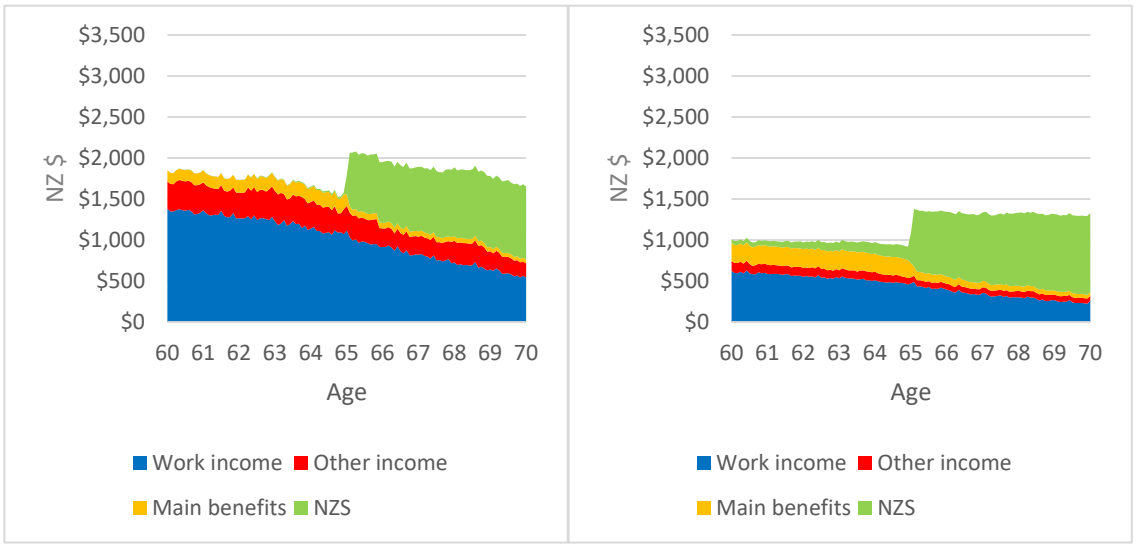
Figure A 6.5 Mean monthly income of Pacifica



(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

Figure A 6.6 Mean monthly income of Asian

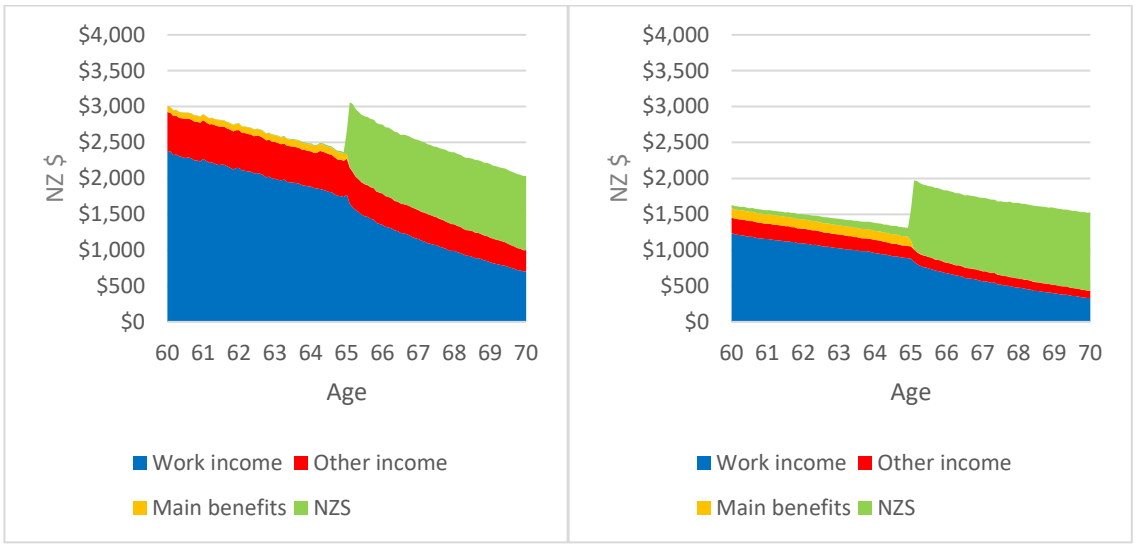


(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

Appendix A 6.3: Mean monthly income by ethnicity and gender (NZ-born only)

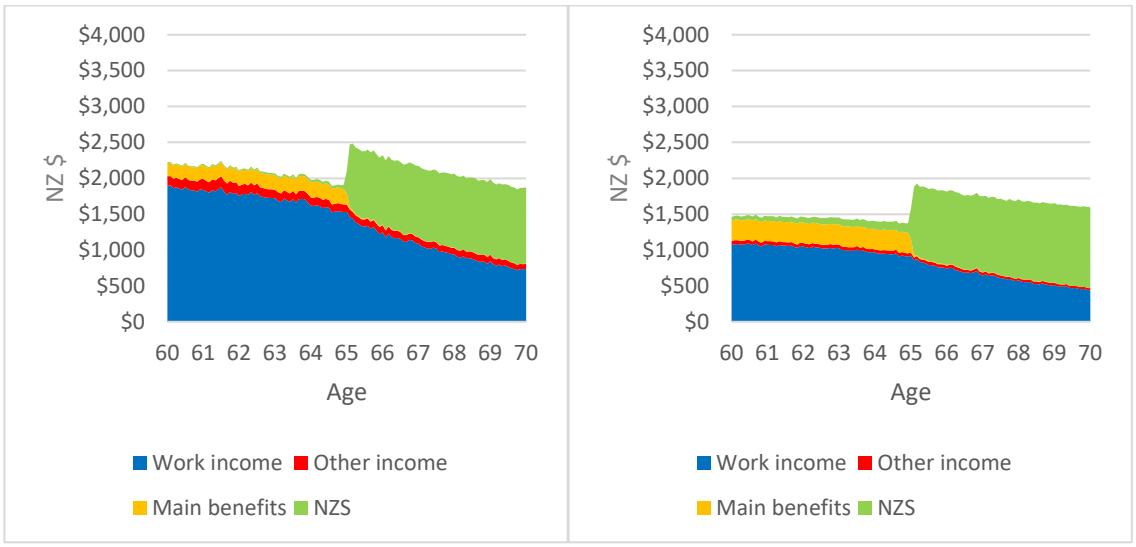
Figure A 6.7 Mean monthly income of NZ-born European



(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

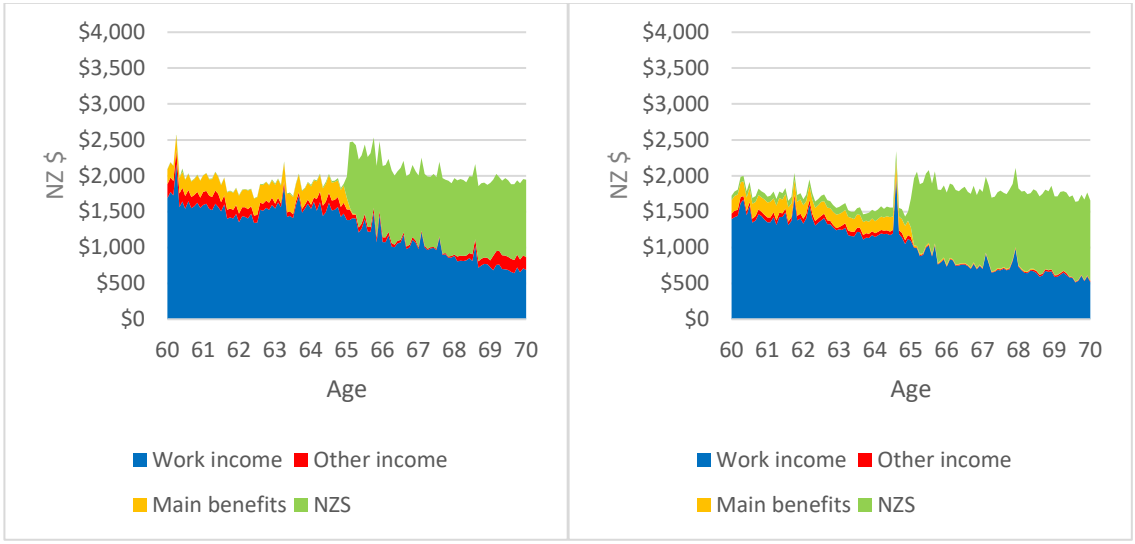
Figure A 6.8 Mean monthly income of NZ-born Māori



(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

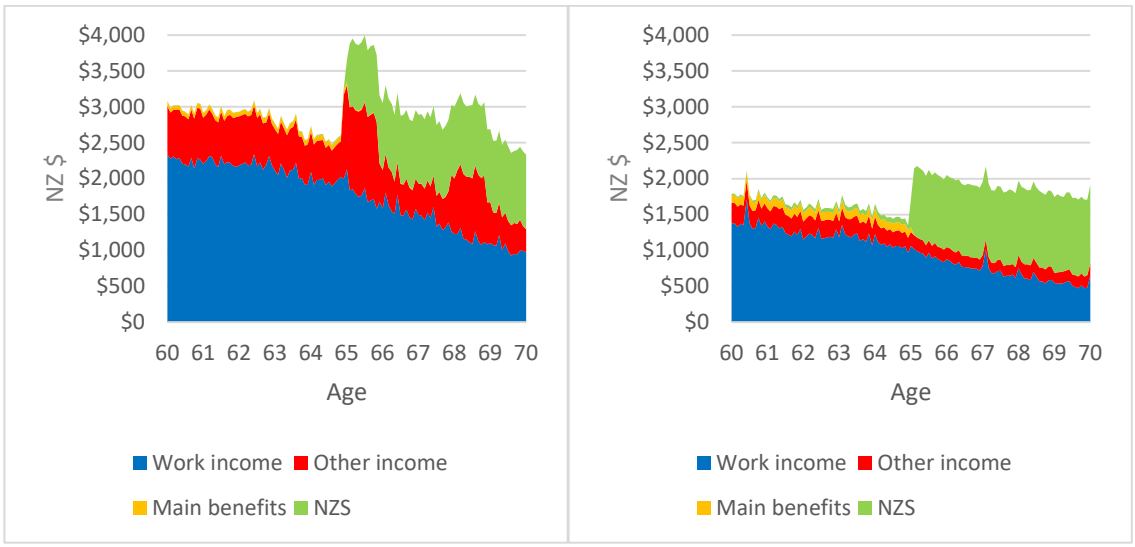
Figure A 6.9 Mean monthly income of NZ-born Pacifica



(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

Figure A 6.10 Mean monthly income of NZ-born Asian

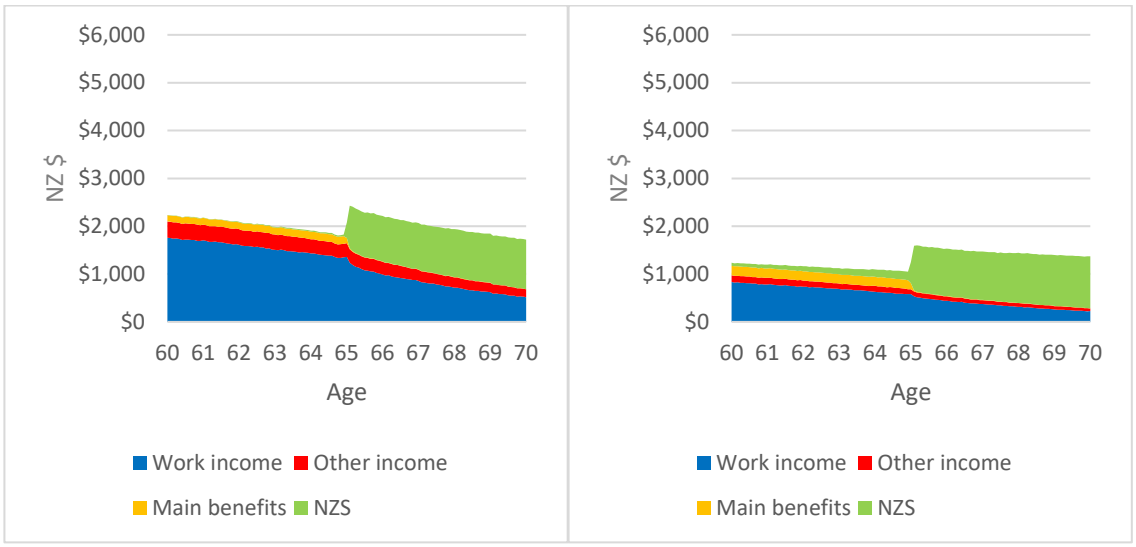


(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

Appendix A 6.4: Mean monthly income by education and gender

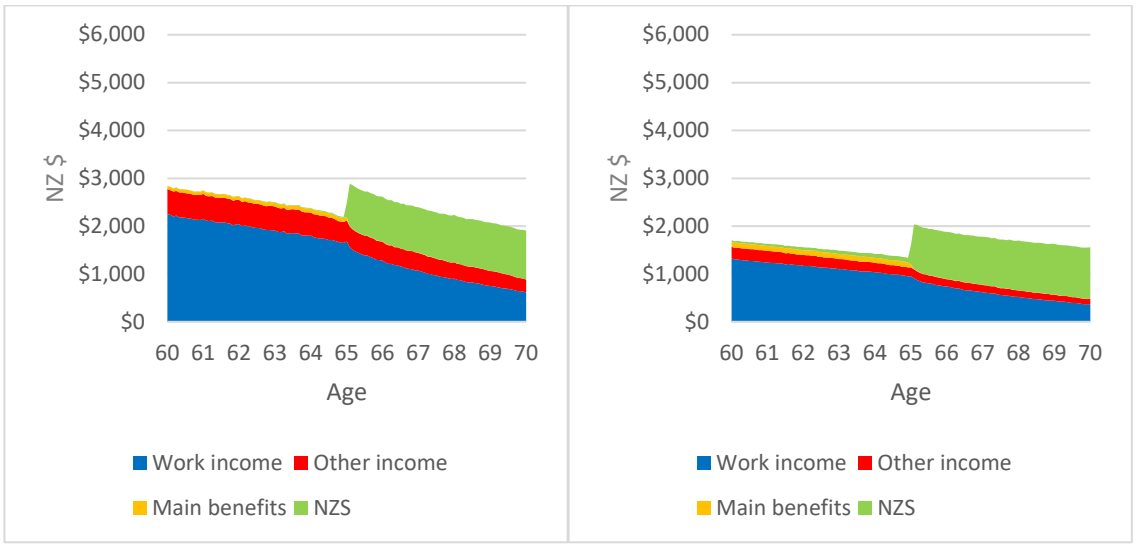
Figure A 6.11 Mean monthly income of No Qualification



(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

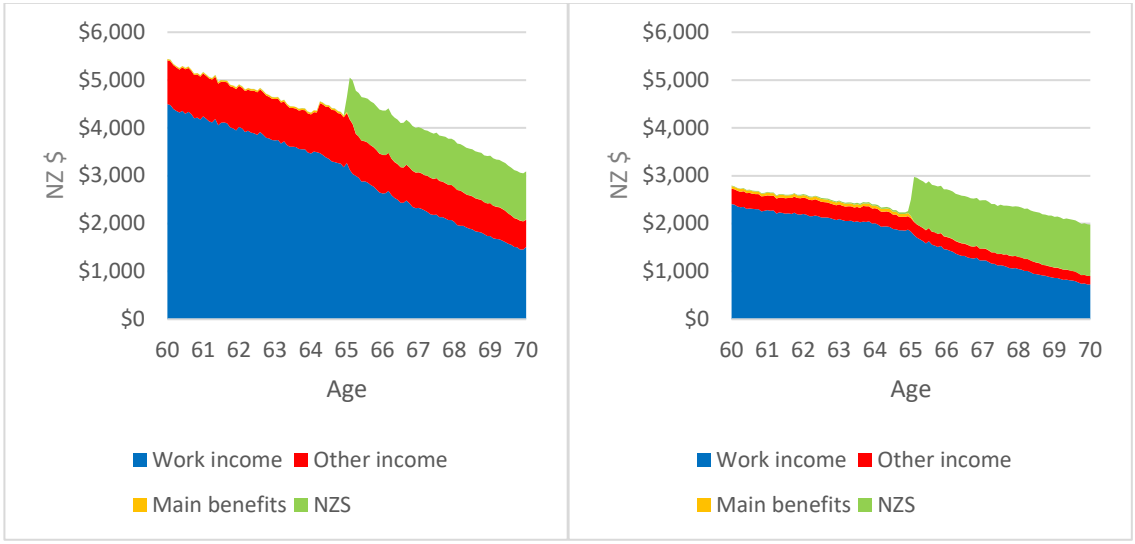
Figure A 6.12 Mean monthly income of Qualification Less Than University Degree



(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

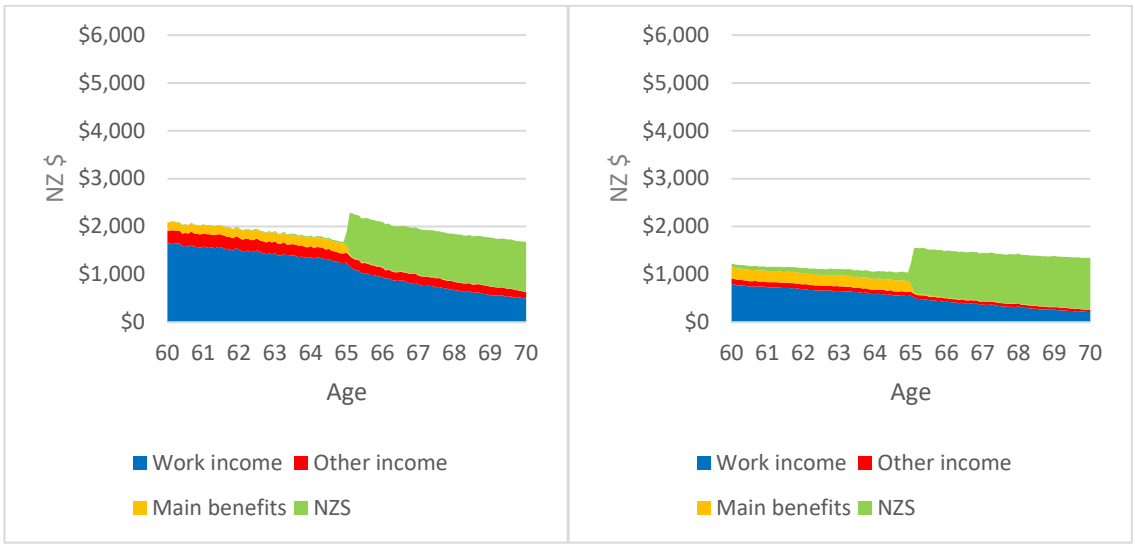
Figure A 6.13 Mean monthly income of University Degree



(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

Figure A 6.14 Mean monthly income of Qualification Unknown

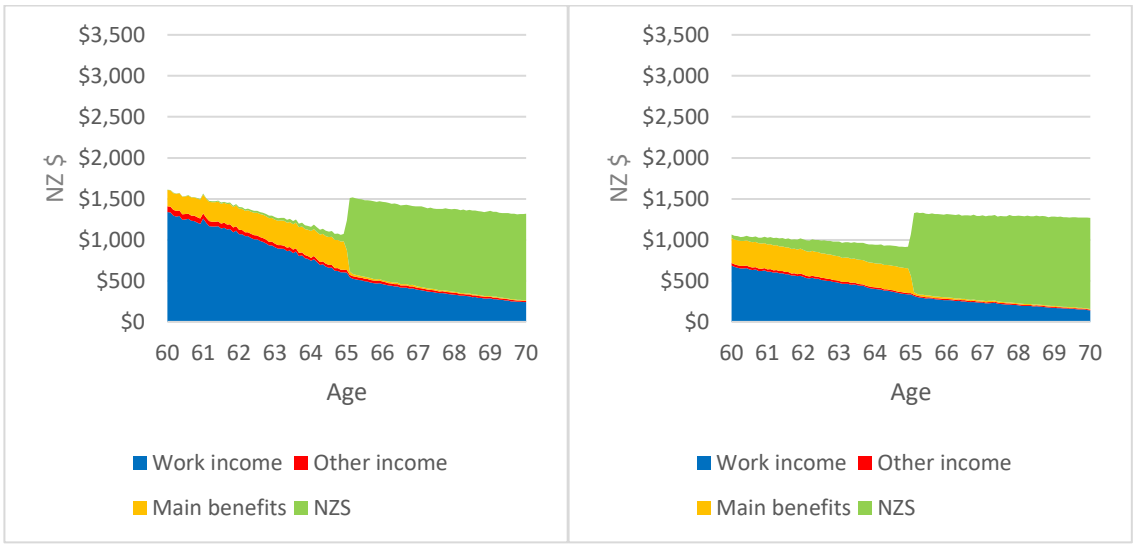


(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

Appendix A 6.5: Mean monthly income by benefit history and gender

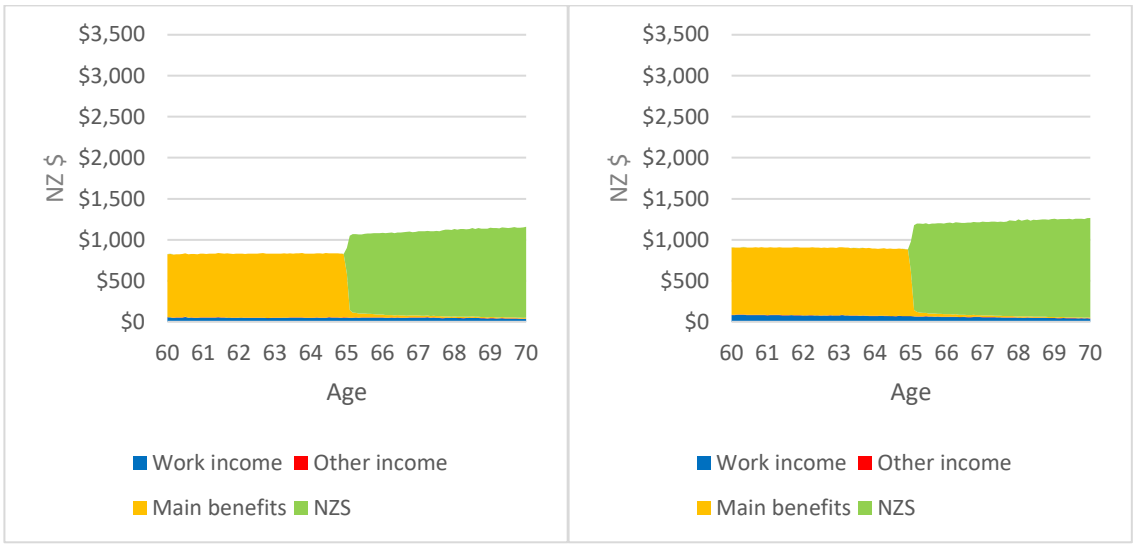
Figure A 6.15 Mean monthly income of Sometimes Benefit



(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

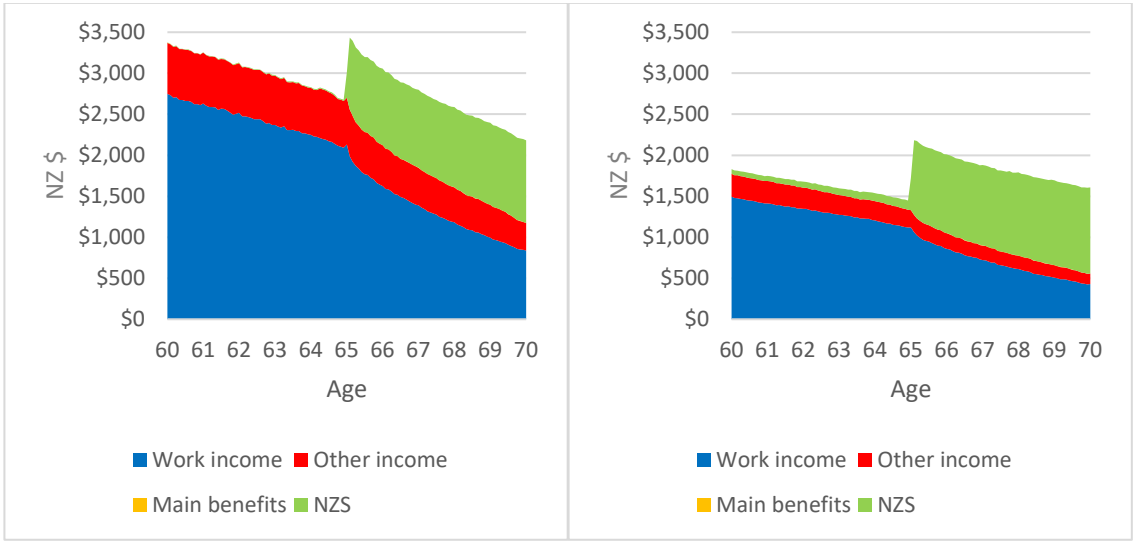
Figure A 6.16 Mean monthly income of Continuous Benefit



(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

Figure A 6.17 Mean monthly income of Never Benefit



(a) Males (b) Females

Source: Refer to Figure 5.1 for further information

7 Employment Rates

7.1 Introduction

The previous chapter illustrated the significant impact New Zealand Superannuation (NZS) had on individuals' monthly average income. This chapter looks at the labour supply change when people reach pension age. As no information on hours of work or willingness to participate in the labour force is measured in the Integrated Data Infrastructure (IDI), this chapter uses the employment rate as a proxy for the labour force participation rate (LFPR). The mean employment rates of the sample cohort were tracked for various subgroups over a ten-year observation period, including gender, birth cohorts, country of birth, ethnicity, education, and benefit history. Three aims motivate the analysis of this chapter. First, it aims to provide an overall view of the employment pattern five years before and after reaching pension age. In addition to the traditional employment figures, it also provides figures with monthly changes in employment rates to better capture the sensitivity of change around age 65. Second, it evaluates the factors that may have an impact on the employment rates. Third, it aims to provide new insights on the differential labour supply behaviour of people in various subpopulations, particularly of those with a pre-65 benefit history.

The structure of this study is as follows. Section 7.2 provides the employment patterns of the entire cohort, as well as various subgroups. It demonstrates the declining trend in employment rate as people age. Specifically, it indicates the monthly change in employment rate relative to the previous month, giving us a clear picture of the sensitivity of monthly changes in the employment rate. The discontinuity in the employment rate at pension eligibility age is highlighted. Section 7.3 provides the methodology and empirical results. Significant differential labour supply effects are found for various subgroups. A brief conclusion, as well as some discussion, is provided in Section 7.4.

