Healthy, Wealthy and Working: Retirement Decisions of Older New Zealanders

Jamas Enright and
Grant M. Scobie

NEW ZEALAND TREASURY
WORKING PAPER 10/02

NOVEMBER 2010

NZ TREASURY WORKING PAPER 10/02

Healthy, Wealthy and Working: Retirement Decisions of Older New Zealanders

MONTH/YEAR

November 2010

AUTHORS

Jamas Enright
Statistical Methods
Statistics New Zealand
PO Box 2922
Wellington
New Zealand

Email jamas.enright@stats.govt.nz
Telephone ++64-4-931 4921
Fax ++64-4-931 4046

Grant M. Scobie
The Treasury
PO Box 3724
Wellington 6140
New Zealand

Email grant.scobie@treasury.govt.nz
Telephone ++64-04-471 5005
Fax ++64-04-473 1151

ACKNOWLEDGEMENTS

The authors acknowledge the support and guidance of Fiona Alpass and Jack Noone of the Department of Psychology, Massey University in making available the data from Wave 1 of the Health, Work and Retirement Longitudinal Survey. Throughout the study they willingly answered questions about the data. Dean Hyslop of Victoria University provided guidance on the use of econometric models, and the authors benefited from discussions with and helpful suggestions made by Heather Holt and Katy Henderson of the Treasury. Judith Davey of the Institute of Policy Studies, Des O'Dea from the Wellington School of Medicine, Adam Tipper from the Ministry of Social Development and David Law and Tony Burton of the Treasury made helpful suggestions on a draft. Kathy Anderson of Vanderbilt University assisted with access to earlier papers.

Access to the data used in this study was provided by Massey University. The results in this study and any errors contained therein are those of the authors, not Massey University.

NZ TREASURY

New Zealand Treasury
PO Box 3724
Wellington 6140
NEW ZEALAND

Email information@treasury.govt.nz
Telephone 64-4-472 2733
Website www.treasury.govt.nz

Abstract

Health status is an important element in the decision to continue working or retire among older workers. Given the demographic projections for the next four decades, there will be increasing opportunities for older workers to remain in the workforce. However, an individual's decision is likely to be influenced by both their health status and their accumulated wealth. This study analyses the influence of health and wealth on the decision to participate in the labour force amongst older New Zealanders, aged 55 to 70. It is based on the first wave of data collected in a longitudinal survey of Health, Work and Retirement conducted by researchers at Massey University.

The study employs a range of measures of health including the results from the international Short Form (SF36), self-reported health status and the prevalence of chronic illness. Regardless of the measures tested, a significant reduction in labour force participation is associated with poorer health status. It is widely recognised that health status itself may partly be determined by labour market characteristics. Attempts to deal with this statistically were not successful. Perhaps surprisingly, wealth did not appear to be strongly related to the decision to retire. A marked fall in participation is associated with the receipt of New Zealand Superannuation at age 65, arguably masking the effect of privately held forms of retirement wealth. The paper reports associations between health, wealth and retirement which do not necessarily constitute evidence of causality.

JEL CLASSIFICATION D19 Household Behaviour; D31 Personal Income and Wealth Distribution; J22 Labour Supply; J26 Retirement

KEYWORDS Health, Wealth, Labour Supply, Retirement, New Zealand

Table of Contents

List of Tables

List of Figures

Healthy, Wealthy and Working: Retirement Decisions of Older New Zealanders

1 Introduction

New Zealand, in common with many other countries, faces an ageing population. Projections by Statistics New Zealand indicate that by 2051 those over 65 will comprise more than a quarter of the total population. Significant economic changes are expected to follow as a result of these demographic shifts. These in turn will have implications for economic growth, productivity, income, fiscal costs and living standards.

One factor that underlies many of these issues is the extent to which older people will continue in the workforce. What are the key determinants that influence the so-called "retirement decision" of older workers? That decision will reflect an individual's preferences together with such factors as age, health, expected income, family status and savings.

The primary objective of this paper is to assess the importance of a person's health status on their participation in the labour market and on the related decision as to retirement. It is reasonable to expect that health status would in some cases directly affect a person's ability to participate in the labour market. In addition there can be indirect channels, as the health status of a person or their family members may well influence the extent of wealth accumulation, expected expenses in retirement and the need for precautionary saving. These factors in turn will influence decisions about workforce attachment and retirement.

Earlier studies on retirement in New Zealand have not been able to incorporate measures of health status, as there were no unit record data at a national level which incorporated income, wealth, socio-economic information and health measures. Recently this situation has changed and two longitudinal surveys are now available. The first of these is the Survey of Family, Income and Employment (SoFIE) conducted by Statistics New Zealand.[1] A recent study by Holt (2010) analyses the relationship between health and labour market participation using data from SoFIE.

[1] For details see: http://www.stats.govt.nz/NR/exeres/D8603CF9-77D4-4592-B1FE-090B82F563FC.htm

The second of these surveys, and the data on which the present study is based, is a survey on Health, Work and Retirement (HWR) based at Massey University. This rich data source allows us to analyse the relation of overall measures of physical and mental health with income, wealth, living standards and labour force participation. In addition, information on 19 chronic diseases allows their individual effects to be studied. As the sample is for 55 to 70-year-olds, it is possible to obtain population estimates for the health and workforce attachment specifically for this older group.