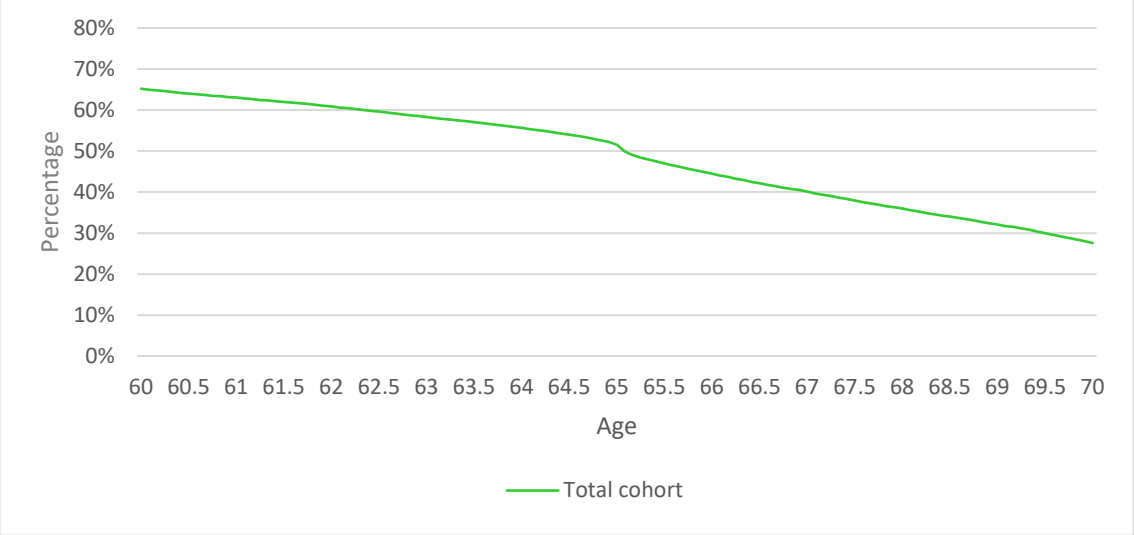
7.2 Employment Rates

Figure 7.1 presents the labour supply changes in terms of employment incidence for the entire cohort five years before and after reaching pension eligibility age on a monthly basis.[57] It shows that the employment rate declines steadily as people age between 60 and 70. For example, it falls from 65.2 percent at age 60 to 27.6 percent at age 70 (a 37.6

[57] A person is counted as employed in a month if he or she receives earnings or self-employment income in that month.

percentage-point decline). Additionally, a significant decrease occurs at the time that most people become eligible for NZS, which is in line with the findings of Dixon and Hyslop (2008). The post-65 decline trend appears to be a little faster than the pre-65 one.

Figure 7.1 Employment rates for total cohort



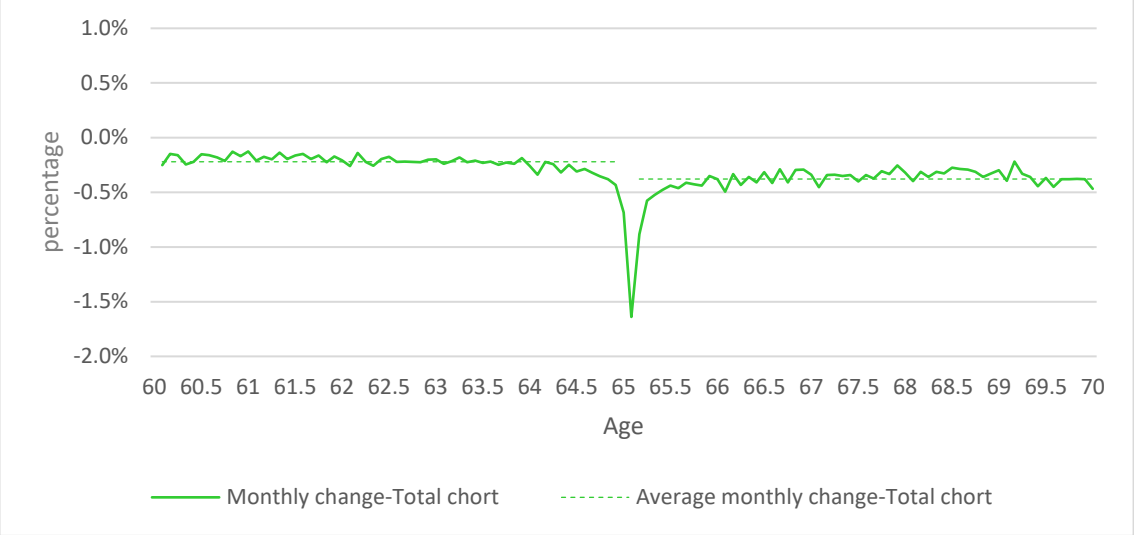
Source: Refer to Figure 5.1 for further information

To better capture the monthly changes in employment rate relative to the previous month, the sensitivity of the change in employment rate over a ten-year period is shown in Figure 7.2. The solid line depicts the change in the current month's employment rate compared to the previous month. The dashed line depicts the average monthly percentage point change in employment rate before and after age 65 (excluding one month before and after reaching 65).[58] It shows that the average monthly drop for those under 65 is 0.22 percentage points, while the drop for those over 65 is 0.38 percentage points (a 72.7 percent increase in the mean employment exit rate after turning 65). This implies that people leave the labour market at a faster rate after 65, which may be a result of aging and/or declining health (Auer & Fortuny, 2000; Gordon & Blinder, 1980). The rate of decline begins to accelerate several months before 65. It peaks at 1.64 percentage points in the first month following turning 65 (shown as the length of the spike around age 65). After that, this rate of decline begins to slow down. About six months after turning 65, the decline reaches the average post-65 trend. It is very important to note that these monthly employment rates appear to be relatively constant over the pre- and post-65 periods. There are no obvious nonlinearities in this outcome on either side of 65. This finding supports our hypothesis that people will choose to exit the labour market due to

[58] All the dashed lines in this chapter exclude one month before and after age 65. This is because we want to measure the normal pre- and post-65 average drop rate instead of including the sharp drop around 65.

the work disincentive generated by the rise in non-labour income of NZS. In fact, this disincentive effect could be underestimated because we cannot determine the intensive margin of employment change – i.e., many people may cut their working hours by transitioning from full-time to part-time jobs. However, this could not be estimated due to a lack of data on working hours.

Figure 7.2 Sensitivity of employment rate change for total cohort

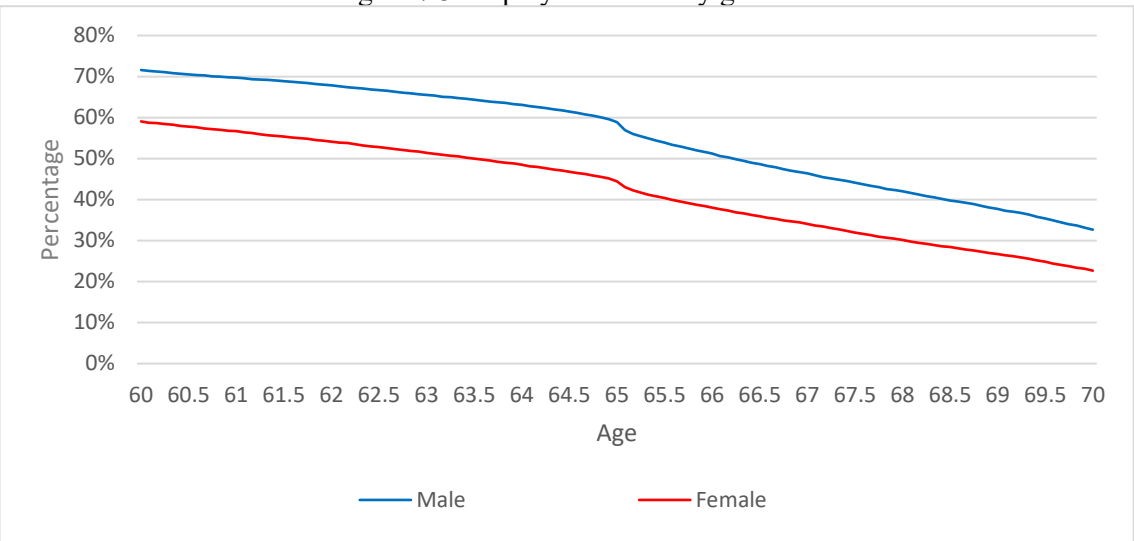


Source: Refer to Figure 5.1 for further information

Different subgroups, such as gender, birth cohorts, ethnicity, education, and benefit histories, show similar patterns of employment rates, as examined in the following sections.

7.2.1 Differences in Employment Rates by Gender

Figure 7.3 Employment rates by gender

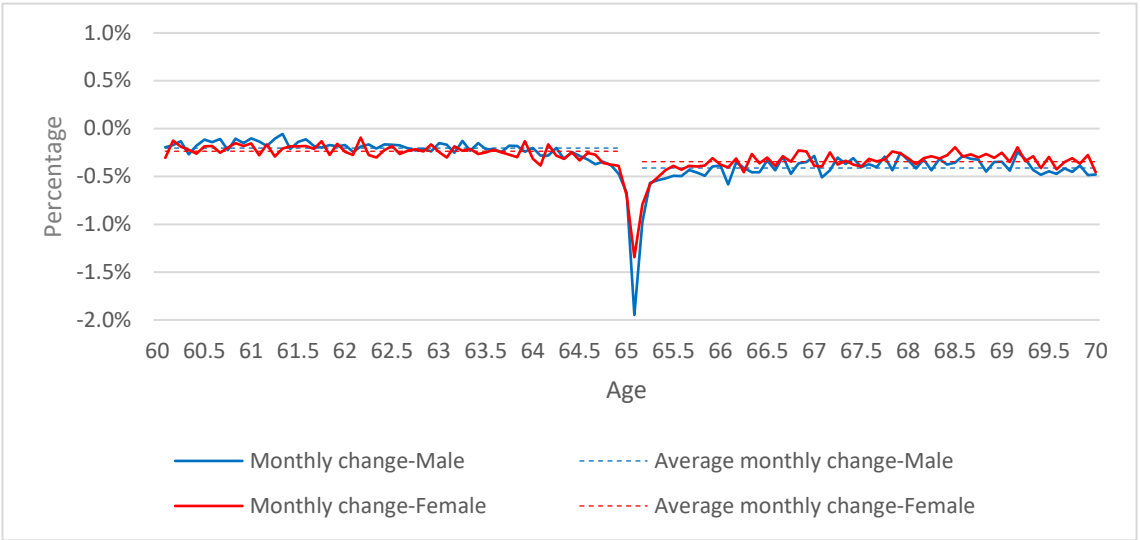


Source: Refer to Figure 5.1 for further information

The employment rates for males and females (Figure 7.3) follow the same pattern as the entire cohort, with males having a higher employment rate than females over the ten-year period, which is in line with the findings of Dixon and Hyslop (2008). The employment rate for males, for example, fell from 71.6 percent at age 60 to 32.7 percent at age 70 (a 38.9 percentage-point decline). Similarly, the employment rate for females fell from 59.1 percent at age 60 to 22.7 percent at age 70 (a lower 36.4 percentage-point decline compared to males). The gender gap in employment rates slightly narrows over time, with 12.5 percentage points at age 60, but only 10.0 percentage points at age 70.

Figure 7.4 displays monthly changes in employment rates compared to the previous month for both males and females. The average monthly pre-65 decline rate for males was 0.20 percentage points, and 0.24 percentage points for females. The average monthly post-65 decline rate for males was 0.41 percentage points, and 0.35 percentage points for females. In the month in which they turn 65, people began to leave the labour market at a faster rate, with employment rates for males falling by 0.67 percentage points and females falling by 0.70 percentage points, compared to the previous month. One month after their 65th birthday, the employment rate for males declined by 1.95 percentage points compared to the previous month, and the rate was 1.34 percentage points for females. The drop in employment rate two months after 65 to two months before 65 is 4.07 percentage points for males, and 3.23 percentage points for females. This indicates that males are more likely to exit the labour market than females around the pension age, validating the findings of Dixon and Hyslop (2008).

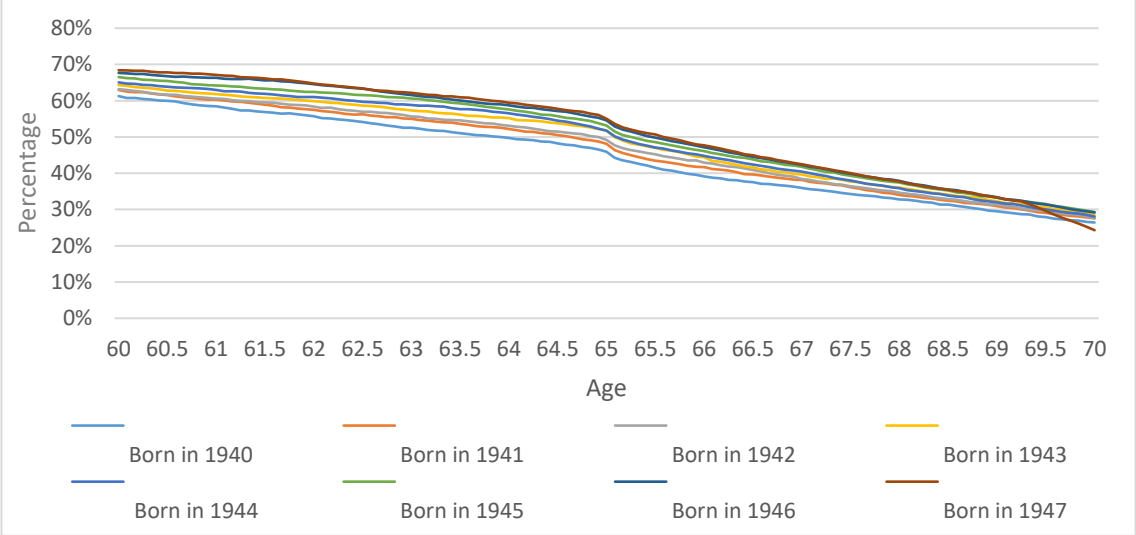
Figure 7.4 Sensitivity of employment rate change by gender



Source: Refer to Figure 5.1 for further information

7.2.2 Differences in Employment Rates by Birth Cohorts

Figure 7.5 Employment rates by birth cohorts



Source: Refer to Figure 5.1 for further information

The changes in employment rates for different birth cohorts are illustrated in Figure 7.5. It shows that later birth cohorts had higher employment rates than earlier birth cohorts, which might be driven by the secular increase in females' LFPR (Hyslop, Rice, & Skilling, 2019).[59] The differences in employment rates before 65 are bigger than the differences after 65. For example, the employment rate at age 60 was 61.3 percent for the 1940 cohort and 68.4 percent for the 1947 cohort, with a difference of 7.1 percentage points. At 70, the employment rate for the 1940 cohort was 26.4 percent and 24.3 percent for the 1947 cohort, a difference of 2.1 percentage points. The gaps in employment rates across the cohorts narrow as people age. The rapid decline in the employment rates for cohort 1947 after age 69 was most likely attributed to the fast decline in self-employment in the agriculture sector in 2016[60]. If excluding the self-employed income as a proxy for employment status (see Figure A 7.2 in Appendix A 7.1), the rapid decline disappeared.

Because there are eight birth cohorts in total, displaying the sensitivity of the employment rate changes in a single figure will be difficult. Like the entire cohort, the largest drops in employment rates occurr one month after turning 65, as shown in Table 7.1. This demonstrates that there is no trend in the reduction of work at 65 across cohorts.

[59] The rise in employment rates for the later born females could give some indication of the rise in LFPR, as illustrated in Appendix A 7.1.
[60] Source: Infometrics, https://www.infometrics.co.nz/article/2019-03-fall-rise-decline-story-new-zealands-self-employment-rate

Table 7.1 Employment rate change from one month after age 65 to age 65

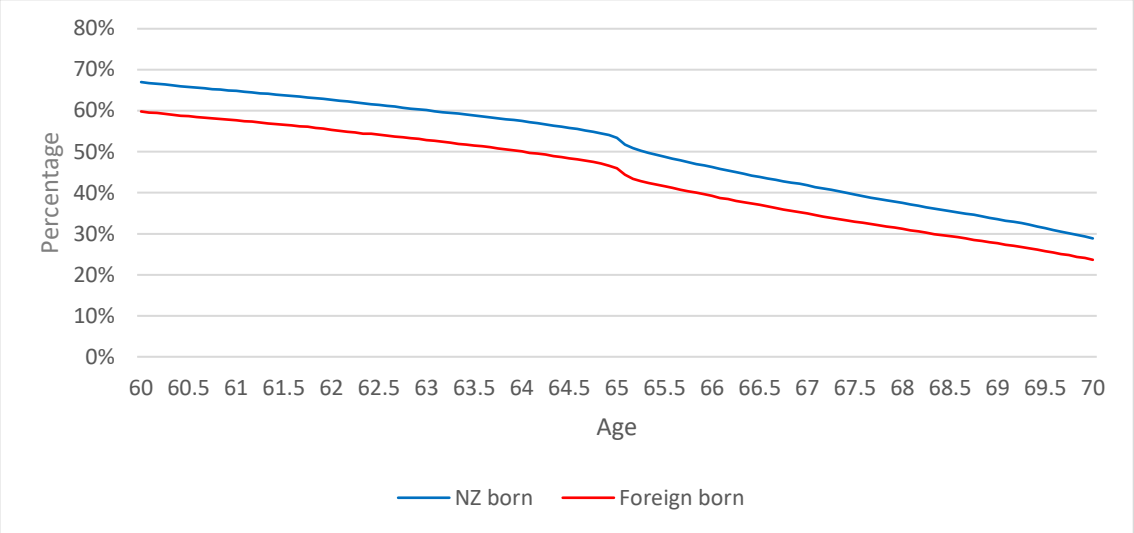
Birth cohorts	1940	1941	1942	1943	1944	1945	1946	1947
Percentage points change	-1.73	-1.77	-1.45	-1.77	-1.65	-1.69	-1.70	-1.43

Source: Refer to Table 4.1 for further information

7.2.3 Differences in Employment Rates by Country of Birth

The changes in employment rates by country of birth are illustrated in Figure 7.6. It shows that employment rates for New Zealand born (NZ-born) people were always higher than those of foreign-born people, which may be due to residency requirements. People born overseas may not be legally qualified for employment in NZ or may have language barriers. With a difference of 38.1 percentage points, the employment rate for NZ-born people declined from 67.0 percent at age 60 to 28.9 percent at age 70. With a difference of 36.2 percentage points, the employment rate for foreign-born people declined from 59.8 percent at age 60 to 23.6 percent at age 70. Before 65, the declining trend in employment rate is almost the same for both NZ-born and foreign-born cohorts. After 65, however, the trend for NZ-born people is slightly steeper than that of foreign-born people.

Figure 7.6 Employment rates by country of birth



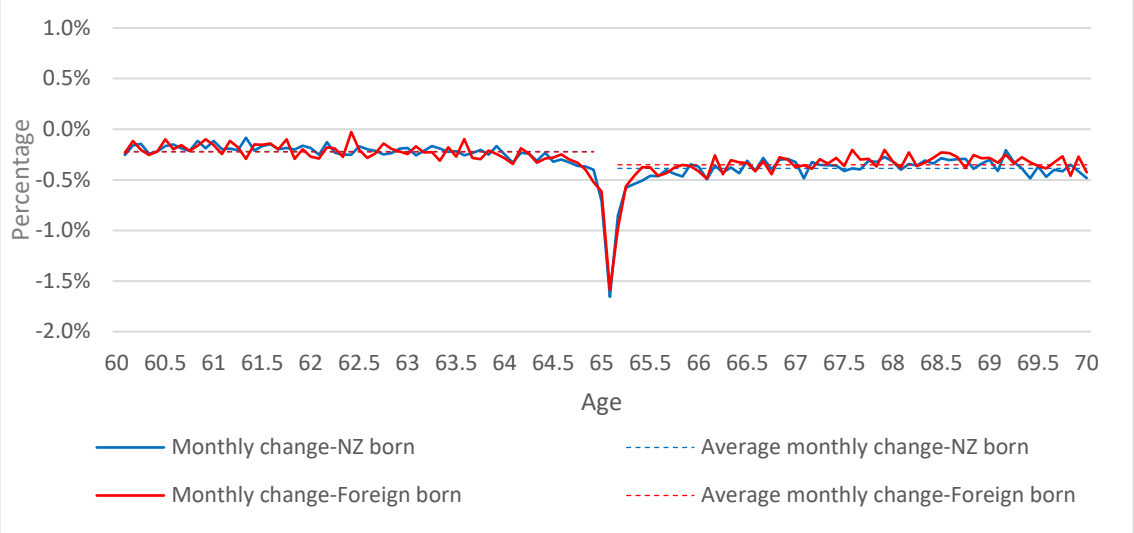
Source: Refer to Figure 5.1 for further information

Figure 7.7 shows the monthly changes in employment rates by country of birth. Prior to 65, the average decline trends were 0.22 percentage points for both NZ-born and foreign-born individuals. After 65, NZ-born people had a faster declining trend than foreign-born people, with an average decline trend of 0.39 percentage points for NZ-born group, and 0.35 percentage points for foreign-born group. This could be attributed to the fact that

those born in NZ had higher NZS take-up rates (see Section 5.2.3). Those who were not born in NZ may not have met the NZS requirements, causing them to remain in the labour market. For both groups, the declines in employment rates peak one month after they turned 65, with 1.66 percentage points for people born in NZ and 1.59 percentage points for people born overseas. It also takes more than six months for the drop rate to slow down after 65, reaching the average post-65 decline rate.

Appendix A 7.2 demonstrates the figures of employment rates and the sensitivity of employment rate changes for both genders by country of birth.

Figure 7.7 Sensitivity of employment rate change by country of birth



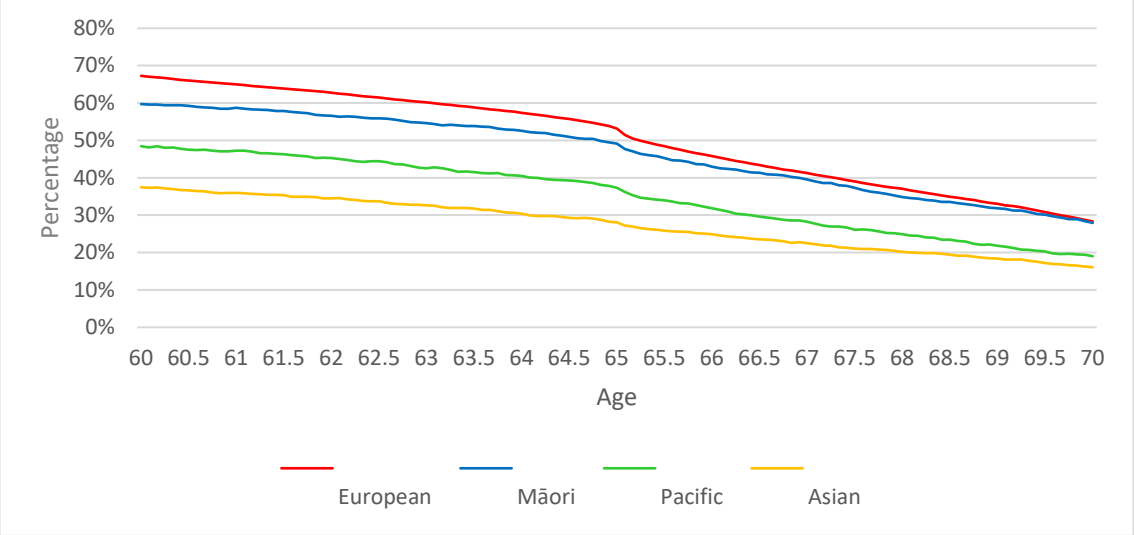
Source: Refer to Figure 5.1 for further information

7.2.4 Differences in Employment Rates by Ethnicity

As shown in Figure 7.8, employment rates differ significantly by ethnicity. Europeans had the highest employment rate, followed by Māori, Pacifica, and Asians. This shows that minority groups are less likely to be engaged in employment activities, which results in relatively lower work income mentioned in Section 6.3.3 (Allmark, Salway, Crisp, & Barley, 2010; Maloney, 2000). At age 60, the employment rate was 67.3 percent for Europeans, 59.7 percent for Māori, 48.4 percent for Pacifica, and 37.4 percent for Asians. At age 70, the employment rate fell to 28.3 percent for Europeans, 27.9 percent for Māori, 19.0 percent for Pacifica, and 16.1 percent for Asians. Europeans had the fastest declining trend both pre- and post-65. Other ethnicity groups showed similar declining trends before 65, but different trends after that age. These differences may be attributed to the differences in NZS take-up rates (see Section 5.2.4). As Europeans had the highest take-

up rates after 65, they left the labour market at the fastest pace. On the other hand, Asians had the lowest take-up rates after 65, leading them to a slower exit from the labour market.

Figure 7.8 Employment rates by ethnicity

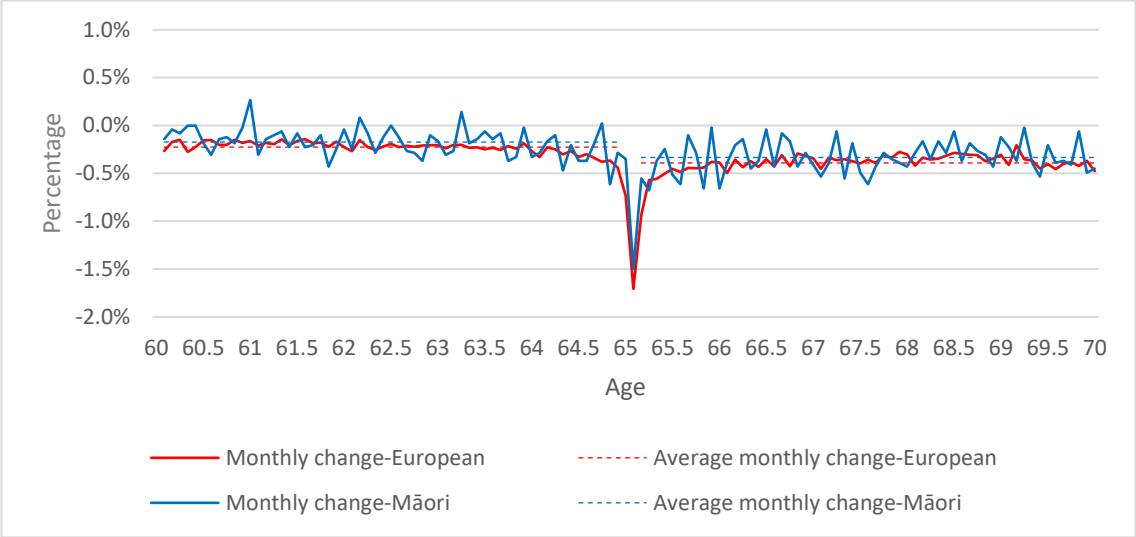


Source: Refer to Figure 5.1 for further information

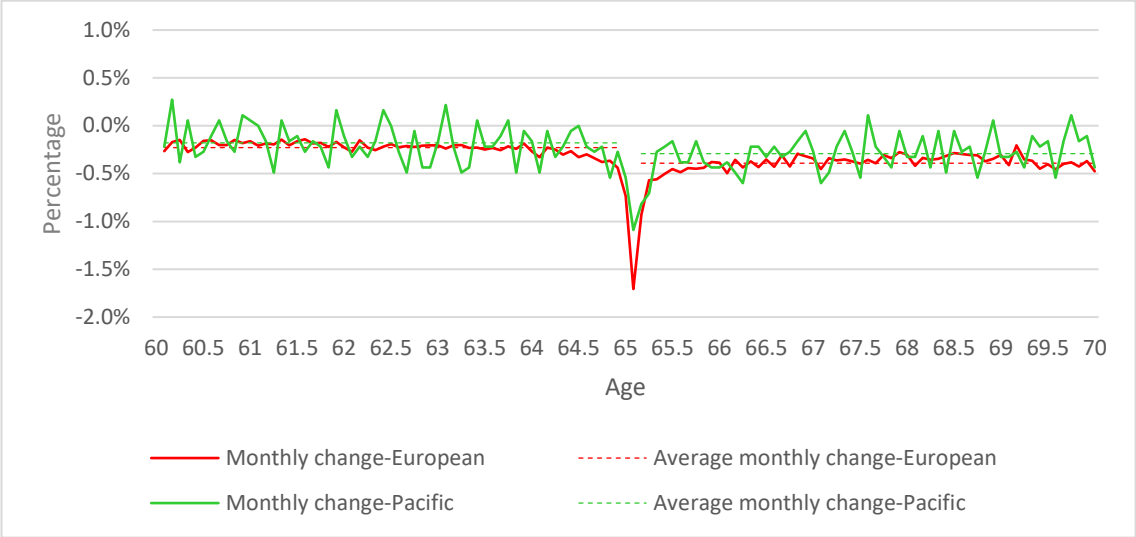
Figure 7.9 shows the sensitivity of changes in the employment rates for the four ethnic groups. Specifically, Europeans are used as a comparison for the other three ethnic groups. As demonstrated in Figure 7.8, Europeans had the highest pre-65 monthly decline rate, at 0.23 percentage points on average. The other three ethnicities had similar pre-65 decline trends of around 0.17 percentage points. After 65, the average monthly declines differ by ethnic groups, with 0.39 percentage points for Europeans, 0.33 percentage points for Māori, 0.29 percentage points for Pacifica, and 0.19 percentage points for Asians. Additionally, the maximum decline one month after 65 differs substantially. For example, the drop rate is 1.71 percentage points for Europeans, 1.50 percentage points for Māori, 1.09 percentage points for Pacifica, and 0.76 percentage points for Asians. This indicates that Europeans are more than two times more likely to exit the labour market than Asians one month after turning 65, as shown by the length of the spikes in Figure 7.9. The findings show that higher NZS take-up rates could accelerate people's exit from the labour market.

Appendix A 7.3 includes the figures of employment rates and the sensitivity of employment rate changes for both genders by ethnicity.

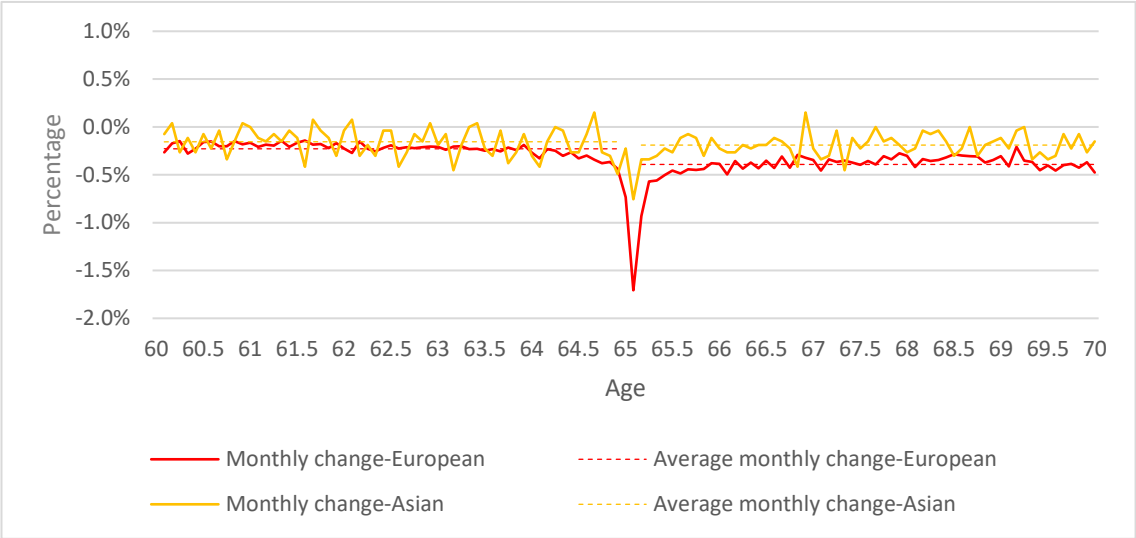
Figure 7.9 Sensitivity of employment rate change by ethnicity



(a) European and Māori



(b) European and Pacifica

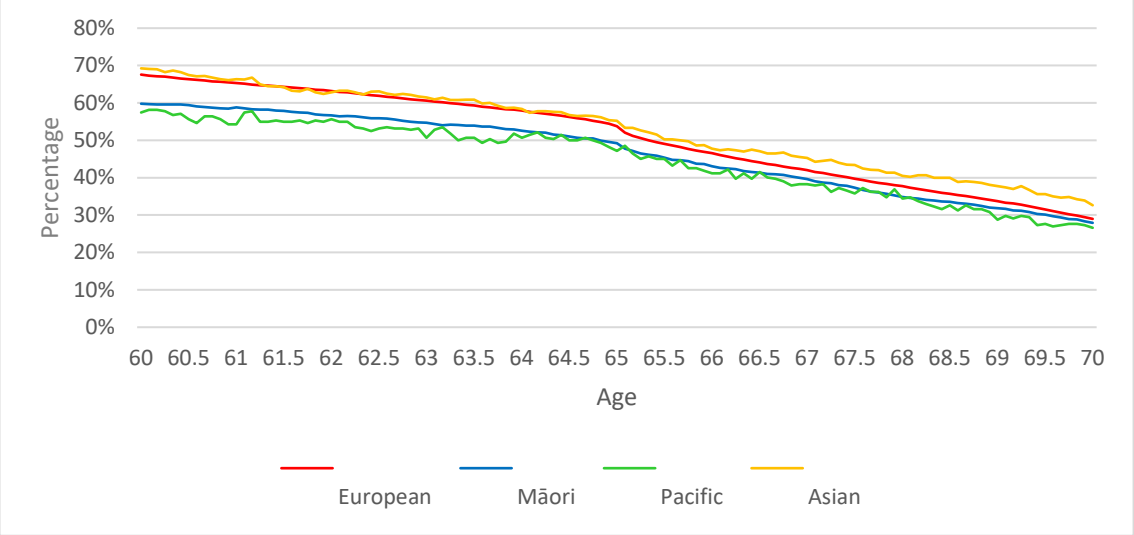


(c) European and Asian

Source: Refer to Figure 5.1 for further information

As mentioned in Section 7.2.3, country of birth plays an important role in influencing the employment rates. To exclude the impact of country of birth, Figure 7.10 depicts the changes in employment rates of different ethnicities for individuals born in NZ. Compared to the entire ethnicity groups shown in Figure 7.8, employment rates for people born in NZ vary less. The fluctuation in the employment rates of Pacifica and Asians may result from the small sample size (5 percent of the entire Pacifica group and 10 percent of the entire Asian group were born in NZ). Instead of Europeans, Asians had the highest employment rate over the ten-year period. Māori and Pacifica had similar decline trends over the ten years, with Pacifica having a relatively lower employment rate.

Figure 7.10 Employment rates by NZ-born ethnicity

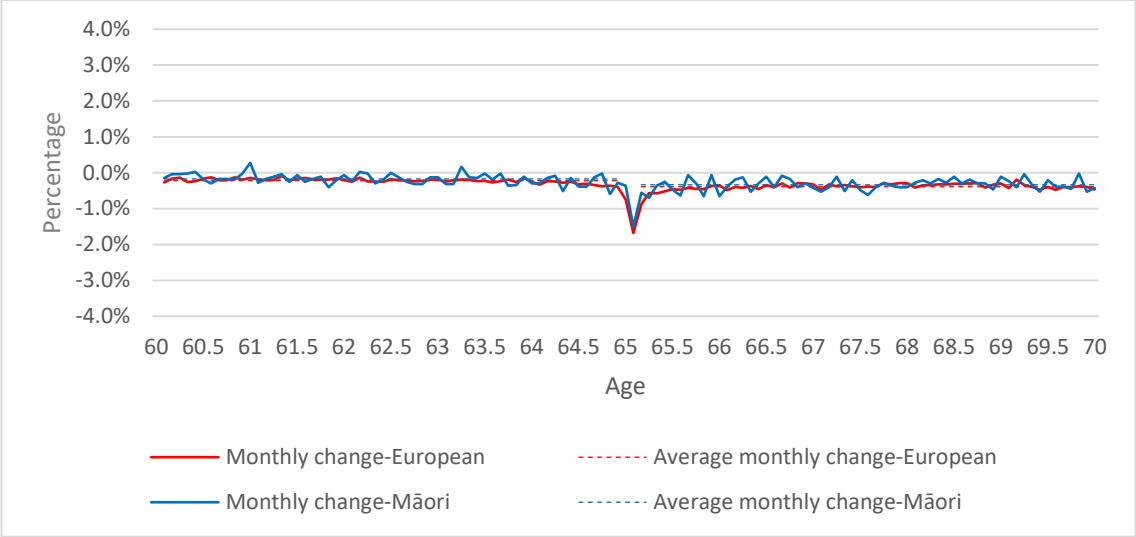


Source: Refer to Figure 5.1 for further information

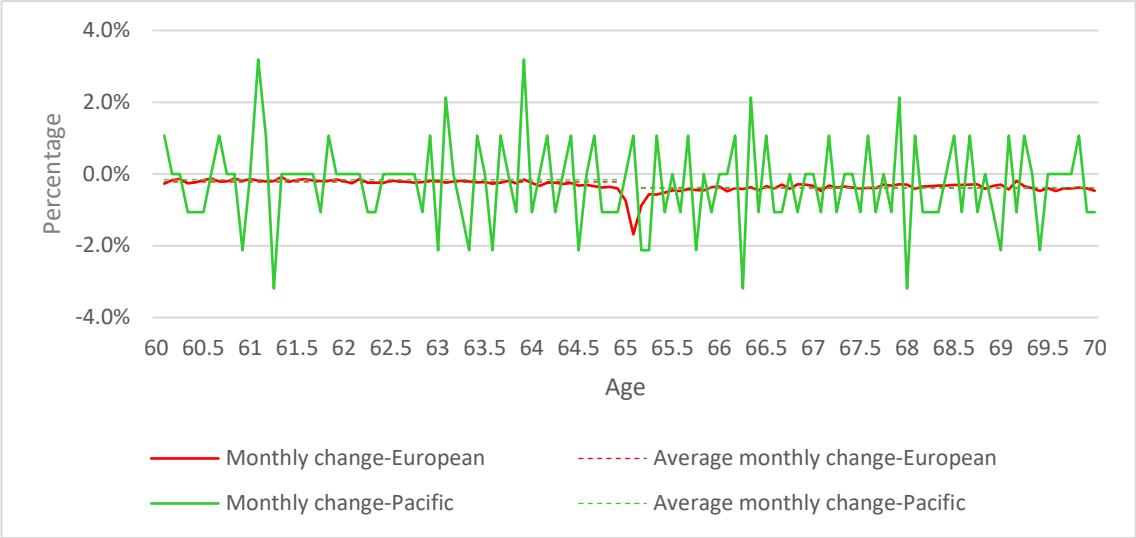
The decline in the employment rates for Europeans and Māori is nearly the same. But it is very difficult to compare the decline in Pacifica and Asians due to the large monthly variation in employment rates, as illustrated in Figure 7.11. The pre- and post-65 decline trends vary by ethnic groups. Before 65, Asians had the fastest monthly decline rate of 0.24 percentage points, while Pacifica had the lowest of 0.16 percentage points. After 65, Europeans had the highest monthly decline rate of 0.39 percentage points, while Māori had the lowest of 0.34 percentage points.

Appendix A 7.3 contains the figures of employment rates and the sensitivity of employment rate changes for both genders by NZ-born ethnicity.

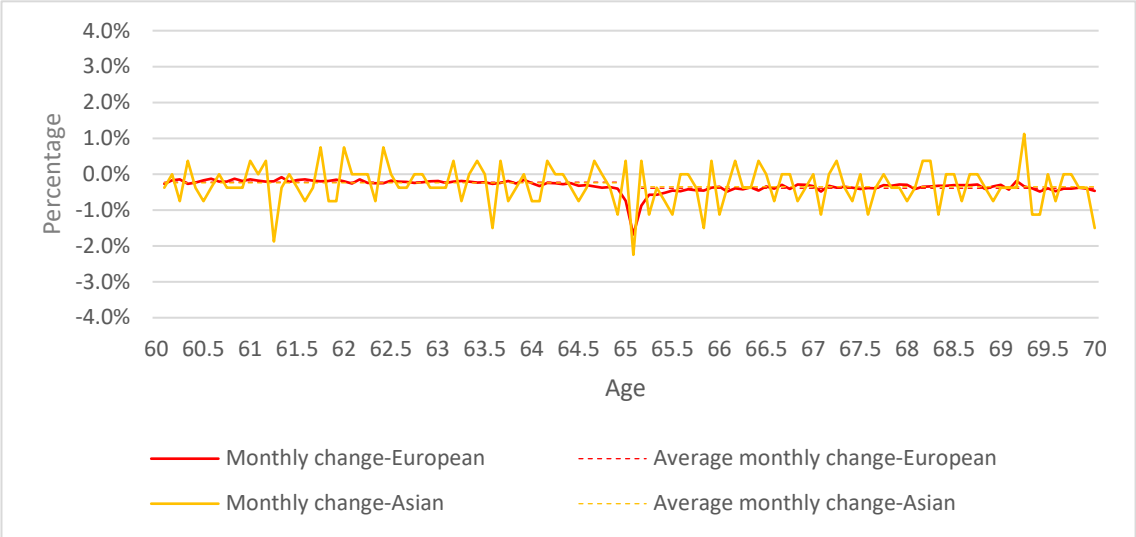
Figure 7.11 Sensitivity of employment rate change by NZ-born ethnicity



(a) European and Māori



(b) European and Pacifica



(c) European and Asian

Source: Refer to Figure 5.1 for further information

7.2.5 Differences in Employment Rates by Education

Figure 7.12 presents employment rates based on educational attainments.[61] For the University Degree group, the employment rate was 75.9 percent at age 60, and 38.1 percent at age 70. For the Qualification Less Than University Degree group, the employment rate fell from 67.8 percent at age 60 to 28.7 percent at age 70. For people without any qualifications, the employment rate dropped from 60.4 percent at age 60 to 23.9 percent at age 70. For people whose qualifications were unknown, the employment rate dropped from 56.6 percent at age 60 to 22.6 percent at age 70. This shows that education has a positive impact on people's probability of being employed, which supports the findings of Ranchhod (2006) and Khawaja and Boddington (2009) that higher education increased the probability of being employed or being the labour force and slowed the process of being retired.

The employment rate gap between the university qualified group and those with other qualifications is 8.1 percentage points at age 60, but 9.4 percentage points at age 70. The rise in the employment rates gap over time is due to a large exit from the labour market of those with other qualifications at pension age. The employment rates gaps between the university qualified group and the other two groups narrow over time, with 15.5 percentage points at age 60 and 14.2 percentage points at age 70 for those without any qualification, and 19.3 percentage points at age 60 and 15.5 percentage points at age 70 for those with unknown qualifications. Despite the higher earnings and savings for the university qualified group over the normal work life, they are more likely to continue working at age 70, which could be attributed to the nature of their jobs being less physically demanding and therefore less affected by declining physical health. It could also reflect the increased work flexibility that they have to work part-time.

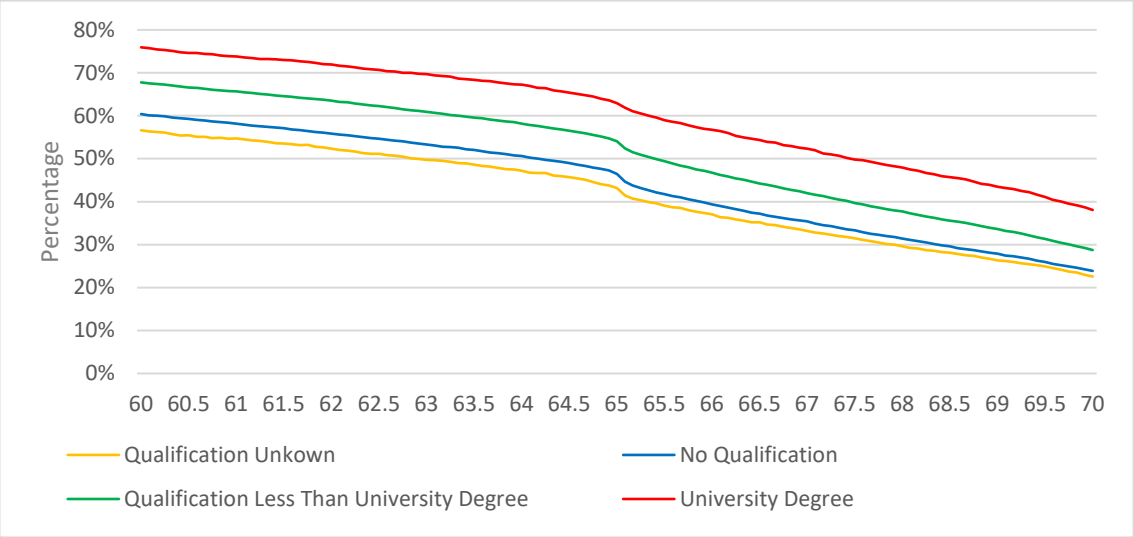
The pre- and post-65 decline trends don't vary much, as seen in Figure 7.13. With an average monthly decline rate of 0.21 (University Degree group) and 0.22 (other three groups) percentage points, the pre-65 trends for the four education groups are nearly identical. The post-65 monthly decline rates are the same (0.4 percentage points) for the Qualification Less Than University Degree and University Degree groups, while the No Qualification group and the Qualification Unknown group have relatively flatter rates of 0.35 and 0.32 percentage points, respectively. The maximum decline rate one month after age 65 is the smallest for the University Degree group (1.07 percentage points). It rises

[61] The definition of educational subgroups can be found in Section 4.6.2.

as educational levels decreased, reaching 1.63 percentage points for people with qualifications less than university degrees, and 1.81 percentage points for those without any qualifications(1.73 percentage points for those qualifications unknown). This further demonstrates that higher education attainments will slow down the speed of exiting the labour market when people receive non-means-tested income from NZS.

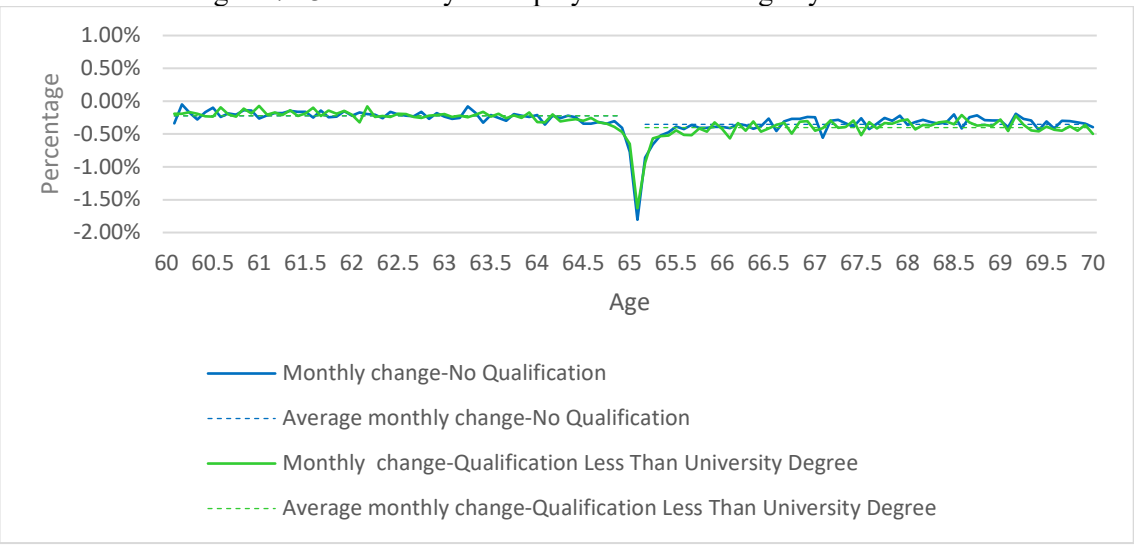
Appendix A 7.5 includes the figures of employment rates and the sensitivity of employment rate changes for both genders by education.

Figure 7.12 Employment rates by education

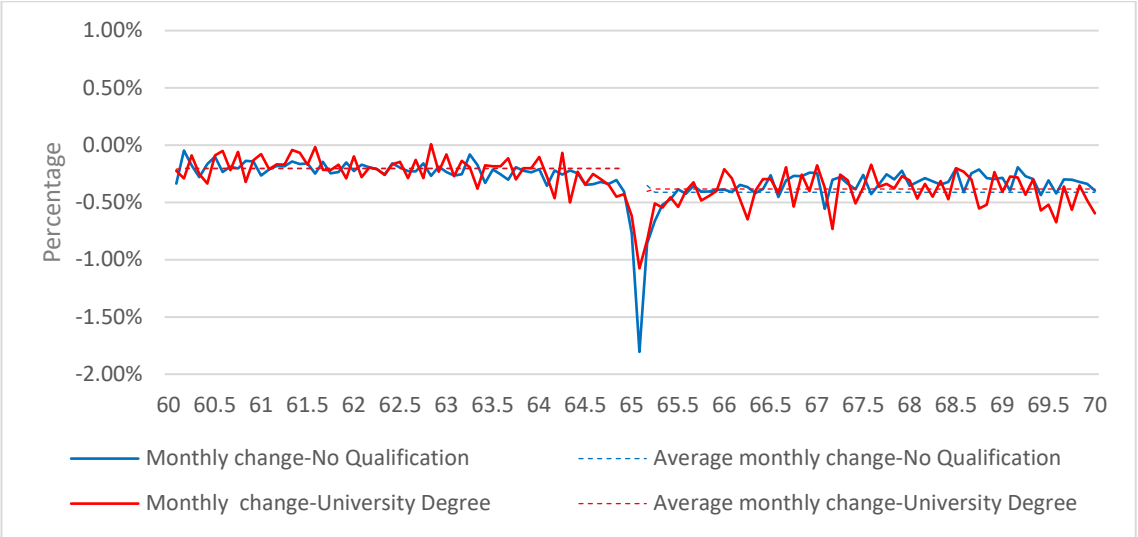


Source: Refer to Figure 5.1 for further information

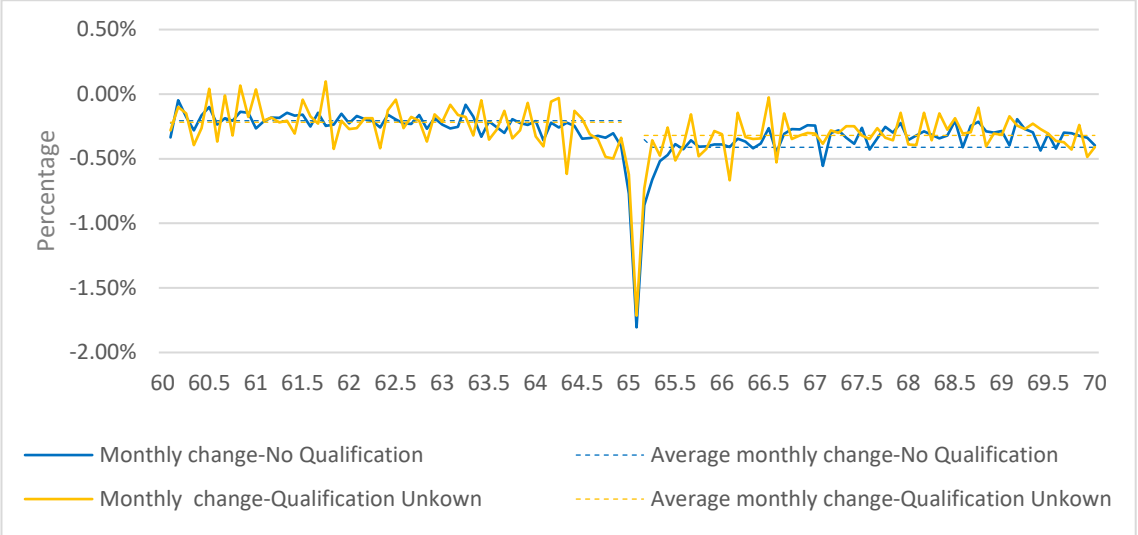
Figure 7.13 Sensitivity of employment rate change by education



(a) No Qualification and Qualification Less Than University Degree



(b) No Qualification and University Degree



(c) No Qualification and Qualification Unknown

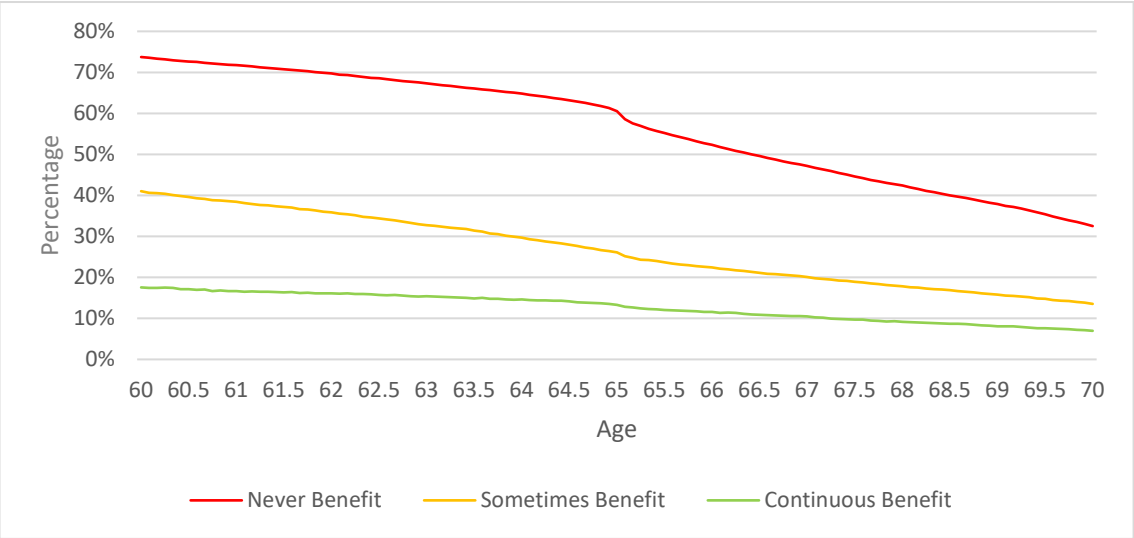
Source: Refer to Figure 5.1 for further information

7.2.6 Differences in Employment Rates by Benefit History

Figure 7.14 shows that employment rates differ considerably for the three benefit history groups.[62] The employment rate for the Never Benefit group fell from 73.7 percent at age 60 to 32.5 percent at age 70, a difference of 41.2 percentage points. The employment rate for the Sometimes Benefit group dropped from 41.0 percent at age 60 to 13.5 percent at age 70, a difference of 27.5 percentage points. The Continuous Benefit group had a flatter trend, with 17.6 percent at age 60 and 7.0 percent at 70, a difference of only 10.6 percentage points. This suggests that having a benefit history negatively affects the probability of a person being employed.

[62] The definition of benefit subgroups can be found in Section 4.6.1.

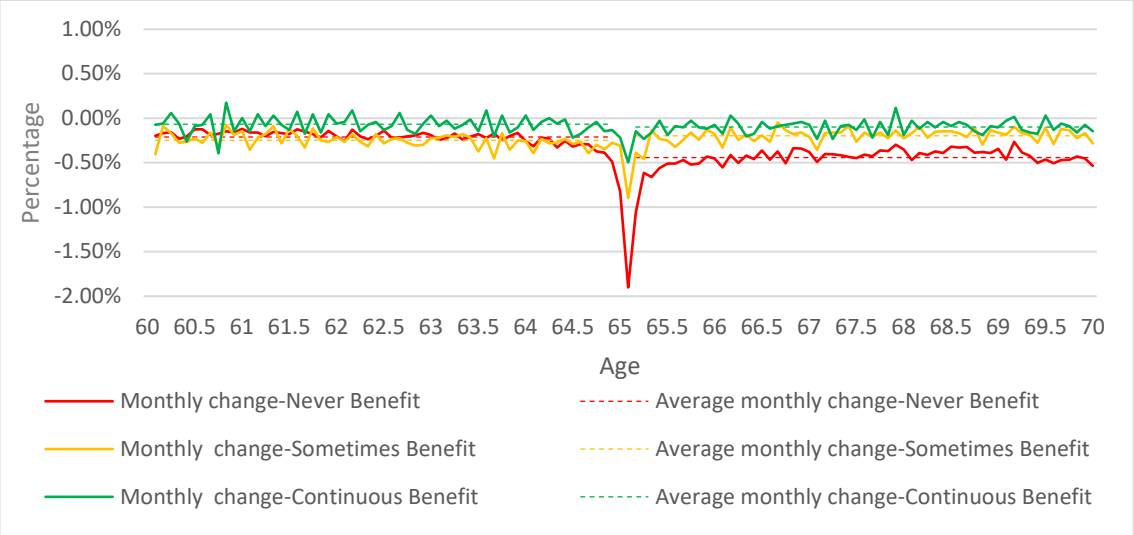
Figure 7.14 Employment rates by benefit history



Source: Refer to Figure 5.1 for further information

The monthly changes in the employment rates for the three benefit history groups can be seen in Figure 7.15. Like other groups, the sharp declines in the employment rates appear around the 65th birthday, starting several months before turning 65. One month after 65, the decline peaks at 1.90 percentage points for the Never Benefit group, 0.90 percentage points for the Sometimes Benefit group, and only 0.49 percentage points for the Continuous Benefit group. This means that if a person receives any main benefits before 65, he or she is less likely to leave the labour market when becoming pension eligible. This implies that pension eligibility has positive relative labour supply effects on those who had a benefit history between the ages of 60 and 64. Using the Never Benefit group as a comparison, the Sometimes Benefit group shows a relative 1.00 percentage point rise in employment rate regarding pension eligibility. The Continuous Benefit group has an even larger impact of a 1.41 percentage points rise. This is in line with the hypothesis of this research that transitioning from a means-tested to a non-means-tested benefit scheme will have a relatively positive impact on individuals' labour supply behaviour.

Figure 7.15 Sensitivity of employment rate change by benefit history



Source: Refer to Figure 5.1 for further information

Appendix A 7.6 includes the figures of employment rates and the sensitivity of employment rate changes for both genders by benefit history.

7.3 Empirical Results Using Regression Analysis

The previous section visually depicted the changes in employment rates for various subgroups over the observation period. However, the precise numerical values of these changes were not calculated. In addition, the statistical significance of these changes was not assessed. In particular, we want to evaluate the three key features of the employment rates: pre- and post-65 time trends, as well as the permanent decline around the pension age. Additionally, we would like to know how these effects vary for subgroups.

7.3.1 Regression Method

As discussed in Section 7.2, the monthly changes in employment rates appear to be relatively constant before and after 65. There are no obvious nonlinearities in this outcome on either side of 65. This creates a picture of discontinuity around pension age, with a permanent decline in employment rates. We want to assess the causal effects of being pension eligible on employment rates, comparing the labour supply behaviour of those with and without the presence of the NZS system. However, this counterfactual situation is unobservable. We can't just remove the NZS system and observe what the employment rate patterns would be over the study period for all individuals in our sample cohort in the absence of NZS. If we could, the causal effects would be very easy to detect by just comparing the changes in employment rates with and without NZS. Such a hypothetical comparison would lead to some interesting questions. For example, would

this linear rate of decline from ages 60 to 64 continue after 65? Would the discontinuity in employment rates around pension age still exist?

We believe that the discontinuity around pension age provides some indication of the possible labour supply impacts from NZS. The precision of the timing of these monthly changes is very compelling. However, it is unclear whether the discontinuity is solely due to being pension eligible or something else relating to turning age 65 (e.g., a cultural convention that age 65 is the typical, expected age of retirement).

The monthly data we have can pinpoint the differences in employment rates around pension age. They demonstrate that reaching the age of 65 does have an impact on employment rates. A comparison of the pre and post periods may give us some insight into the possible effects that NZS has on the employment rates.

Maximum Likelihood Probit regression is used to analyze these effects. For the binary probit model, we have a latent framework:

$$y_{it}^{*} = \alpha + \beta_1 t + \beta_2 t\_Post65_t + \gamma_1 Perm_t + \boldsymbol{\lambda X} + \varepsilon_{it} \tag{7.1}$$

$$y_{it} = \begin{cases} 1, if\, y_{it}^{*} > 0 \\ 0, if\, y_{it}^{*} = 0 \end{cases} \tag{7.2}$$

where y_{it}^{*} is a latent variable that could be interpreted as the propensity for individual i to be employed in time t. y_{it} is the outcome variable of interest, $y_{it} = 1$ if individual i was employed at month t (where $t = 1,2,\cdots,121$); $y_{it} = 0$ otherwise. β_1 captures the linear time trend before 65; β_2 captures the change in the time trend after 65, with $t\_Post65 = t - 61$ if $t > 61$; 0 otherwise. That is, the time trend after 65 is the sum of $\beta_1 + \beta_2$. γ_1 captures the permanent drop in employment of being pension eligible with $Perm = 1$ if $t > 58$; 0 otherwise. Our estimation of the permanent effect started two months before being pension eligible instead of right after reaching age 65. This would allow for a five-month 'transition period' around the 65th birthday month (two months before and after turning 65) for our estimation, as shown in Section 7.2 that the permanent decline in employment rates lasts for several months both before and after pension age.[63] $\boldsymbol{X}$ represents a vector of individual characteristics (such as pre-65 benefit history, gender, country of birth, ethnicity, education, and birth cohorts) and the macro environment

[63] γ_1 did not capture the entire transition period effect. If allowing for the five-month transition period effect, the permanent decline of being pension eligible would be $E(y|t = 63) - E(y|t = 58) = (\alpha + 63\beta_1 + 2\beta_2 + \gamma_1 + \boldsymbol{\lambda X}) - (\alpha + 58\beta_1 + \boldsymbol{\lambda X}) = 5\beta_1 + 2\beta_2 + \gamma_1$.

(unemployment rate) that may affect the propensity to be employed, and ε_{it} is the disturbance term.

The conditional probability that an individual i is employed at time t equals to 1 can be expressed as:

$$Pr(y_{it} = 1|\boldsymbol{Z}) = F(\rho \boldsymbol{Z}) \tag{7.3}$$

where $F(.)$ is the standard normal cumulative distribution function (CDF), $\boldsymbol{Z}$ represents all independent variables (the time trends before and after age 65, permanent effect of being pension eligible, and vector **X**) given in equation (7.1).

This study does not utilize fixed effects regression since variation in the dependent variable is a problem. As the data is on an individual level, a person-specific effect can only be identified if there is some variation in the dependent variable over the sample period. In our sample cohort, 22.8 percent of individuals did not work at all over the entire ten-year period, while 14.4 percent worked every month. In total, 37.2 percent of individuals either worked every month or did not work over the ten-year observation period.[64] In using fixed effects regressions, 37.2 percent of the cohort will be omitted from the estimation because their fixed effects could not be identified due to a total lack of variation in the employment state for these people, which is a significant exclusion.

In addition, the inclusion of fixed effects would have little impact on the estimated coefficients of the key independent variables in this analysis. Fixed effects are important controls to include if they're correlated with other covariates. This isn't possible in this situation, because the three key features of this regression specification (two linear time trends, and a permanent effect) are all due to the same aging process that confronts all individuals in our cohorts. Experimentation with the inclusion of these individual fixed effects confirmed this fact. For consistency of the analysis for this thesis, regarding NZS take-up rates and income, this study chooses to include all the cohorts using ordinary probit analysis.

Any other expansion can be made on the basis of equation (7.1), such as adding interactions between different subgroups with the time trends, and temporary and permanent effects.

[64] These people either received main benefits, other income, or had no income.

7.3.2 Empirical Results on Employment Rates

The estimated marginal effects from this Probit analysis presented in Table 7.2 all have the expected signs and are statistically different from zero at the 1% level. The rate of decline in being employed before 65 is quite modest, with every one-month increase in age lowering the probability of being employed by 0.21 percentage points. The post-65 decline is 0.37 percentage points for each month.[65] We observe that being pension eligible coincides with a permanent decline of 3.40 percentage points in the probability of being employed.[66] These effects are likely due to the work disincentive generated by the non-means-tested NZS.

With all other independent variables held constant, the probability of being employed for a male is 10.48 percentage points higher than a female. Those born in NZ have a 4.35 percentage-point higher probability of being employed than those born overseas.

Compared to having some European identity, having some Māori identity increases the probability of being employed by 3.79 percentage points, with the controls of education and benefit history (similar results to those seen in the previous chapter with respect to work income). On the other hand, having some Pacifica or Asian identities lowers the probability of being employed by 1.23 and 17.57 percentage points, respectively. Based on unadjusted statistics, Māori would be expected to have lower employment rates than Europeans, on average, due to their relatively lower educational levels and higher possibility of receiving social welfare assistance. After removing the controls of education and benefit history, the sign of the Māori coefficient changes to negative, resulting in a decline in the probability of being employed by 3.82 percentage points (column 2 of Table 7.2). That is, having some Māori identity actually lowers the probability of being employed by 3.82 percentage points compared to those with European identity without controlling for education and benefit history.

Compared to those having no qualifications, having a qualification less than university degrees increases the probability of being employed by 2.82 percentage points, and having a university degree increases the probability of being employed by 8.76 percentage

[65] This is the average ***monthly*** change before and after 65. The cumulative decline in the employment rate was 12.6 (0.21 x 60) percentage points before 65, and 22.2 (0.37 x 60) percentage points after 65.
[66] The permanent declines in this chapter did not include the five-month transition period. If allowing for the five-month transition period effect, this permanent decline for entire sample cohort would be greater, with 4.77 (5 x 0.21+2 x 0.16+3.4) percentage points (see footnote 63).

points. This indicates that educational levels have a positive relationship with people's labour supply.

Compared to those who did not receive a main benefit between the ages of 60 and 64, having sometimes received a main benefit reduces the probability of being employed by 18.70 percentage points, and having continuously received main benefits reduces the probability of being employed by 44.91 percentage points. This suggests that those with lower labour supply were more likely to be eligible for the income requirements for the main benefits.

The unemployment coefficient is positive, meaning that every one-percentage-point rise in the unemployment rate increases the probability of being employed by 0.20 percentage points. For ordinary people, a rise in the unemployment rates may result in a decline in the employment rates. However, our sample cohort consists of people aged between the ages of 60 and 70. They might not be as sensitive to cyclical unemployment as younger individuals are – or more of their unemployment may be frictional and due to moving jobs. When cyclical unemployment struck, they were less likely to lose their jobs than younger individuals. This estimated effect of unemployment picks up more about labour supply than labour demand.

Table 7.2 also shows that the later birth cohorts have a higher probability of being employed than the earlier birth cohorts.

Table 7.2 Probit estimation of employment rates, no interaction

	With Control of Education and Benefit History	Without Control of Education and Benefit History
	Marginal Effects	**Marginal Effects**
	1	2
t	-0.0021***	-0.0021***
	(1.7200E-5)	(1.700E-5)
t_Post65	-0.0016***	-0.0016***
	(2.6100E-5)	(2.620E-5)
Perm	-0.0340***	-0.0338***
	(6.3670E-4)	(6.353E-4)
Other Control Variables		
Male	0.1048***	0.1278***
	(1.4776E-3)	(1.572E-3)
NZ born	0.0435***	0.0357***
	(1.9178E-3)	(2.036E-3)
Māori	0.0379***	-0.0382***
	(3.0654E-3)	(3.324E-3)
Pacifica	-0.0123***	-0.1208***
	(5.2317E-3)	(5.760E-3)
Asian	-0.1757***	-0.2130***
	(4.7570E-3)	(5.108E-3)
Other Ethnicities	-0.0222***	-0.0369***
	(4.9141E-3)	(5.217E-3)
Qualification Less Than University Degree	0.0282***	-
	(1.7328E-3)	-
University Degree	0.0876***	-
	(2.7362E-3)	-
Qualification Unknown	-0.0071***	-
	(2.9175E-3)	-
Unemployment Rate	0.0020***	0.0021***
	(2.7420E-4)	(2.751E-4)
Sometimes Benefit	-0.1870***	-
	(1.9333E-3)	-
Continuous Benefit	-0.4491***	-
	(3.1662E-3)	-
Cohort 1941	0.0099***	0.0171***
	(3.2051E-3)	(3.405E-3)
Cohort 1942	0.0152***	0.0267***
	(3.2141E-3)	(3.416E-3)
Cohort 1943	0.0214***	0.0412***
	(3.2226E-3)	(3.430E-3)
Cohort 1944	0.0224***	0.0465***
	(3.1507E-3)	(3.352E-3)
Cohort 1945	0.0305***	0.0608***
	(3.1051E-3)	(3.304E-3)
Cohort 1946	0.0342***	0.0698***
	(3.0242E-3)	(3.217E-3)
Cohort 1947	0.0330***	0.0724***
	(2.9734E-3)	(3.161E-3)
Monthly Observations (n x t)	26,773,428	26,773,428
Number of Individuals (n)	221,268	221,268
Pseudo R-square	0.1250	0.0632

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Numbers in parentheses are adjusted standard errors controlling for person-level clustering. Pseudo $\mathrm{R-square} = 1 - \frac{ln\hat{L}(M_{Full})}{ln\hat{L}(M_{Intercept})}$. M_{Full} = Model with predictors; $M_{Intercept}$ = Model without predictors; $\hat{L}$ = Estimated likelihood.

Interaction with Gender

Table 7.3 demonstrates estimations of the gender-related interactions with time trends and permanent effects. All of the estimates are statistically significant at the 1% level. The monthly declines in the probability of being employed for females are 0.22

percentage points before 65, and 0.35 percentage points after 65. Males have a slower pre-65 decline trend and a faster post-65 decline trend than females, with a 0.20 percentage-point monthly decline before 65 and a 0.38 percentage-point monthly decline after 65. Though the time trend differences in gender are small, gender does have a significant impact on the labour supply around pension age. After being pension eligible, females have a permanent decline in the probability of being employed by 2.82 percentage points, which is bigger than the decline of 2.1 percentage points that Dixon and Hyslop found in 2008. Males, on the other hand, have a permanent decline of 4.04 percentage points, which is smaller than the drop of 4.2 percentage points that Dixon and Hyslop found in 2008. The disparity between this study and Dixon and Hyslop's decline in employment rates at pension age could be attributed to the differences in sample cohort, observation period, and regression methodology. In addition, rather than measuring the permanent drop in employment rate right after reaching 65, this study examined it two months before being pension eligible. However, all the findings suggest that 'retirement' around 65 is much more likely to happen for males compared to females.

Table 7.3 Probit estimation of employment rates, interaction with gender

	Marginal Effects
T	-0.0022***
	(2.320E-5)
t_Post65	-0.0013***
	(3.600E-5)
Perm	-0.0282***
	(8.547E-4)
Male t*	0.0002***
	(3.440E-5)
Male t_Post65*	-0.0005***
	(5.250E-5)
Male Perm*	-0.0122***
	(1.280E-3)
Other Control Variables	
Male	0.1070***
	(1.945E-3)
NZ born	0.0435***
	(1.918E-3)
Māori	0.0379***
	(3.065E-3)
Pacifica	-0.0123***
	(5.232E-3)
Asian	-0.1758***
	(4.758E-3)
Other Ethnicities	-0.0223***
	(4.916E-3)
Qualification Less Than University Degree	0.0282***
	(1.733E-3)
University Degree	0.0875***
	(2.736E-3)
Qualification Unknown	-0.0072***
	(2.917E-3)
Unemployment Rate	0.0020***
	(2.742E-4)
Sometimes Benefit	-0.1870***
	(1.933E-3)
Continuous Benefit	-0.4490***
	(3.167E-3)
Cohort 1941	0.0099***
	(3.205E-3)
Cohort 1942	0.0152***
	(3.214E-3)
Cohort 1943	0.0214***
	(3.223E-3)
Cohort 1944	0.0224***
	(3.151E-3)
Cohort 1945	0.0305***
	(3.046E-2)
Cohort 1946	0.0030***
	(3.419E-2)
Cohort 1947	0.0030***
	(3.301E-2)
Monthly Observations (n x t)	26,773,428
Number of Individuals (n)	221,268
Pseudo R-square	0.1250

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Numbers in parentheses are adjusted standard errors controlling for person-level clustering. Refer to Table 7.2 for the definition of Pseudo R-square.

Interaction with Country of Birth

The monthly decline in employment rates for those born in NZ does not differ significantly from those born in foreign countries, as shown in Table 7.4, which is consistent with the graphic analysis in Section 7.2.3. The monthly drop in employment rate for people born in foreign countries is 0.21 percentage points before 65, and 0.36 percentage points after 65. The difference in the probability of being employed for those born in NZ before 65 is very small and insignificant, which indicates that NZ-born people had the same pre-65 time trend as those born in foreign countries. The monthly drop in the probability of being employed is 0.36 percentage points for those born in foreign countries, and 0.37 percentage points for those born in NZ. People born in foreign countries see a statistically significant permanent drop in the probability of being employed, with 3.46 percentage points after being pension eligible. Though the difference in the permanent effect of those born in NZ and those born in foreign countries is not statistically significant, the permanent effect for those born in NZ is significant at the 1% level, with a 3.38 percentage-point drop. These findings indicate that country of birth has a minor impact on the monthly decline in employment rate, as well as the permanent labour supply effects of being pension eligible.

Table 7.4 Probit estimation of employment rates, interaction with country of birth

	Marginal Effects
T	-0.0021***
	(3.3600E-5)
t_Post65	-0.0015***
	(5.2100E-5)
Perm	-0.0346***
	(1.2561E-3)
NZ born t*	1.7600E-5
	(3.9000E-5)
NZ born t_Post65*	-0.0001***
	(6.0300E-5)
NZ born Perm*	0.0008
	(1.4577E-3)
Other Control Variables	
Male	0.1048***
	(1.4776E-3)
NZ born	0.0437***
	(2.3951E-3)
Māori	0.0379***
	(3.0658E-3)
Pacifica	-0.0122***
	(5.2304E-3)
Asian	-0.1757***
	(4.7587E-3)
Other Ethnicities	-0.0222***
	(4.9141E-3)
Qualification Less Than University Degree	0.0282***
	(1.7329E-3)
University Degree	0.0876***
	(2.7361E-3)
Qualification Unknown	-0.0071***
	(2.9175E-3)
Unemployment Rate	0.0020***
	(2.7420E-4)
Sometimes Benefit	-0.1870***
	(1.9332E-3)
Continuous Benefit	-0.4491***
	(3.1663E-3)
Cohort 1941	0.0099***
	(3.2051E-3)
Cohort 1942	0.0152***
	(3.2141E-3)
Cohort 1943	0.0214***
	(3.2226E-3)
Cohort 1944	0.0224***
	(3.1507E-3)
Cohort 1945	0.0305***
	(3.1051E-3)
Cohort 1946	0.0342***
	(3.0241E-3)
Cohort 1947	0.0330***
	(2.9733E-3)
Monthly Observations (n x t)	26,773,428
Number of Individuals (n)	221,268
Pseudo R-square	0.1250

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Numbers in parentheses are adjusted standard errors controlling for person-level clustering. Refer to Table 7.2 for the definition of Pseudo R-square.

Interaction with Ethnicity

People with some European identity have a downward trend in employment propensities over the entire period among all the ethnic groups (see Table 7.5). The monthly decline

in the probability of being employed is 0.21 percentage points for people with some European identity before 65, and 0.37 percentage points after 65. The time trends for people with some Māori and Pacifica differ less both before (0.17 percentage points for Māori, and 0.19 percentage points for Pacifica) and after 65 (0.35 percentage points for Māori, and 0.34 percentage points for Pacifica). People with some Asian identity have the slowest declines over the entire period, with a 0.16 percentage-point decline before 65 and a 0.24 percentage-point decline after 65. The slower exit of people with some Asian identity after 65 may be attributed to their relatively lower NZS take-up rates with the failure to meet the NZS residency requirements. As a result, they are more likely to keep working after 65 instead of exiting the labour market at a faster rate.

After being pension eligible, people with some European identity experience the largest permanent decline of 3.53 percentage points in the probability of being employed. This effect is lower if people had some other ethnic identities, with 2.96 percentage points for people with some Māori identity, 2.76 percentage points for people with some Pacifica identity, and 1.78 percentage points for people with some Asian identity. These findings suggest that people with other ethnic identities usually have smaller labour supply impacts than people with some European identity around pension age, which may also be attributed to their lower NZS take-up rates.

Table 7.5 Probit estimation of employment rates, interaction with ethnicities

	Marginal Effects
T	-0.0021***
	(1.8700E-5)
t_Post65	-0.0016***
	(2.8300E-5)
Perm	-0.0353***
	(6.9130E-4)
Māori t*	0.0004***
	(6.9800E-5)
Māori t_Post65*	-0.0002***
	(1.0740E-4)
Pacifica t*	0.0003***
	(1.0700E-4)
Pacifica t_Post65*	-2.0500E-5
	(1.7060E-4)
Asian t*	0.0005***
	(8.8500E-5)
Asian t_Post65*	0.0008***
	(1.3610E-4)
Other Ethnicities t*	0.0003***
	(1.1030E-4)
Other Ethnicities t_Post65*	-0.0001**
	(1.6900E-4)
Māori Perm*	0.0057***
	(2.5906E-3)
Pacifica Perm*	0.0077***
	(3.9621E-3)
Asian Perm*	0.0175***
	(3.1781E-3)
Other Ethnicities Perm*	0.0121***
	(4.0287E-3)
Other Control Variables	
Male	0.1048***
	(1.4772E-3)
NZ born	0.0435***
	(1.9186E-3)
Māori	0.0108***
	(3.8560E-3)
Pacifica	-0.0322***
	(6.2395E-3)
Asian	-0.2231***
	(5.3635E-3)
Other Ethnicities	-0.0432***
	(6.2585E-3)
Qualification Less Than University Degree	0.0282***
	(1.7326E-3)
University Degree	0.0875***
	(2.7351E-3)
Qualification Unknown	-0.0071***
	(2.9149E-3)
Unemployment Rate	0.0020***
	(2.7410E-4)
Sometimes Benefit	-0.1869***
	(1.9316E-3)
Continuous Benefit	-0.4487***
	(3.1636E-3)
Cohort 1941	0.0099***
	(3.2049E-3)
Cohort 1942	0.0152***
	(3.2136E-3)
Cohort 1943	0.0214***
	(3.2221E-3)
Cohort 1944	0.0225***
	(3.1503E-3)
Cohort 1945	0.0305***
	(3.1045E-3)

Table 7.5 Continued

Cohort 1946	0.0342***
	(3.0237E-3)
Cohort 1947	0.0331***
	(2.9727E-3)
Monthly Observations (n x t)	26,773,428
Number of Individuals (n)	221,268
Pseudo R-square	0.1252

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Numbers in parentheses are adjusted standard errors controlling for person-level clustering. Refer to Table 7.2 for the definition of Pseudo R-square.

Interaction with Education

Table 7.6 demonstrates that the downward trends in employment propensities for the various educational subgroups vary within 0.02 percentage points, with around 0.21 percentage points before 65 and around 0.36 percentage points after 65. Like other groups, the post-65 labour market exit rate is faster than the pre-65 period. The permanent labour supply effects after being pension eligible, however, vary a lot. We see a 3.62 percentage-point permanent drop in the probability of being employed for people with no qualifications. This effect is offset by the rise in educational attainments. The permanent drop is 3.35 percentage points for people with qualifications less than university degrees, and 2.91 percentage points for people with university degrees. These findings suggest that having a higher level of education has little impact on the monthly labour market exit. Alternatively, higher educational attainment reduces the permanent exit from the labour market after being pension eligible as discussed earlier (Khawaja & Boddington, 2009; Ranchhod, 2006).

Table 7.6 Probit estimation of employment rates, interaction with education

	Marginal Effects
T	-0.0021***
	(2.9200E-5)
t_Post65	-0.0015***
	(4.5600E-5)
Perm	-0.0362***
	(1.1161E-3)
Qualification Less Than University Degree t*	2.8900E-5*
	(3.8500E-5)
Qualification Less Than University Degree t_Post65*	-0.0002***
	(5.9400E-5)
University Degree t*	4.5000E-5
	(6.1100E-5)
University Degree t_Post65*	3.6900E-5
	(9.1100E-5)
Qualification Unknown t*	0.0001***
	(6.4700E-5)
Qualification Unknown t_Post65*	0.0001***
	(1.0090E-4)
Qualification Less Than University Degree Perm*	0.0026***
	(1.4499E-3)
University Degree Perm*	0.0071***
	(2.2050E-3)
Qualification Unknown Perm*	0.0021
	(2.4312E-3)
Other Control Variables	
Male	0.1049***
	(1.4775E-3)
NZ born	0.0435***
	(1.9178E-3)
Māori	0.0379***
	(3.0646E-3)
Pacifica	-0.0123***
	(5.2305E-3)
Asian	-0.1757***
	(4.7559E-3)
Other Ethnicities	-0.0222***
	(4.9130E-3)
Qualification Less Than University Degree	0.0276***
	(2.2310E-3)
University Degree	0.0803***
	(3.6193E-3)
Qualification Unknown	-0.0158***
	(3.6654E-3)
Unemployment Rate	0.0020***
	(2.7450E-4)
Sometimes Benefit	-0.1870***
	(1.9334E-3)
Continuous Benefit	-0.4490***
	(3.1679E-3)
Cohort 1941	0.0099***
	(3.2049E-3)
Cohort 1942	0.0152***
	(3.2139E-3)
Cohort 1943	0.0214***
	(3.2224E-3)
Cohort 1944	0.0225***
	(3.1505E-3)
Cohort 1945	0.0305***
	(3.1049E-3)

Table 7.6 Continued

Cohort 1946	0.0342***
	(3.0240E-3)
Cohort 1947	0.0331***
	(2.9732E-3)
Monthly Observations (n x t)	26,773,428
Number of Individuals (n)	221,268
Pseudo R-square	0.1250

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Numbers in parentheses are adjusted standard errors controlling for person-level clustering. Refer to Table 7.2 for the definition of Pseudo R-square.

Interaction with Benefit History

The average decline in the probability of being employed before and after 65 differs significantly for the three benefit history groups, as shown in Table 7.7. Before age 65, every one-month rise in age lowers the probability of being employed by 0.20 percentage points for the Never Benefit group. After 65, there is an additional 0.19 percentage-point reduction, leading to a total monthly drop of 0.39 percentage points.

The pre-65 monthly drop for the Sometimes Benefit group is 0.31 percentage points, and the post-65 monthly drop is 0.28 percentage points. That is, the pre-65 declining trend for the Sometimes Benefit group is faster than the post-65 declining trend, which is completely different from the subgroups we discussed previously, where post-65 declines are normally faster than pre-65. The slower decline in employment rates for the Sometimes Benefit group after 65 is mostly attributed to the work disincentive generated by the means-tested system of the main benefits. Transitioning from the pre-65 means-tested scheme to the post-65 non-means-tested NZS lowers the work disincentive once people reach pension age. As a result, people exit the labour market at a slower rate.

The monthly decline for the Continuous Benefit group is relatively flatter than the other two groups over the entire study period, with a 0.09 percentage-point pre-65 declining trend and a 0.20 percentage-point post-65 declining trend. The rates are almost half of those for the Never Benefit group both before and after 65. One probable explanation is that they have mostly relied on benefits (either main benefits or NZS), resulting in lower employment rates than the other two groups. As a result, their monthly exit from the labour market is less than the other two groups.

After being pension eligible, permanent drops in employment rates become obvious. But the magnitudes of the drops are different for the three groups due to their pre-65 benefit histories, which provides us an opportunity to measure the differential labour supply effects of the three groups around pension age. We use the Never Benefit group (people

who did not receive any main benefits between the ages of 60 to 64) as the control group, the Sometimes Benefit (people who had sometimes received the main benefits between the ages of 60 to 64) and Continuous Benefit (people who had continuously received the main benefits between the ages of 60 to 64) as the treatment groups, both of which can provide a counter-factual situation. We want to investigate what would have happened to those who received pre-65 main benefits if they had not received them. We assume that the Sometimes Benefit and Continuous Benefit groups would experience exactly the same employment drops after being pension eligible in the absence of pre-65 benefit history. That is, we assume that they would experience the same magnitude drop in employment rates as the Never Benefit group.

The mean predicted probability of being employed falls by 3.87 percentage points for the Never Benefit group after being pension eligible. In other words, people in the Never Benefit group would choose to exit the labour market due to a rise in the non-labour income of NZS, with a probability of 3.87 percentage points. On the basis of the assumption that in the absence of pre-65 benefit history, the drop in employment rates after 65 for the treatments groups would have been the same as in the control group (Never Benefit group), i.e., the probability of being employed for the Sometimes Benefit and Continuous Benefit groups would have decreased by 3.87 percentage points. However, the permanent drop in the probability of being employed for the Sometimes Benefit group is only 2.27 percentage points. This rate is 1.60 percentage points lower when compared to the predicted drop of 3.87 percentage points. In addition, the permanent drop in the probability of being employed for the Continuous Benefit group is only 1.53 percentage points. Compared to the predicted 3.87 percentage-point drop, this rate is 2.34 percentage points lower. The transition from pre-65 means-tested main benefits to post-65 non-means-tested NZS could be the cause of this increase in employment rate when compared with the counterfactual.

The main benefits that people received before 65 were means-tested, which would have disincentivised the beneficiaries from working. After reaching pension age, people switched to the non-means-tested NZS, which lowered the work disincentive generated by the means-tested programme, leading to a relative rise in labour supply compared to those who never received main benefits before 65. This is in line with our hypothesis from Section 2.4.3, which states that transitioning from means-tested main benefits to non-means-tested NZS increases the incentive to stay in the workforce. Furthermore, this positive relative labour supply effect is larger if a person has continuously received main

benefits between the ages of 60 and 64. Furthermore, approximately half of beneficiaries in the Continuous Benefit group received health-related benefits before 65.[67] This raises the question of whether they were fully qualified for the main benefits if they were able to resume work after transitioning to the non-means-tested NZS. However, due to data limitations, further investigation is not possible.

[67] Health-related benefits indicate Sickness Benefit (SB) and Invalid's Benefit (IB), which has been mentioned in Section 2.2.1.

Table 7.7 Probit estimation of employment rates, interaction with benefit history

	Marginal Effects
T	-0.0020***
	(1.9300E-5)
t_Post65	-0.0019***
	(2.9000E-5)
Perm	-0.0387***
	(7.1950E-4)
Sometimes Benefit t*	-0.0011***
	(5.1000E-5)
Sometimes Benefit t_Post65*	0.0022***
	(7.5000E-5)
Continuous Benefit t*	0.0011***
	(6.6200E-5)
Continuous Benefit t_Post65*	0.0008***
	(1.0660E-4)
Sometimes Benefit Perm*	0.0160***
	(1.7909E-3)
Continuous Benefit Perm*	0.0234***
	(2.5401E-3)
Other Control Variables	
Male	0.1047***
	(1.4753E-3)
NZ born	0.0435***
	(1.9156E-3)
Māori	0.0377***
	(3.0515E-3)
Pacifica	-0.0121***
	(5.2090E-3)
Asian	-0.1755***
	(4.7512E-3)
Other Ethnicities	-0.0222***
	(4.9054E-3)
Qualification Less Than University Degree	0.0282***
	(1.7296E-3)
University Degree	0.0875***
	(2.7347E-3)
Qualification Unknown	-0.0071***
	(2.9077E-3)
Unemployment Rate	0.0017***
	(2.7400E-4)
Sometimes Benefit	-0.1595***
	(2.5294E-3)
Continuous Benefit	-0.5256***
	(3.5900E-3)
Cohort 1941	0.0099***
	(3.1972E-3)
Cohort 1942	0.0153***
	(3.2067E-3)
Cohort 1943	0.0215***
	(3.2160E-3)
Cohort 1944	0.0226***
	(3.1449E-3)
Cohort 1945	0.0307***
	(3.0996E-3)
Cohort 1946	0.0345***
	(3.0190E-3)
Cohort 1947	0.0333***
	(2.9681E-3)
Monthly Observations (n x t)	26,773,428
Number of Individuals (n)	221,268
Pseudo R-square	0.1258

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Numbers in parentheses are adjusted standard errors controlling for person-level clustering. Refer to Table 7.2 for the definition of Pseudo R-square.

7.4 Conclusions

This chapter examined the changes in employment rates for the study cohort over a ten-year observation period, including the three key features (pre- and post-65 time trends, and permanent effect). It showed that the employment rates decline as people age. Significant declines occur around pension eligibility age, but the process lasts for several months, which indicates a transition period for exiting the workforce.

To precisely capture the changes in employment rates, Probit regression was used in this study. Significant differential labour supply behaviour was discovered, particularly among individuals having pre-65 benefit histories, as illustrated in Table 7.8. For the entire sample cohort, the average monthly decline in the probability of being employed is 0.21 percentage points before 65, and 0.37 percentage points after 65. The permanent drop of being pension eligible was 3.40 percentage points.

Males have a slower rate of decline in the probability of being employed before 65 and a faster rate of decline in the probability of being employed after 65. Before 65, the probability of being employed is -0.20 percentage points for males, and -0.22 percentage points for females each month. After 65, the probability of being employed is -0.38 percentage points for males, and -0.35 percentage points for females each month. Males also have a higher permanent decline in employment rates than females after being pension eligible, with 4.04 percentage points for males and 2.82 percentage points for females. These results support Dixon and Hyslop's findings in 2008 that males were more likely than females to leave the workforce when they reached pension age.

Country of birth has a smaller impact on the probability of being employed. For example, before 65, the monthly declines in the probability of being employed are both 0.21 percentage points for NZ-born and foreign-born cohorts. After 65, the monthly decline is 0.37 percentage points for people born in NZ, and 0.36 percentage points for people born overseas. In addition, the permanent drop after being pension eligible is 3.38 percentage points for NZ-born cohort, and 3.46 percentage points for foreign-born cohort, only a 0.08 percentage-point difference.

People with some European identity have faster monthly and permanent declines in the probability of being employed than people with other ethnicities. Before 65, the monthly decline in the probability of being employed is 0.21 percentage points for people with some European identity, 0.17 percentage points for people with some Māori identity, 0.19

percentage points for people with some Pacifica identity, and 0.16 percentage points for people with some Asian identity. After 65, the monthly decline in the probability of being employed is 0.37 percentage points for people with some European identity, 0.35 percentage points for people with some Māori identity, 0.34 percentage points for people with some Pacifica identity, and 0.24 percentage points for people with some Asian identity. The permanent drop after reaching pension eligibility is 3.53 percentage points for people with some European identity, 2.96 percentage points for people with some Māori identity, 2.76 percentage points for people with some Pacifica identity, and 1.78 percentage points for people with some Asian identity. The faster workforce exit rate that people with some European identity had is most likely due to their higher NZS take-up rates. As people with other ethnic identities have relatively lower NZS take-up rates, they may have to resume working after reaching pension age.

People with different educational attainments have similar monthly declines in the probability of being employed, with about 0.21 percentage points before 65 and about 0.36 percentage points after 65. However, the permanent drops after reaching the pension eligibility age vary, with 3.62 percentage points for people without any qualifications, 3.35 percentage points for people with qualifications less than university degrees, and 2.91 percentage points for people with university degrees. This indicates that people with higher educational attainments are less likely to exit the labour market and more likely to work till age 70 (Khawaja & Boddington, 2009; Ranchhod, 2006), which could be attributed to the nature of their jobs that are less physically demanding and therefore less affected by declining physical health. It could also reflect the increased work flexibility that they have to work part-time.

Both monthly and permanent declines differ significantly for the three benefit history subgroups. The monthly decline for the Never Benefit group in the probability of being employed is 0.20 percentage points prior to 65, and 0.39 percentage points post-65. The Sometimes Benefit group has a faster pre-65 declining trend (0.31 percentage points) than post-65 (0.28 percentage points). The Continuous Benefit group has a relatively flatter decline trend both before (0.09 percentage points) and after (0.20 percentage points) 65. One possible explanation for the flatter time trends of the Continuous Benefit group is that they have mostly relied on either main benefits or NZS, resulting in lower employment rates than the other two groups. As a result, their monthly exit from the labour market is less than the other two groups.

We discovered substantial positive relative labour supply effects of those having benefit histories, using the Never Benefit as the control group, the Sometimes Benefit and the Continuous Benefit as the treatment groups, both of which can provide a counter-factual situation. We assume that the Sometimes Benefit and Continuous Benefit groups would experience exactly the same employment drops (3.87 percentage points) after being pension eligible in the absence of pre-65 benefit history. We found that the Sometimes Benefit group has a relative 1.60 percentage-point rise, and the Continuous Benefit group has a relative 2.34 percentage-point rise in the probability of being employed, when compared to the Never Benefit group. That is, people with a pre-65 benefit history have a positive relative labour supply impact than those without a pre-65 benefit history. Furthermore, this effect is even bigger if people had continuously received main benefits between the ages of 60 and 64. This finding supports our hypothesis that transitioning from means-tested main benefits to non-means-tested NZS will reduce the work disincentive generated by the means-tested scheme. In other words, being pension eligible accelerates the exit from the labour market for general people. However, it reduces the work disincentive generated by the pre-65 means-tested main benefits, resulting in a relative rise in participation in the labour force. This substantial impact has never been discovered before.

Two concerns are raised in this study. First, the overall employment rate was overestimated as we include annual self-employment income as a proxy for employment, assuming a person worked every month if he or she earned self-employment income. Second, the exit from the labour market at pension age would be underestimated. Some people may not be completely retired when they reach retirement age. Instead, they may reduce working hours by switching from full-time to part-time. However, this could not be estimated due to a lack of working hour information in the IDI. This, too, could not be measured due to data limitations.

Table 7.8 Key features on patterns of monthly employment rates from ages 60 to 70

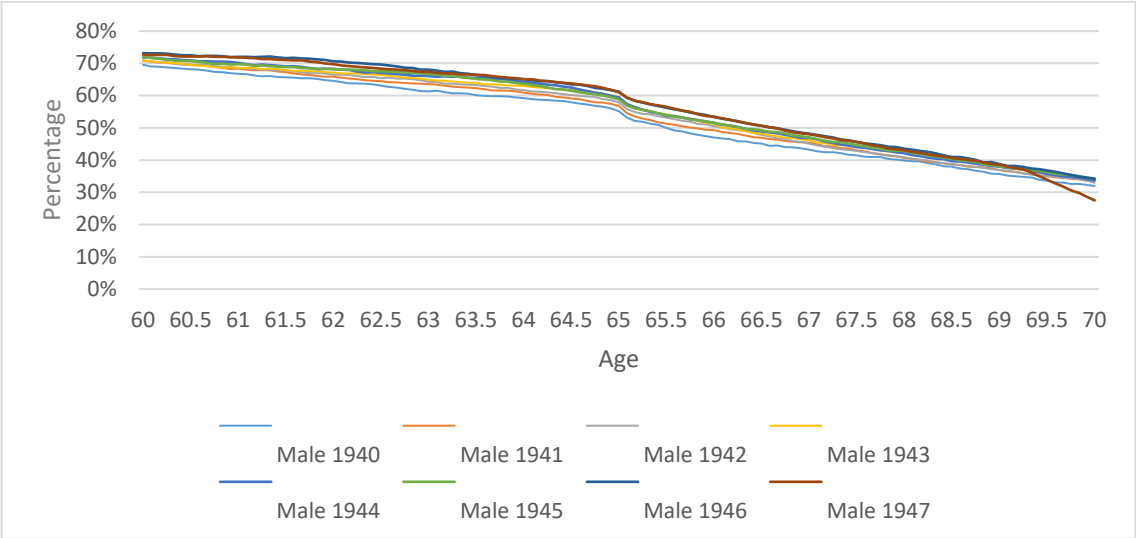
	Pre-65 Linear Time Trend	**Permanent Intercept Shift after being Pension Eligible**	**Post-65 Linear Time Trend**
	1	2	3
Full Sample	-0.0021***	-0.0340***	-0.0037***
By Gender			
Males	-0.0020***	-0.0404***	-0.0038***
Females	-0.0022***	-0.0282***	-0.0035***
By Country of Birth			
NZ Born	-0.0021***	-0.0338***	-0.0037***
Foreign Born	-0.0021***	-0.0346***	-0.0036***
By Ethnicity			
Europeans	-0.0021***	-0.0353***	-0.0037***
Māori	-0.0017***	-0.0296***	-0.0035***
Pacifica	-0.0019***	-0.0276***	-0.0034***
Asian	-0.0016***	-0.0178***	-0.0024***
Other Ethnicities	-0.0018***	-0.0232***	-0.0035***
By Education			
No Qualification	-0.0021***	-0.0362***	-0.0036***
Qualification Less Than University Degree	-0.0021***	-0.0335***	-0.0038***
University Degree	-0.0021***	-0.0291***	-0.0036***
Qualification Unknown	-0.0020***	-0.0340***	-0.0034***
By Benefit History			
Never Benefit	-0.0020***	-0.0387***	-0.0039***
Sometimes Benefit	-0.0031***	-0.0227***	-0.0028***
Continuous Benefit	-0.0009***	-0.0153***	-0.0020***

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. This is a summary of Probit estimates on employment rates from Table 7.2 to Table 7.7.

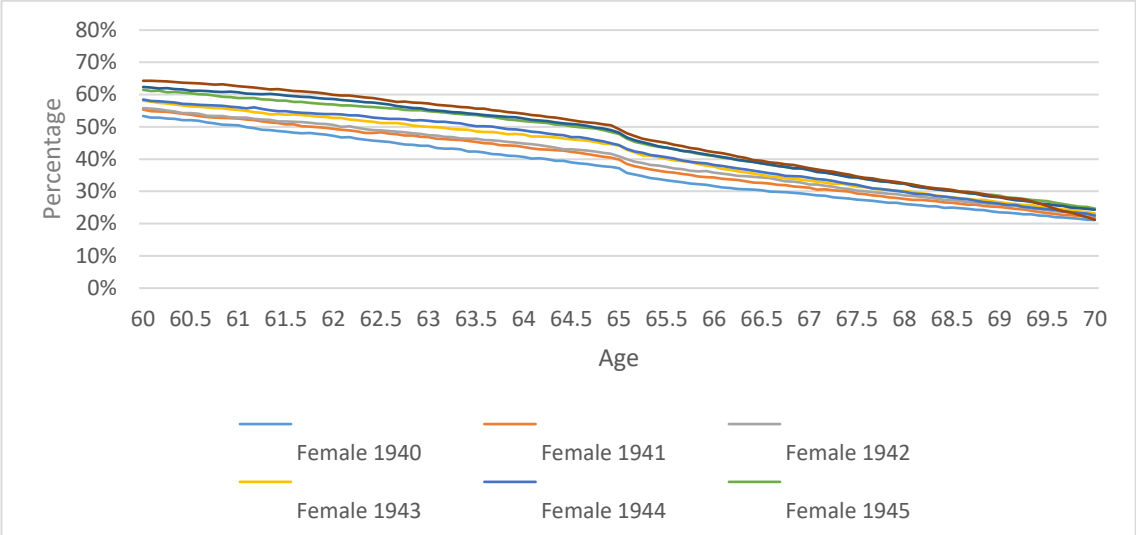
7.5 Appendix 7

Appendix A 7.1: Employment rates by birth cohorts and gender

Figure A 7.1 Employment rates (including self-employment) by birth cohorts



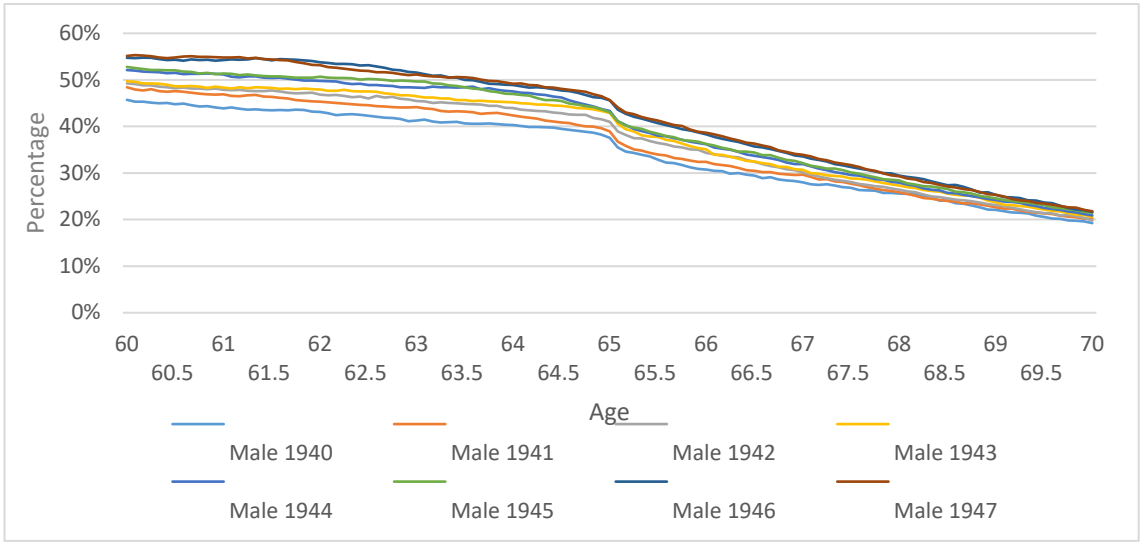
(a) Males



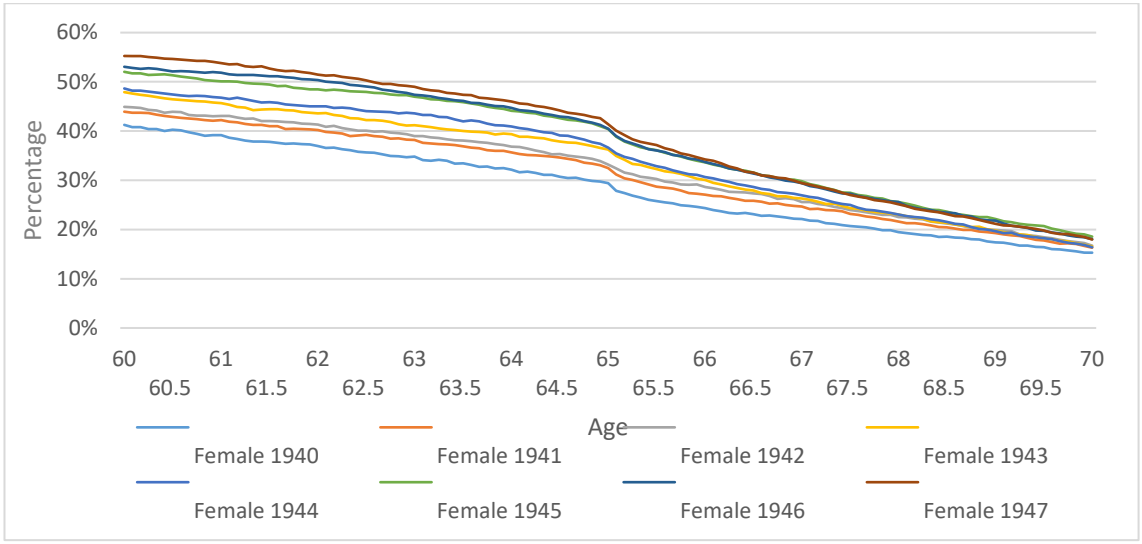
(b) Females

Source: Refer to Figure 5.1 for further information

Figure A 7.2 Employment rates (excluding self-employment) by birth cohorts



(a) Males

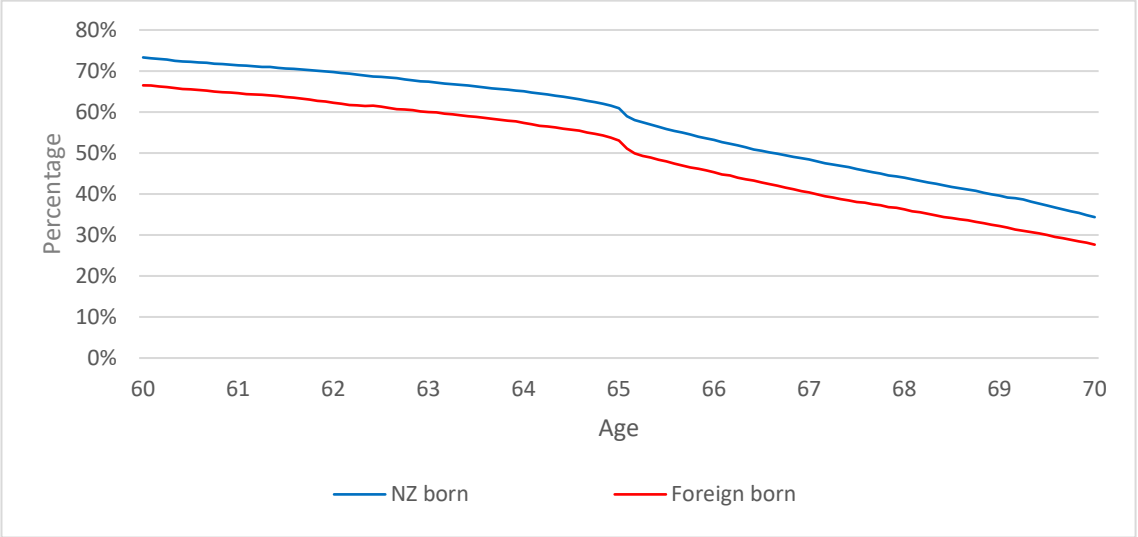


(b) Females

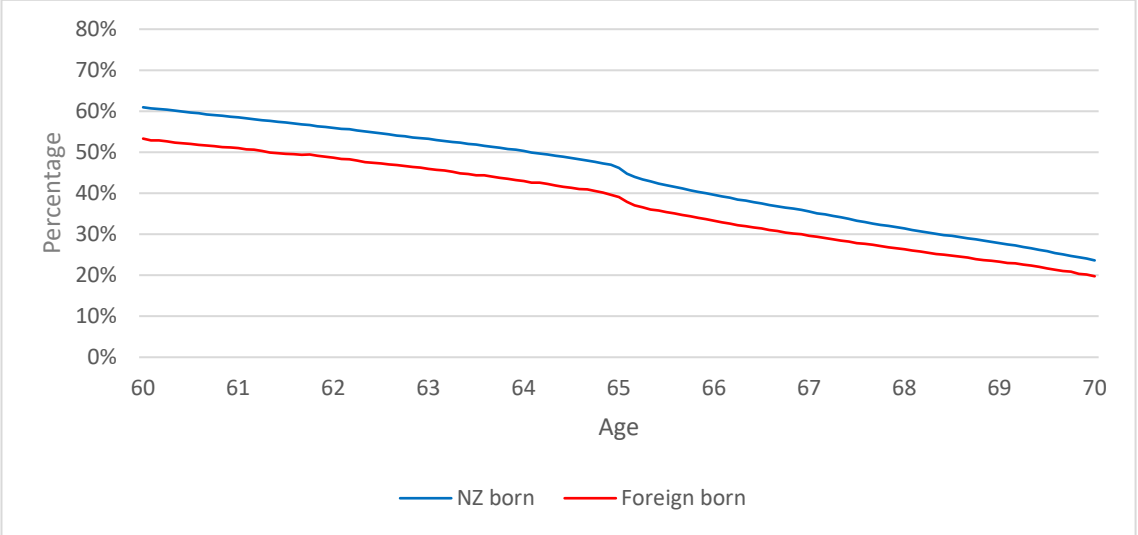
Source: Refer to Figure 5.1 for further information

Appendix A 7.2: Employment rates by country of birth and gender

Figure A 7.3 Employment rates by country of birth



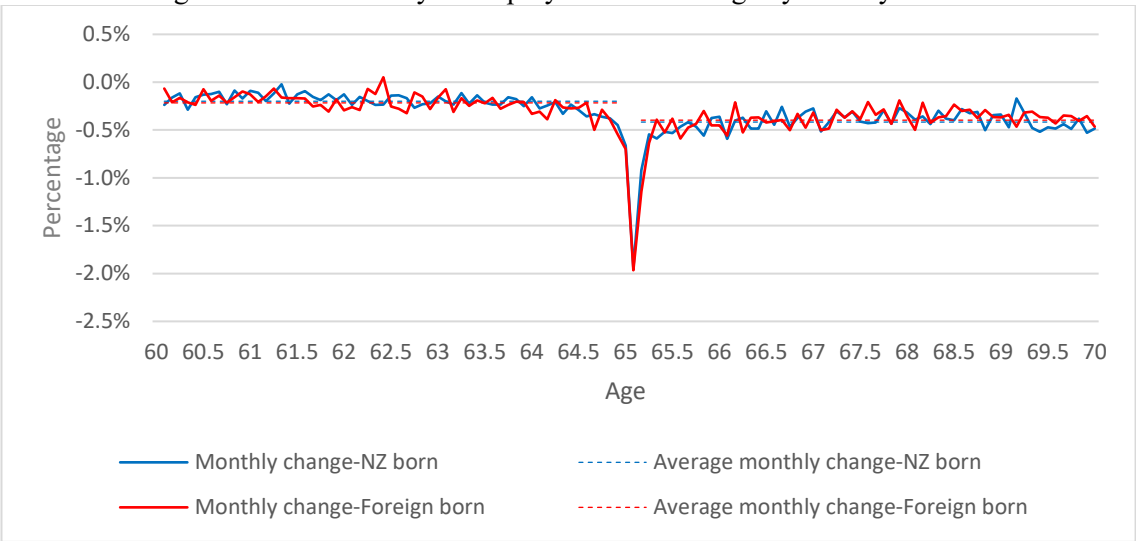
(a) Males



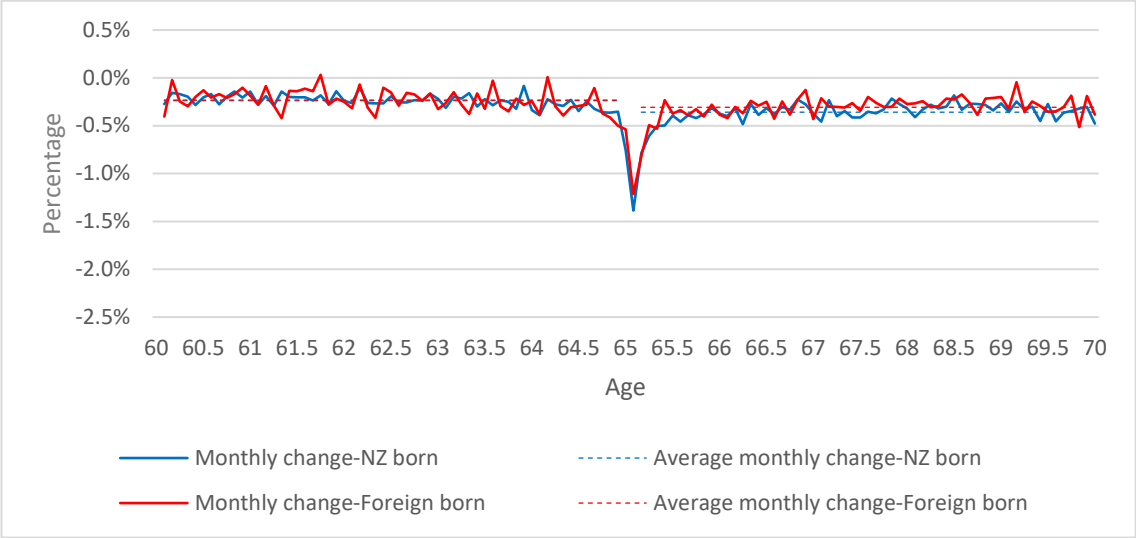
(b) Females

Source: Refer to Figure 5.1 for further information

Figure A 7.4 Sensitivity of employment rate change by country of birth



(a) Males

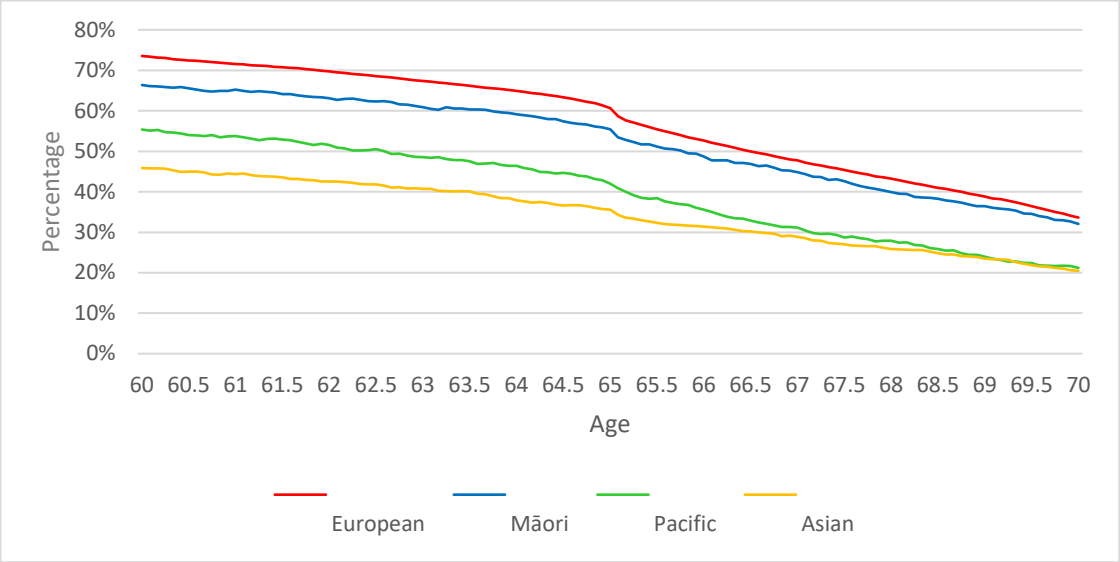


(b) Females

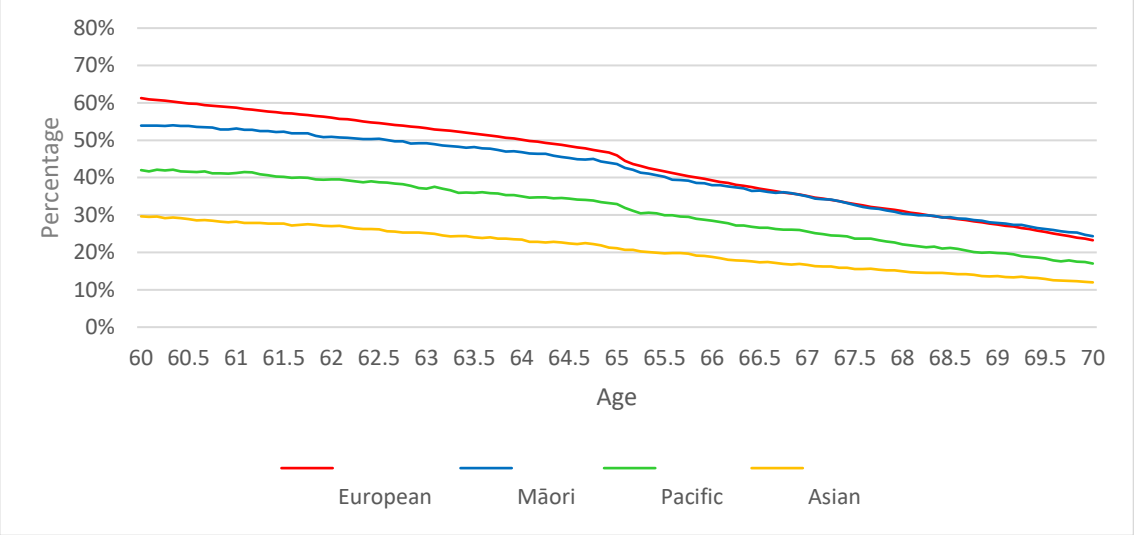
Source: Refer to Figure 5.1 for further information

Appendix A 7.3: Employment rates by ethnicity and gender

Figure A 7.5 Employment rates by ethnicity



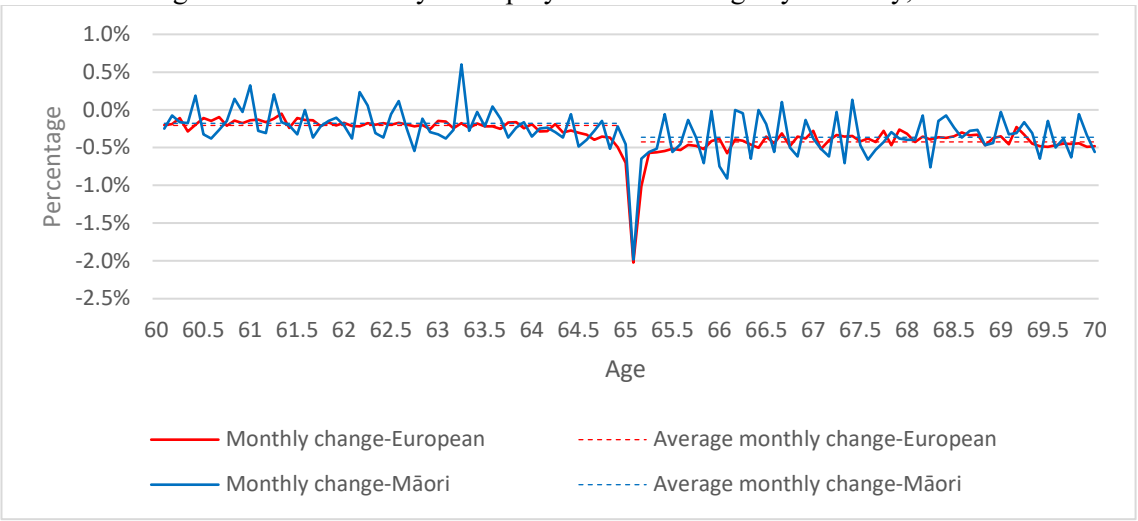
(a) Males



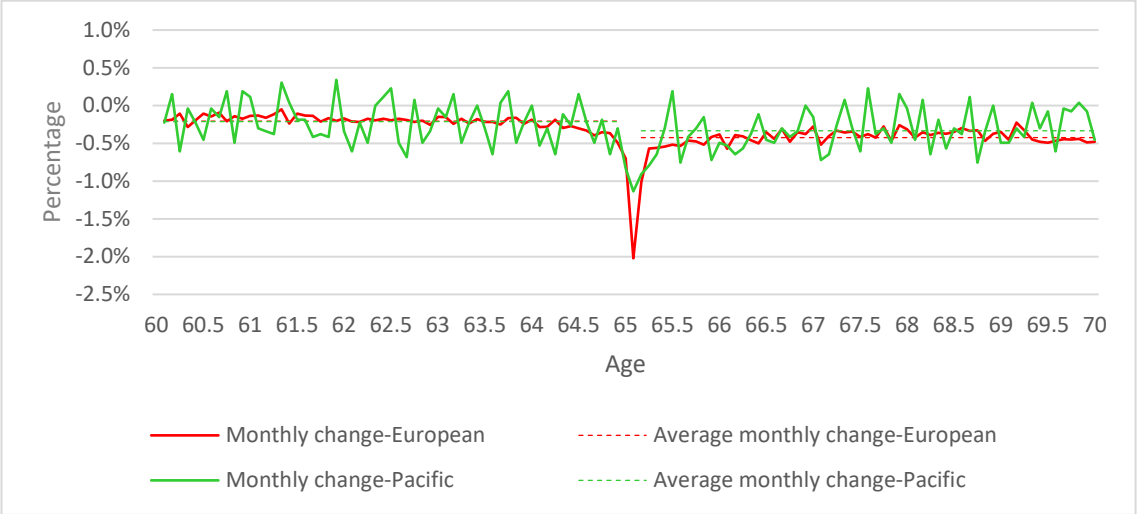
(b) Females

Source: Refer to Figure 5.1 for further information

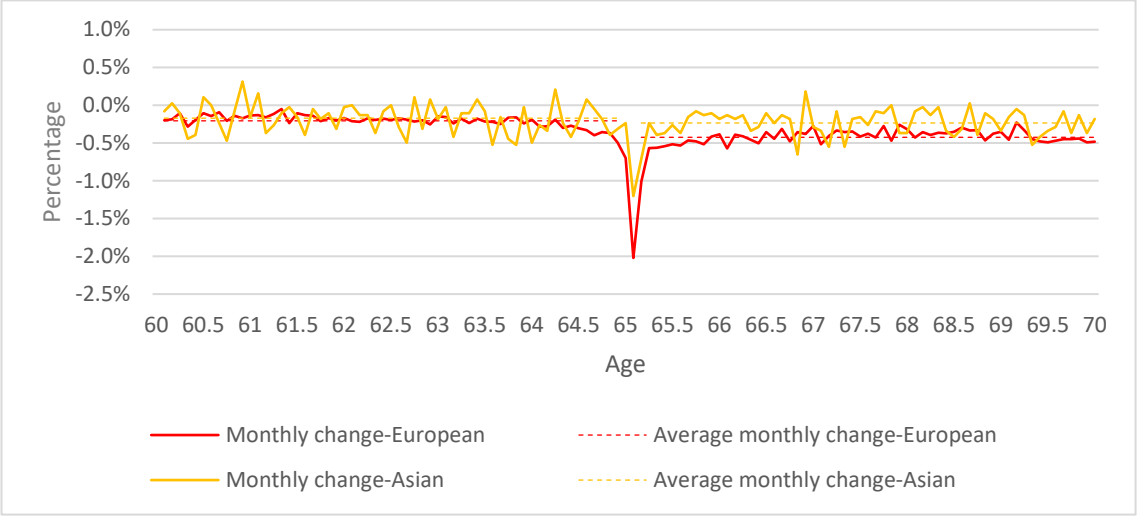
Figure A 7.6 Sensitivity of employment rate change by ethnicity, males



(a) European and Māori



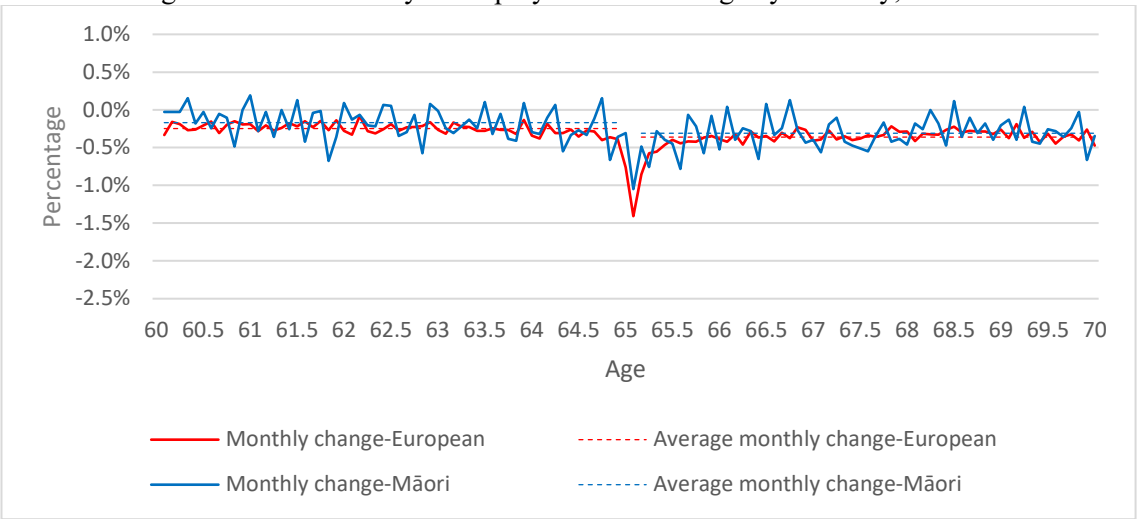
(b) European and Pacifica



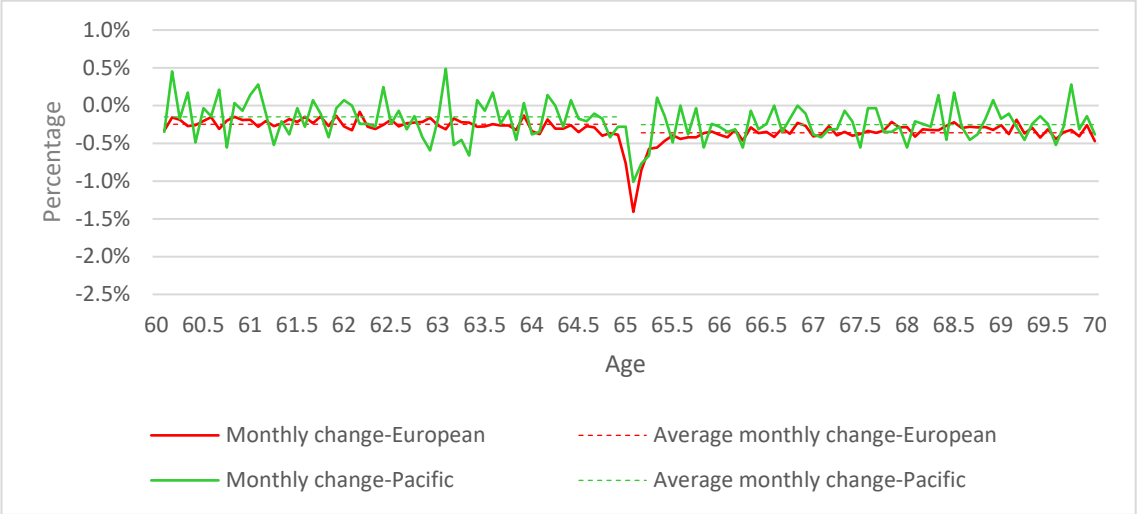
(c) European and Asian

Source: Refer to Figure 5.1 for further information

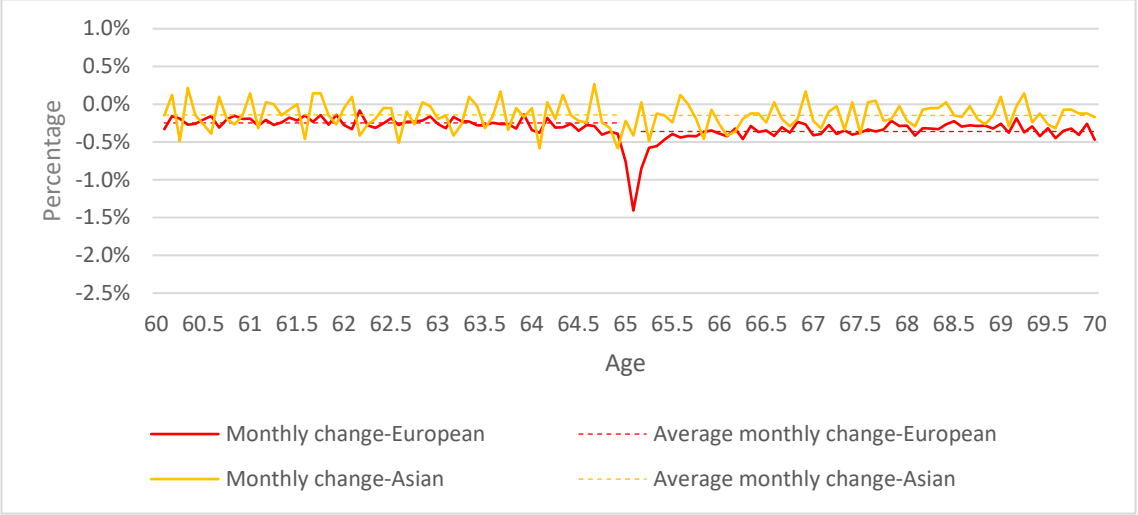
Figure A 7.7 Sensitivity of employment rate change by ethnicity, females



(a) European and Māori



(b) European and Pacifica

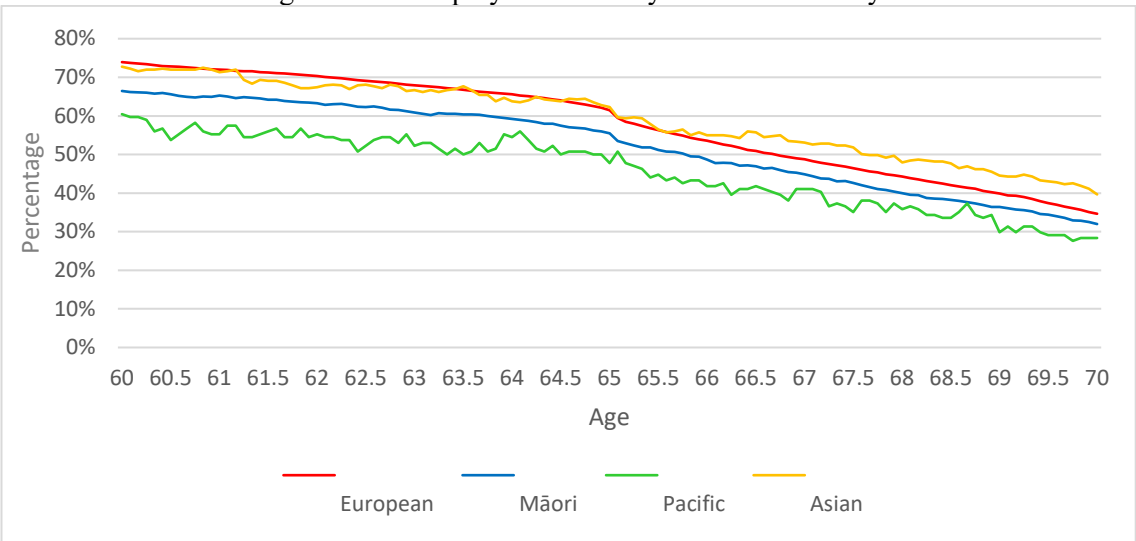


(c) European and Asian

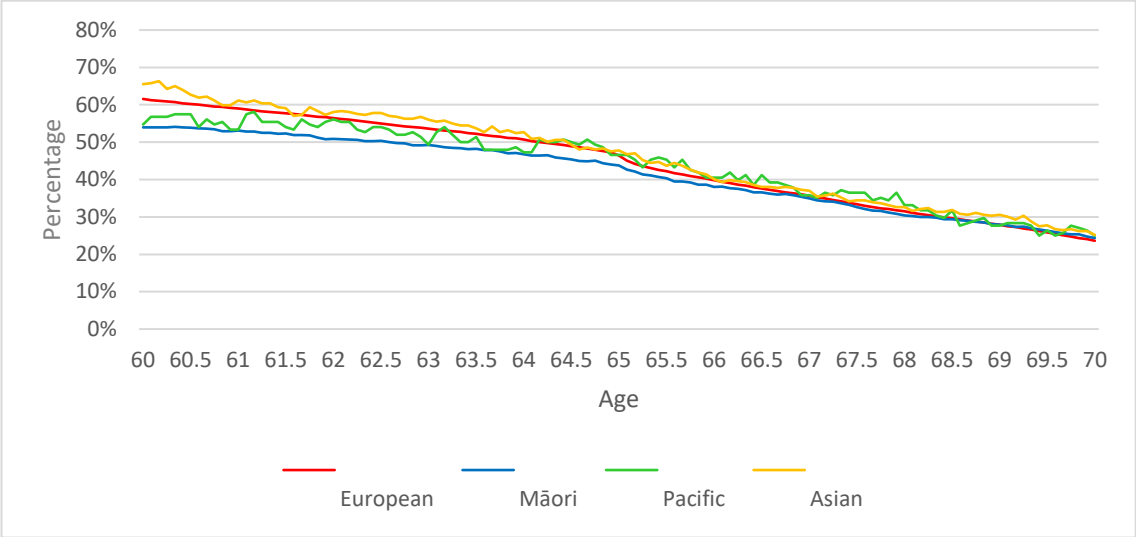
Source: Refer to Figure 5.1 for further information

Appendix A 7.4: Employment rates by ethnicity and gender (NZ-born only)

Figure A 7.8 Employment rates by NZ-born ethnicity



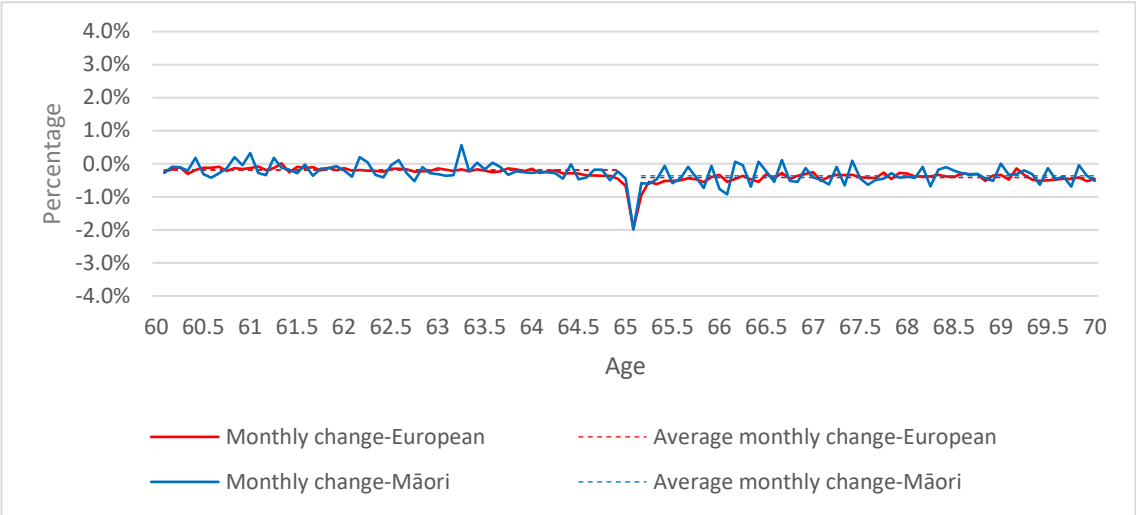
(a) Males



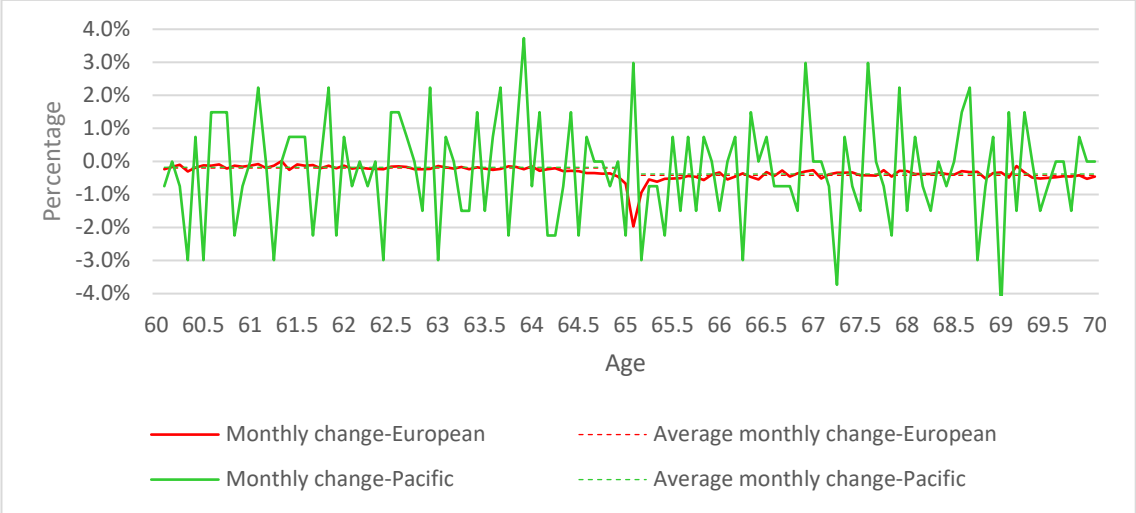
(b) Females

Source: Refer to Figure 5.1 for further information

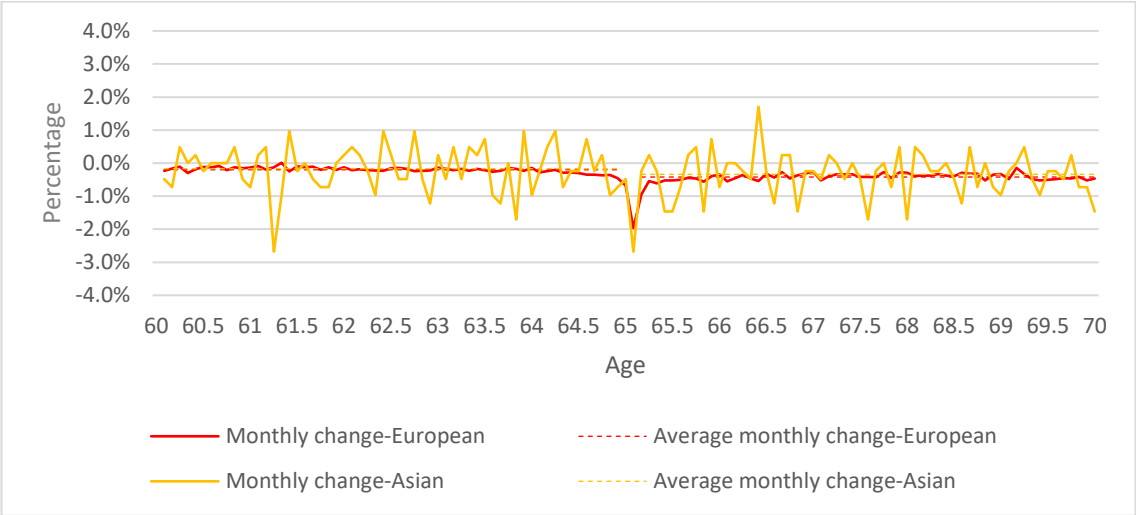
Figure A 7.9 Sensitivity of employment rate change by NZ-born ethnicity, males



(a) European and Māori



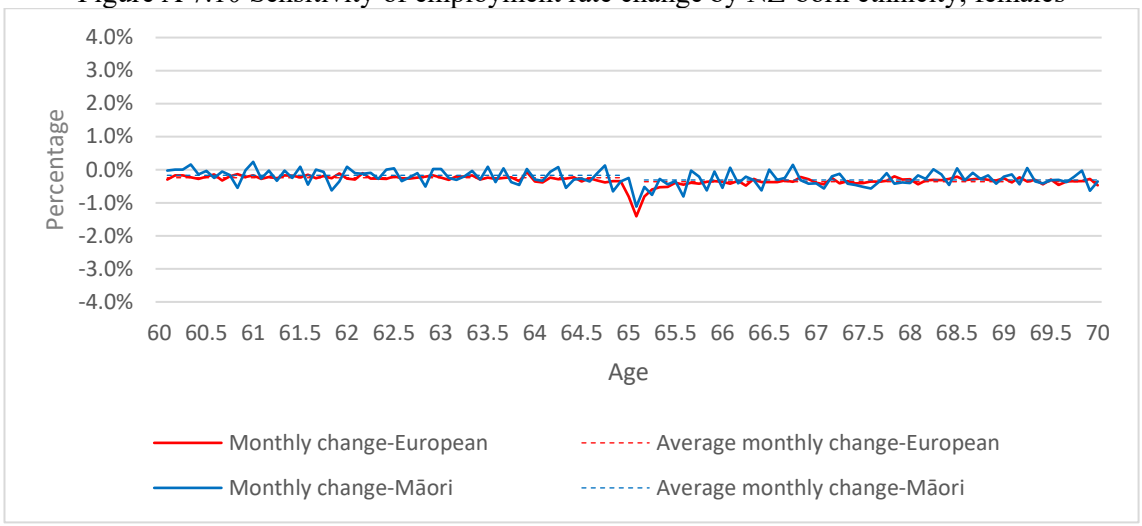
(b) European and Pacifica



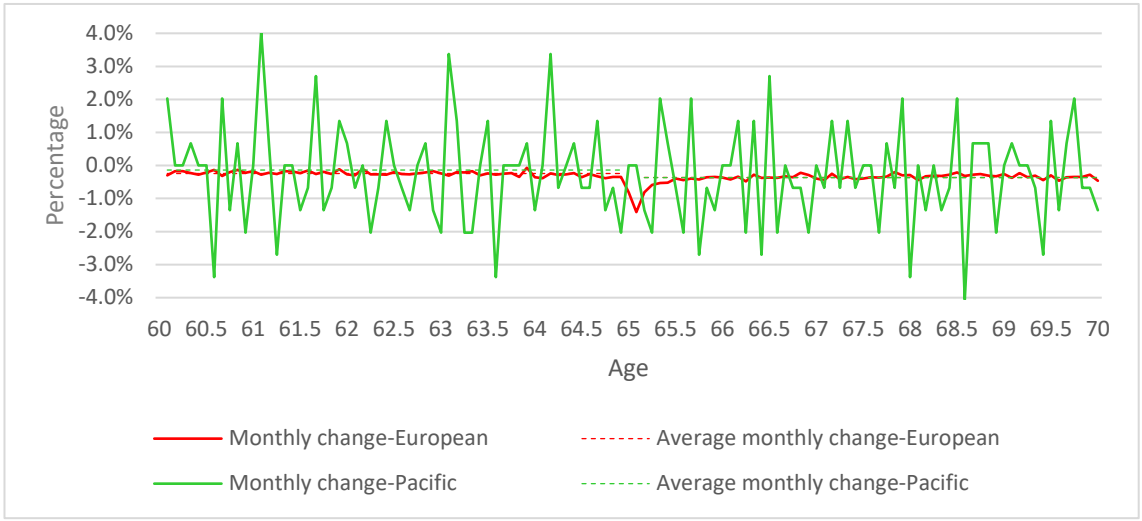
(c) European and Asian

Source: Refer to Figure 5.1 for further information

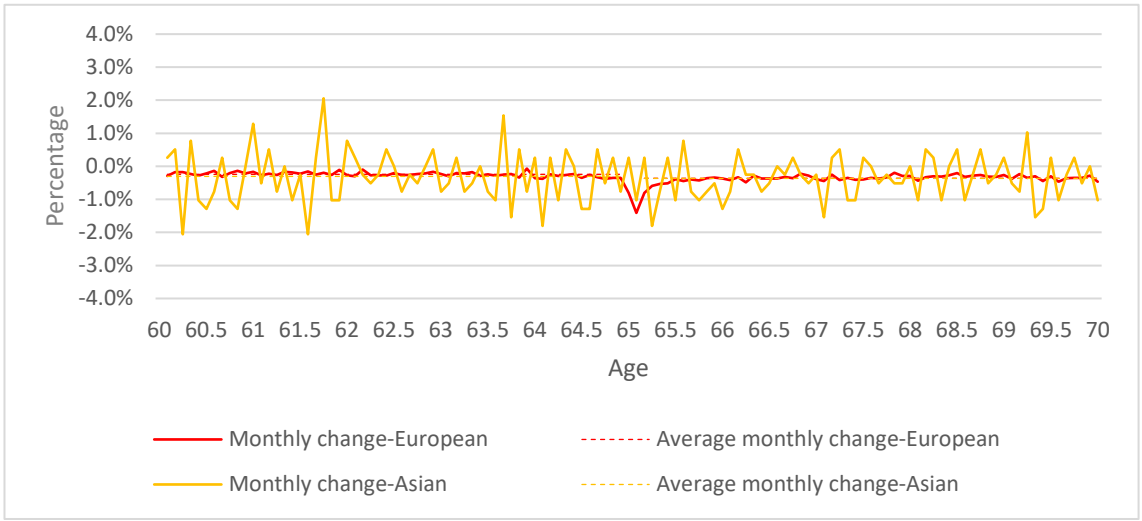
Figure A 7.10 Sensitivity of employment rate change by NZ-born ethnicity, females



(a) European and Māori



(b) European and Pacifica

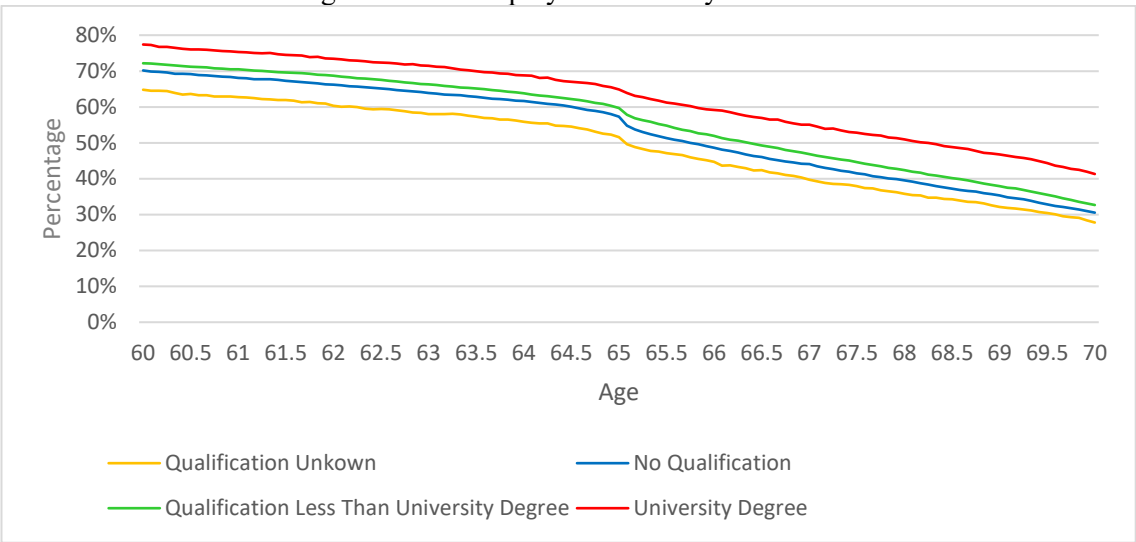


(c) European and Asian

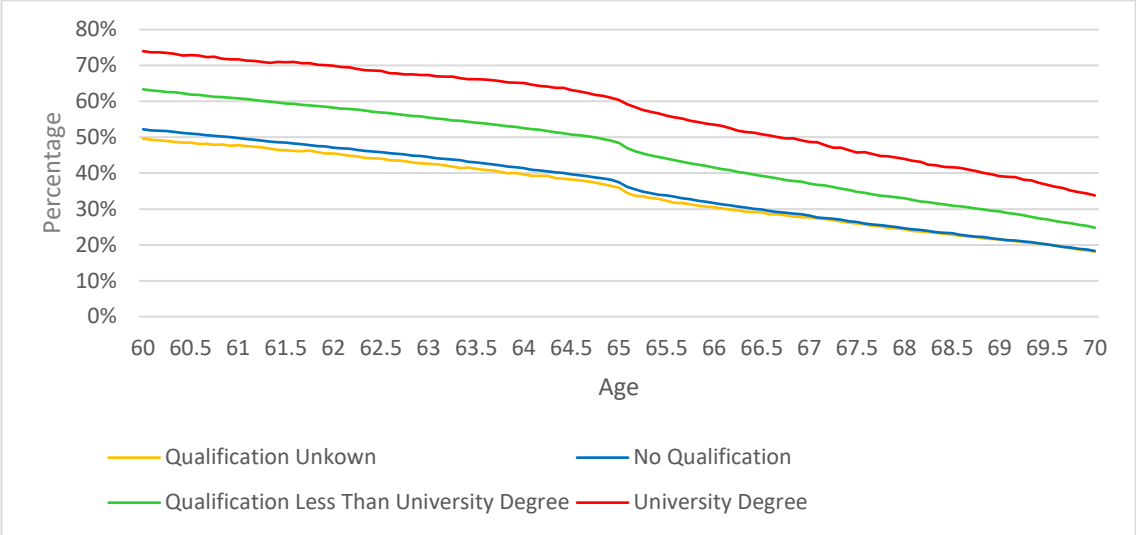
Source: Refer to Figure 5.1 for further information

Appendix A 7.5: Employment rates by education and gender

Figure A 7.11 Employment rates by education



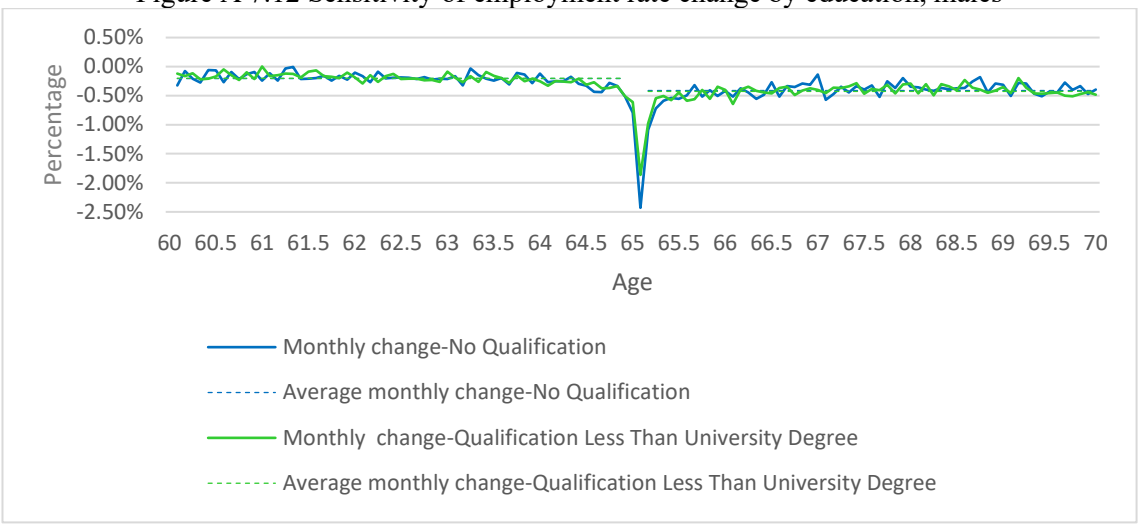
(a) Males



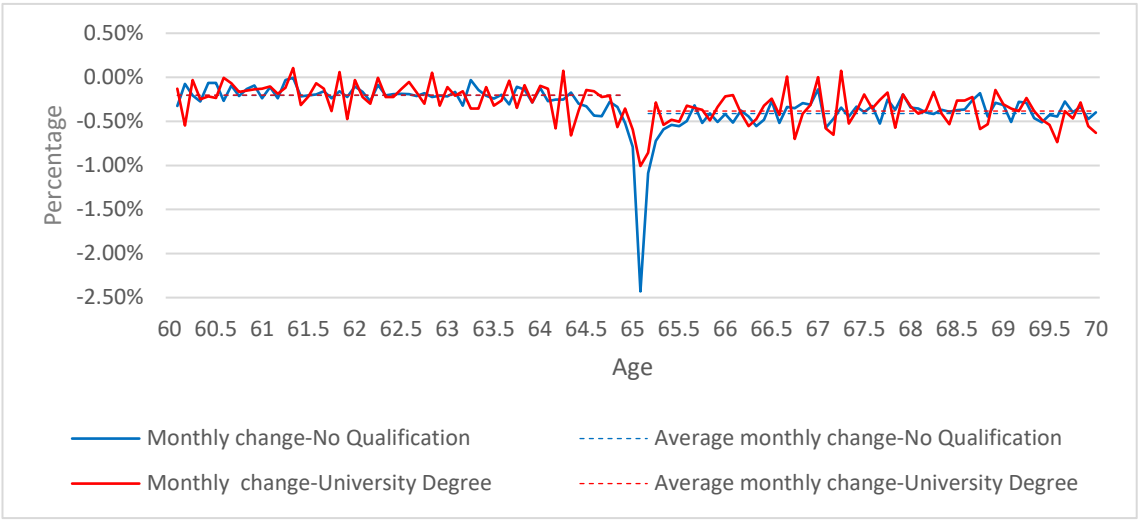
(b) Females

Source: Refer to Figure 5.1 for further information

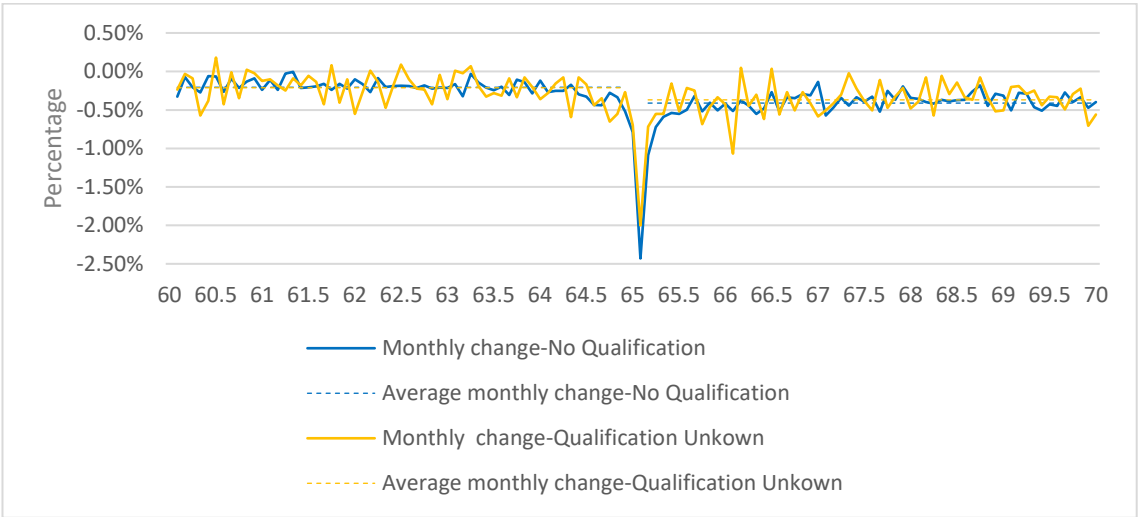
Figure A 7.12 Sensitivity of employment rate change by education, males



(a) No Qualification and Qualification Less Than University Degree



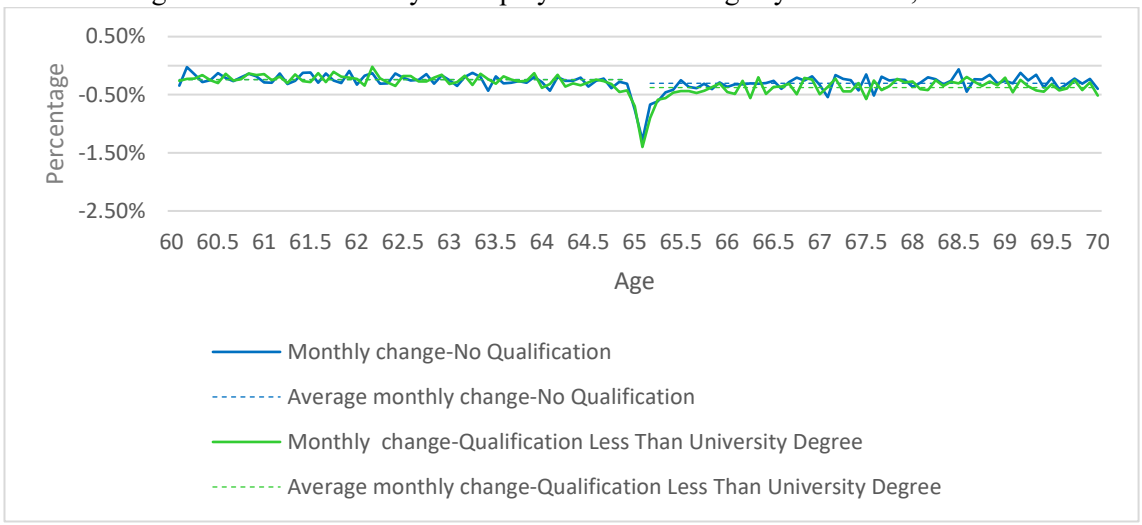
(b) No Qualification and University Degree



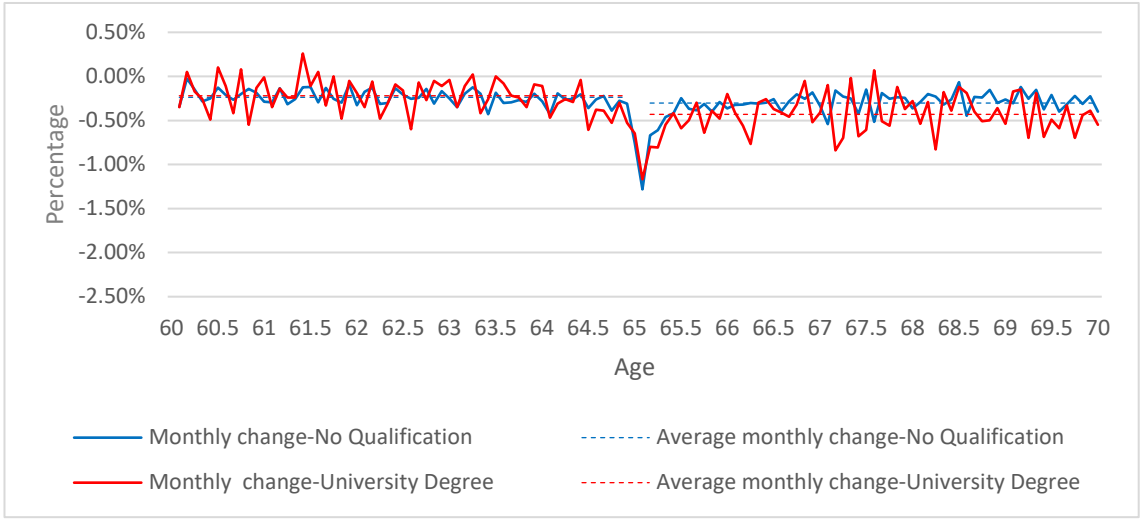
(c) No Qualification and Qualification Unknown

Source: Refer to Figure 5.1 for further information

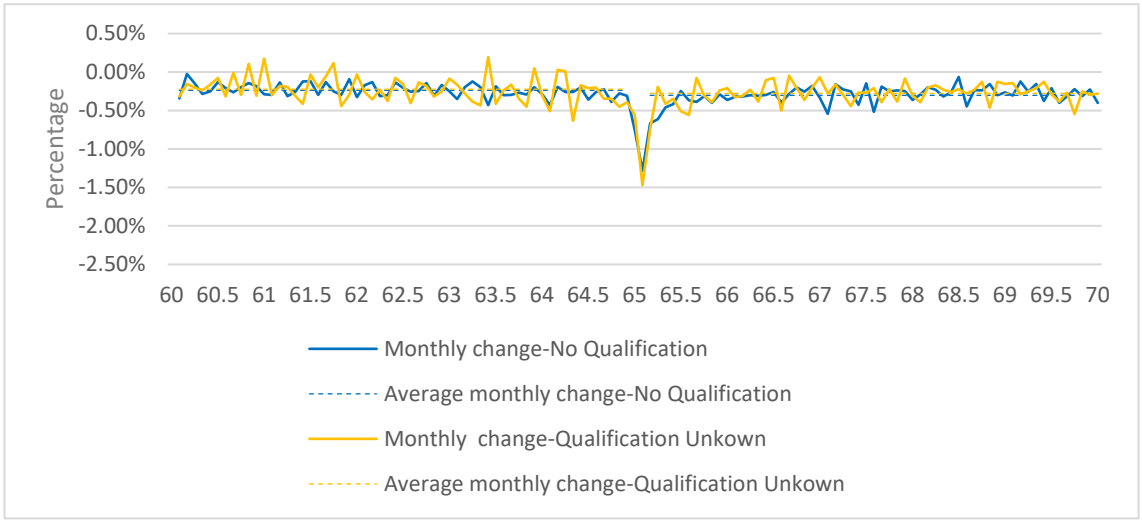
Figure A 7.13 Sensitivity of employment rate change by education, females



(a) No Qualification and Qualification Less Than University Degree



(b) No Qualification and University Degree

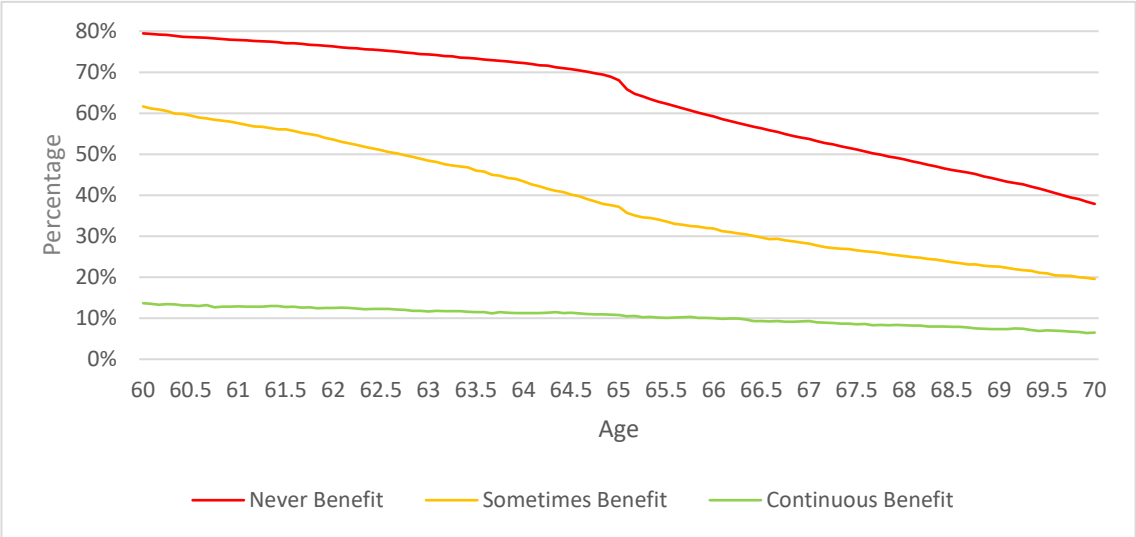


(c) No Qualification and Qualification Unknown

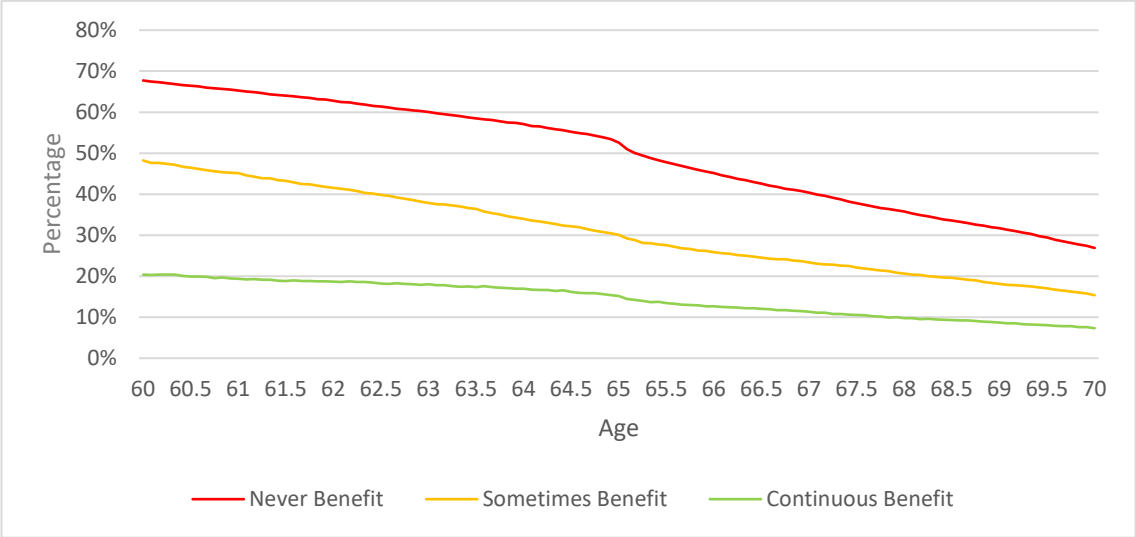
Source: Refer to Figure 5.1 for further information

Appendix A 7.6 : Employment rates by benefit history and gender

Figure A 7.14 Employment rates by benefit history



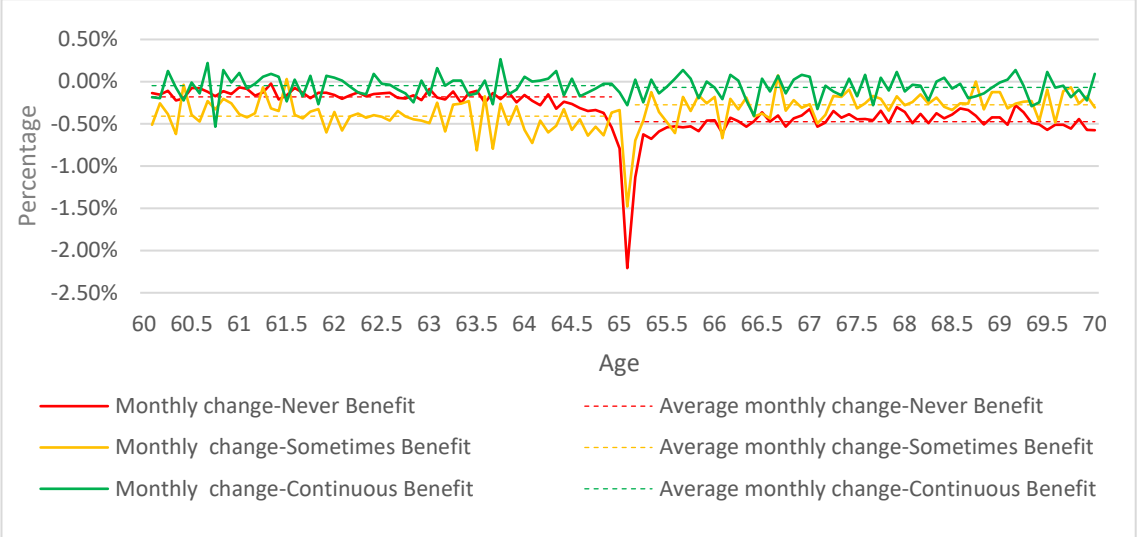
(a) Males



(b) Females

Source: Refer to Figure 5.1 for further information

Figure A 7.15 Sensitivity of employment rate change by benefit history



(a) Males

(b) Females

Source: Refer to Figure 5.1 for further information

8 Summary and Conclusions

8.1 Introduction

The aim of this study has been to examine the behavioural implications of pension eligibility, including New Zealand Superannuation (NZS) take-up rates, total and work income, and employment rates.

Chapters 5, 6 and 7 all used the same linked dataset from IDI, a sample cohort of 221,268 individuals who were likely eligible for Superannuation at age 65, consisting of 108,426 males (49 percent) and 112,842 females (51 percent).[68] A ten-year observation period was included, five years before and after this pension age.

Chapter 5 analysed the NZS take-up rate for the entire sample cohort, as well as various subgroups. The Hazard-based duration models were used to capture the occurrence of not taking up NZS, including the Kaplan-Meier estimator and the Cox proportional hazards model. Empirical evidence of take-up issues was found for some subpopulations.

Chapter 6 looked at the changes in total and work income over a ten-year period, separately. Four key features of total and work income, pre- and post-time trends, and temporary and permanent effects of being pension eligible, were examined. It introduced the idea of NZS as an 'income enhancement' rather than the typical view of it as an immediate replacement of lost work income at pension age. Furthermore, the length of the enhancement effect was predicted from the regression results.

Chapter 7 focused on the employment patterns five years before and after pension age. It highlighted the nearly linear time trends and the permanent drop in employment rates when people reached pension age. In addition, it provided new insights on the differential labour supply behaviour of people in various subgroups.

The following sections of this chapter present a summary of the key findings of this research and provide some related discussions. On the basis of these findings, this chapter provides some possible future policy implications for the current pension system.

[68] About 0.25% of the total sample cohort who took up NZS once they reached age 65 but reportedly stopped receiving it by age 70, which may be indicative of errors in administrative data was removed in the survival analysis in Chapter 5.

Furthermore, the data and methodology limitations are also highlighted in this chapter. Lastly, suggestions are made for some potential future research in this area.

8.2 Overall Findings

We believe that this study provides important insights and significant findings related to the possible effects of NZS on take-up rates, and the impact of the NZS system on over 65 age group's income and employment.

8.2.1 NZS Take-up Rates

Unlike other pension schemes, which will be affected by the contribution rates and means-testing rules, NZS solely depends on the age of 65, partnership, and residency status. This motivates us to see a 100 percent take-up rate after age 65 for the eligible cohort. In addition, the New Zealand (NZ) government also aims to grant and assess the full and correct entitlement to all eligible individuals (WEAG, 2018). However, this does not appear to be the case.

The NZS take-up rate for the entire sample cohort was 96.4 percent three months after turning 65, and it continued to increase over time, reaching 98.7 percent at age 70. These findings were far higher than the two prior studies (Dixon & Hyslop, 2008; Hurnard, 2005), which found that the maximum NZS take-up rates were around 95 percent and 92 percent following the age of eligibility for Superannuation, respectively. Our study did a better job of identifying an eligible population by excluding those who appear to be ineligible for NZS from our sample cohort. We removed individuals who emigrated permanently to other countries, as well as those who died over the observation period. However, due to data limitations, we can only ensure that our sample cohort meets five years of residency between the ages of 60 and 65. We cannot guarantee that all individuals have 10 years of residency since age 20.

Our results showed that, normally, groups with relatively lower initial NZS take-up rates had higher increasing rates up to age 70. The NZS take-up rate gaps narrow over time. A major reason in some cases for this increase in take-up rates is the failure to meet the NZS residency requirements immediately after turning 65. However, it could also indicate unnecessary delays with individuals applying for and receiving their NZS entitlements once they become eligible for this public pension, which could be related to the information and administrative costs discussed by Hernanz et al. (2004).

Meeting the residency requirements seem like one of the biggest obstacles to taking up NZS, especially for those who were born in foreign countries. For example, the probability of taking up NZS in a given month after age 65 is 9.4 percentage points higher for NZ-born individuals compared to foreign-born ones. Similarly, compared to Europeans, the probability of taking up NZS in a given month after 65 is 15.3 percentage points lower for Pacifica and 39.3 percentage points lower for Asians, as most Asians and Pacifica people were born in foreign countries in our sample cohort.[69] It indicates that even though we tried to rule out the possibility of people not meeting the NZS residency criteria when constructing the sample cohort, there were still people who failed to meet them. However, this group of people who failed to meet NZS residency requirements could have received main benefits.

We observed potential take-up barriers for Māori, even considering the receipt of general government benefits. For example, compared to Europeans, the probability of taking up NZS in a given month after age 65 is 9.2 percentage points lower for Māori, and the probability of taking up NZS/main-benefits in a given month after age 65 is 7.4 percentage points lower. We rule out the possibility that Māori's lower take-up is due to them not meeting NZS residency given 96 percent of them in our sample cohort were born in NZ.[70] This provides some evidence of the take-up issue of a universal public pension system without means-testing found in the existing literature, which only focuses on the means-tested benefits (Van Oorschot, 1991). Furthermore, it shows some ethnic inequalities in pension protection argued by Vlachantoni et al. (2017).

Our hypothesis of not fully taking up NZS because they remain on main benefits is partially true. For example, after considering general government benefits, the Kaplan-Meier NZS/main-benefits non-take-up rates are always lower than the NZS non-take-up rates. However, these redefined non-take-up rates do not reach zero for most of the subgroups after being pension eligible, except for people continuously receiving main benefits between the ages of 60 and 64. Cox proportional hazard estimates, at the same time, also provide some evidence of people remaining on the main benefits instead of transitioning to NZS right after being pension eligible. For example, compared to Europeans, the probability of taking up NZS in a given month after age 65 is 9.2 percentage points lower for Māori, but the probability of taking up NZS/main-benefits in

[69] Refer to footnote 40 for further information about foreign-born Asian and Pacifica people.
[70] Refer to footnote 40 for further information.

a given month after age 65 is only 7.4 percentage points lower. For the Sometimes Benefit group, the probability of taking up NZS in a given month after age 65 is 1.2 percentage points lower and the probability of taking up NZS/main-benefits in a given month after age 65 is 19.5 percentage points higher compared to the Never Benefit group. For the Continuous Benefit group, the probability of taking up NZS in a given month after age 65 is 1.7 percentage points lower and the probability of taking up NZS/main-benefits in a given month after age 65 is 36.2 percentage points higher compared to the Never Benefit group. We would expect that beneficiaries would be informed by Work and Income that they could be eligible for higher monthly payments from NZS after 65. Especially if they were continuously on the main benefits, they should have directly transitioned from the main benefits to NZS. For this reason alone, they would be expected to have higher NZS take-up rates than the Never Benefit and Sometimes Benefit groups. However, this is not the case. Some of them continued to remain on the main benefits after being pension eligible, which is most likely due to health issues. They may have received a more generous total support, including monetary and non-monetary benefits, than NZS, which drove them to choose to stay on main benefits. Unfortunately, we do not have the data to confirm this.

8.2.2 Income

Three significant findings on the impact of eligibility on average total income were uncovered. First, the post-65 monthly decline in total income is normally faster than pre-65, with the exceptions of the Sometimes Benefit and Continuous Benefit subgroups. The Sometimes Benefit group experienccs a faster pre-65 decline in total income than post-65, which may be due to the faster decline in work income before 65. The Continuous Benefit group has a nearly flat total income trend before 65, largely because they relied almost entirely on the main benefits. After being pension eligible, the Continuous Benefit group doesn’t see a drop in total income like other subgroups, but experiences a rise of $1.75 each month, which is largely due to the increase in NZS take-up rates.

Second, the temporary rises in total income in the month of reaching 65 are smaller than the permanent effects of being pension eligible, as it is the transition period for getting NZS. This temporary rise in total income is most likely due to the partial effect of receiving NZS instead of the bump in work income resulting from lump sum redundancy or retirement payments that may have occurred at 65.

Third, statistically significant permanent effects are found on total income after being pension eligible, with an average of $564.99 for the overall cohort, which is equivalent to a substantial 30.8 percent of the average income at the age of 64. Though the rates differ by subgroups, the effects are substantial. One of the factors that influences the magnitude of the permanent effect is the residency condition of NZS. For example, NZ-born people have a higher permanent effect than foreign-born, because NZ-born people are more likely to meet the NZS requirements. We have tried to create a sample who should be eligible for NZS even if they were born in foreign countries. However, due to data limitations, we could only ensure people met the five years' residency between the ages of 60 and 65. Similarly, having some European identity has a higher permanent effect than those with other ethnic identities, which is likely due to their higher NZS take-up rates.

Another factor that affects the permanent effect is the attainment of educational qualifications. People with any qualification have relatively higher NZS than those without qualifications or unknown qualifications. The last factor that affects the permanent effect is the pre-65 benefit history. Having a pre-65 benefit history tends to reduce the permanent effect because the role of NZS is essentially a substitute for pre-65 main benefits and the net amount adds to their total income. If the pre-65 benefit amount is high, the enhancement effect of NZS will be small.

Similarly, three key findings were discovered for average monthly work income. First, the time trends in work income follow the same patterns as total income, with the post-65 monthly decline in work income decreasing faster than pre-65 (with the exception of the Sometimes Benefit group). This is because work income makes up the largest proportion of total income for most groups before 65. The Sometimes Benefit group experiences a faster pre-65 decline in total income than post-65, which may be due to the faster decline in work income. Though the Continuous Benefit group has a faster post-65 decline than pre-65, the rate is nearly zero over the entire observation period, which shows that they almost have no work income to lose.

Second, all the temporary effects (which may have resulted from lump sum redundancy or retirement payments) in the month of reaching 65 in work income are not statistically different from zero, except for males (significant at the 10% level). This suggests that males may have received some lump sum or redundancy payment at the month of being pension eligible.

Third, statistically significant permanent effects are found on work income after being pension eligible, except for the Continuous Benefit group. In other words, being pension eligible generally reduces work income by a significant amount, but it differs among subgroups.

Surprisingly, we found that NZS is not an immediate replacement for lost work income at age 65. Instead, NZS generates a substantial enhancement effect (i.e., on average, it more than replaced the post-65 reduction in other income). This effect even lasts for nearly five years for the entire sample cohort (predicted to terminate at age 69.44) before total income on average falls to the same level as the month immediately before becoming pension eligible. Subgroups of males, NZ-born, foreign-born, Europeans, people with qualifications, and those who did not have a pre-65 benefit history see a less than five-year NZS enhancement effect. The average enhancement effect across these subgroups is 3.78 years (predicted to terminate at age 68.78). Other subgroups, however, experience a more than five-year NZS enhancement effect, with an average effect of 9.44 years (predicted to terminate at age 74.44) across these subgroups. Specifically, the Continuous Benefit group has a NZS enhancement effect that is never expected to end until death, with an estimated $1.75 higher monthly total income after 65.

Another set of interesting findings related to people with different ethnicities. With the controls of education and benefit history, the regression results show that people with some Māori or Pacifica identity have higher monthly income than people with some European identity. Based on unadjusted statistics, they would be expected to have lower incomes than Europeans, on average, due to their relatively lower educational levels and higher possibility of having benefit histories (Rashbrooke et al., 2021; Robson et al., 2000; Treasury, 2018). After removing the controls of education and benefit history, people with some Māori or Pacifica identity turn out to receive less monthly income than people with some European identity, both in total and work income. This suggests that the relatively lower incomes of Māori and Pacifica people between the ages of 60 and 70 are mostly explained by their education levels, benefit history, and other factors controlled for in this regression.

8.2.3 Employment Rates

Significant differences in labour supply behaviour around pension age were discovered in this study, particularly among those with pre-65 benefit histories. There are three major discoveries. First, the post-65 negative monthly employment trend is normally steeper

than the similar pre-65 trend for all the subgroups, except for the Sometimes Benefit group. This indicates that people are more likely to exit the labour market after becoming pension eligible.

Second, statistically significant labour supply declines were found after becoming pension eligible. Three major reasons affect the magnitude of the permanent declines. Gender has a big impact on people's labour supply. The regression results show that males are more likely to 'retire' than females after reaching pension age, supporting the findings of Dixon and Hyslop (2008). Ethnicity also has an impact on the permanent effects. For example, people with some European identity are more likely to exit the labour market than people with some other ethnic identities, which may be due to their relatively higher NZS take-up rates. As people with other ethnic identities had relatively lower NZS take-up rates, they have to resume working after reaching 65. Lastly, education also determines the magnitude of the permanent drop in employment rates. People with higher educational attainments are less likely to exit the labour market and more likely to work till age 70 (Khawaja & Boddington, 2009; Ranchhod, 2006), which could be attributed to their jobs being less physically demanding and therefore less affected by declining physical health. It could also reflect the increased work flexibility that they have to work part-time.

Third, positive relative labour supply effects were discovered for those with pre-65 benefit histories, using the Never Benefit as the control group, and the Sometimes Benefit and Continuous Benefit as the treatment groups. With the assumption that, in the absence of a pre-65 benefit history, the Sometimes Benefit and Continuous Benefit groups would experience exactly the same employment declines (3.87 percentage points) after being pension eligible. We found that the Sometimes Benefit group has a relative 1.60 percentage-point rise in the probability of being employed compared to the Never Benefit group. Additionally, the Continuous Benefit group even has a relative 2.34 percentage-point rise in the probability of being employed, when compared to the Never Benefit group. These findings support our hypothesis that transitioning from means-test main benefits to non-means-tested NZS is associated with the removal of work disincentives generated by the means-tested scheme. In response, we found empirical evidence of a positive relative labour supply effect for those transitioning from main benefits to NZS. This indicates that, though being pension eligible accelerates the exit from the labour market for most people, it reduces the work disincentive for people with pre-65 benefit histories, and results in a relative rise in their participation rate in the labour force. We are unaware of any previous studies that found empirical evidence of such an effect.

8.3 Policy Implications

The most concerning finding of this study is that some take-up issues appear to exist with NZS. These effects appear to be concentrated among the minority groups, especially Māori. This means some people who were eligible for NZS did not receive it due to some unknown factors, such as the language barrier, or a lack of internet access or computer literacy. Four policy implications were suggested for the government to make sure everyone who is qualified for NZS can and does receive it.

First, the government should consider raising public awareness of applying for NZS, as mentioned by (Hernanz et al., 2004; Menefee et al., 1981; WEAG, 2018) that knowledge and information is an important factor that affects the non-take-up rates. This could be done by collaborating with employers to inform their employees who are nearing retirement about NZS and by advertising in local communities or social media, such as making videos explaining the key features of NZS.

Second, the government should explore the feasibility and practicalities of adopting an auto-enrol process where individuals can automatically receive NZS as soon as they become eligible, as suggested by (Currie, 2004; Hernanz et al., 2004; Van Oorschot, 1991) that will increase the take-up rates.

Third, the government may need to develop a multilingual website for NZS, as well as the application process, which has been suggested by (Hernanz et al., 2004; Van Oorschot, 1991) to solve the language barrier that some Pacifica and Asian people face.

Fourth, the government may need to produce regular estimates of NZS take-up rates using administrative data, as Hernanz et al. (2004) and WEAG (2018) suggested. In this way, the efficiency of the current pension system could be monitored, as well as to spot the non-take-up issues. Policymakers can make better decisions to improve the NZS take-up rates.

The enhancement effect NZS generated at the pension age lasted an average of nearly five years after becoming pension eligible. This indicates that the current pension system provides a rather secure and generous retirement environment for the elderly. However, if life expectancy rises, this nearly five-year enhancement effect may not be sufficient. Specifically, for those who were eligible for NZS but did not receive it, they may not experience the enhancement effect. In other words, they may not have enough financial

support for their retirement life. The government should make certain changes to the pension system in preparation for future increases in life expectancy, ensuring that the enhancement effects last for a longer time.

Being pension eligible substantially decreased the labour supply for most people. However, people with a pre-65 benefit history saw positive relative labour supply effects around pension age. This means some people who continuously received the main benefits between the ages of 60 and 64, who normally were not in the labour market, may have returned to the labour market after transitioning to the non-means-tested NZS (or at least not withdrawn from the labour market). This suggests that the current non-means-tested pension system provides a work incentive for individuals with pre-65 benefit histories, and they respond accordingly by increasing their labour supply relative to those without a pre-65 benefit history.

8.4 Limitations of this Research

Some limitations of this study need to be recognised. The first and foremost is that people in our sample cohort may not have all met the NZS residency requirements. Although we tried to ensure everyone in our sample cohort did meet the NZS residency requirements (a citizen or permanent resident residing in NZ at least 10 years after age 20 and 5 years after age 50), due to data limitations, we could only ensure that people met the five years of residency between ages of 60 and 65.

Second, due to a lack of unemployment status in the IDI, we could only look at the employment outcomes as a proxy for labour force status and overall labour supply.

Third, family information is lacking in the IDI, which prevented this study from conducting a household-level investigation. In addition, one could not tell the reasons for those who continuously lived in NZ and did not receive any work or other income. They may depend on their spouses or do not report their income through IRD.

Fourth, because arrival (departure) cards only record the intentions of an individual's arrival (departure) at the time of their arrival (departure), these can be changed, and people may alter their intentions after arrival (departure). This may result in the exclusion of those who should be included and the inclusion of those who should be excluded in our sample cohort. Another issue is that the purpose of the arrival (departure) cards may be misrepresented, as it is self-identified information. It is possible that when people

entered (exited) NZ permanently, they did not specify this on their departure or arrivals card.

Fifth, the estimated employment rates were overestimated as a result of including annual self-employed income as a proxy of employment and assuming that a person was employed for every month if receiving self-employed income. On the other hand, the exit from the labour market at the pension age would be underestimated. When people reach pension age, they may not completely stop working. Instead, they may switch from full-time to part-time. However, this could not be estimated due to a lack of working hours information in the IDI.

Lastly, due to a lack of the counterfactual situation without the presence of the NZS system, we could not measure the true causal effect of being pension eligible on total income, work income, and employment rates. Instead, we could only provide some evidence of the possible behavioural effects of this provision of NZS by concentrating on monthly changes in outcomes around the 65^{th} birthday (i.e., the age of eligibility for NZS). It is this sharp discontinuity around this age of eligibility for public pensions that provides compelling evidence of its potential effects on individual employment and personal income. We cannot rule out that there is something else around the NZS eligible age that could be causing those behavioural changes, such as the age of 65 being the cultural norm for the typical age of retirement.

8.5 Future Research Directions

Four possible areas could be considered for further investigation. First, this study discovered that some people who were continuously receiving main benefits between the ages of 60 and 64, remained on the main benefits after being pension eligible instead of transitioning to NZS. We suspect that this is because they were more likely to have health issues, and received relatively higher benefits (both monetary and non-monetary) than NZS. Thus, a thorough study of all supplementary benefits and non-monetary benefits might be included to investigate the true reason that prevented or persuaded them from transitioning to NZS after being pension eligible.

Second, a twenty-year observation period is required to verify that all sample cohorts meet the NZS residence requirements. In this case, the take-up issues could be further investigated with a clearer understanding of who meets these eligibility requirements.

Third, as previously stated, we cannot rule out the possibility that something other than the 65th birthday is affecting some of the observed changes in income and employment rates, such as age 65 being the typical retirement age. A further analysis using data from the household labour force survey (HLFS), which shows a gradual increase in the pension age from 60 to 65 between 1992 to 2001, would be necessary. HLFS data allows us to discover the entire period over which this age of eligibility for this public pension gradually increased. We can identify whether it is the pension eligibility age or a typical retirement age of 65 that causes the labour supply behaviour changes. In addition, HLFS data contains information on both employment and unemployment status, allowing for a direct evaluation of the labour force participation rates rather than the employment outcomes.

Fourth, this study only looked at the behavioural changes around pension age. A further research of the interaction between the changing labour supply behaviour and the sustainability of the current pension system is needed. This would show the direct labour supply impact on the sustainability of the pension system.

8.6 Conclusions

This study used individual-level linked administrative data to conduct a thorough evaluation of the behavioural effects of New Zealand's public retirement programme (Superannuation), including NZS take-up rates, total/work income, and employment rates. It provides some new perspectives on the current pension scheme and explores some potential future implications. In addition, this study offers a potential contribution to the international literature about the evidence on older workers' labour supply and retirement behaviour under a publicly-funded and non-means-tested policy environment.

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