In Section 2 we present a brief account of the data, followed by an overview of the results from the HWR survey (Section 3). Section 4 discusses methodological issues, and Sections 5 to 10 summarise the results for wealth, income, living standards, health, labour force participation and chronic diseases, respectively. Section 11 contains a summary and conclusions, and highlights some key limitations.

The paper examines associations between health, wealth and retirement; it does not provide evidence that, for example, poor health "causes" retirement. Health and retirement are almost invariably jointly determined and the question of the direction of causality is a challenging statistical issue which we address without resolving.

2 The data

The HWR survey was established by the School of Psychology at Massey University in collaboration with the Health Research Council of New Zealand, the New Zealand Institute for Research on Ageing and the Centre for Māori Health, Research and Development at Massey University, to investigate the factors surrounding work and retirement for those aged 55 to 70.[2] The first wave was run in 2006, with a total 6,662 respondents to a postal questionnaire.[3] The sample was drawn from the Electoral Roll[4], and those identifying as being of Māori descent were deliberately over sampled.

> …equal probability sampling procedures were used to select both the general and Māori sub-samples for the HWR study. Both sub-samples were treated independently and random selection was used to select 55 to 70 year-old New Zealanders participants from each population of interest (the general and Māori respectively) to their respective sub-sample. (Towers, 2007)

A summary of the sample size is given in Table 2-1.

Table 2-2 summarises the sample by age groups, and shows the number of usable observations. A total of 822 records were dropped as they did not report at least one of age, gender, ethnicity, physical or mental health status. The sample was further pruned of eleven cases by eliminating those whose reported age fell below 50. The sample was reweighted to reflect these adjustments. The weighting was done by ethnicity, as the population totals were provided for those values (Towers 2007). All results in Section 3 onwards are the weighted results unless otherwise indicated. Additionally, the wider age ranges are used, including those under 55 and over 70, unless otherwise indicated.

Table 2-1-A summary of the sampling for the HWR survey

Category	General Electoral Roll	of which those identifying as being of Māori descent
Total number of 55-70-year-olds	609,000	47,436
Sample drawn	5,264	7,781
Number excluded[1]	210	341
Final sample	5,054	7,440
Response rate	62%	48%
Number of respondents	3,133	3,529
Total sample numbers available for analysis	6,662 (corresponding to an overall response rate of 53%)	

Note: 1. Excluded from the study as they were never able to participate (eg they were unable to be contacted, were deceased or had been institutionalised).

Note that not all observations can be used, as they may be dropped from models if they are missing values for variables other than the ones listed above.

[2] For full details of the survey, methodology and results, see: http://hwr.massey.ac.nz/

[3] The questionnaire used in the 2006 survey, the results of which are the basis for the present study, is available online at http://hwr.massey.ac.nz/surveys.htm

[4] The Electoral Roll contains date of birth and provides for persons of Māori descent to identify as such.

Table 2-2-Sample size and adjustments for the age ranges

Age range	Total number of respondents	Number of usable observations	Number falling exactly in the age range
55-59[1]	2,838	2,306	1,995
60-64	1921	1,567	1,567
65-70[2]	1,742	1,466	1,461
Total	6,662[3]	5,339	5,023

Notes:

1. Includes those observations aged less than 55 in the first two columns.
2. Includes those observations aged more than 70 in the first two columns.
3. Includes 161 observations with no determinable age, sex or ethnicity.

A complete listing of all the variables used in this study together with their definitions, means, medians and inter-quartile ranges, is set out in Appendix B.

3 Overview

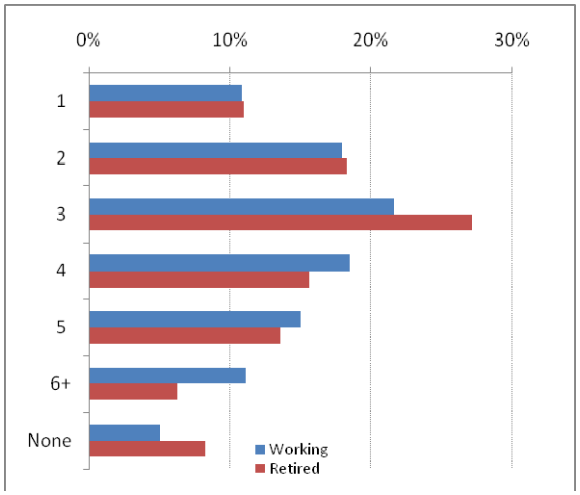
This section provides a series of basic tabulations with the aim of providing the reader with an overview of the survey results for key variables relevant to this study.

3.1 Wealth

Respondents were asked to indicate which assets they owned (real estate, farms, businesses, holiday homes, financial investments etc). Where the respondent failed to indicate either yes or no, for this analysis the assumption is made of "no". The present value of expected income from New Zealand Superannuation (NZS) is a legitimate part of the wealth of an individual and could be counted as part of total wealth; this has not been done in this study.[5] The results are summarised in Figure 1, for both those working and retired.[6]

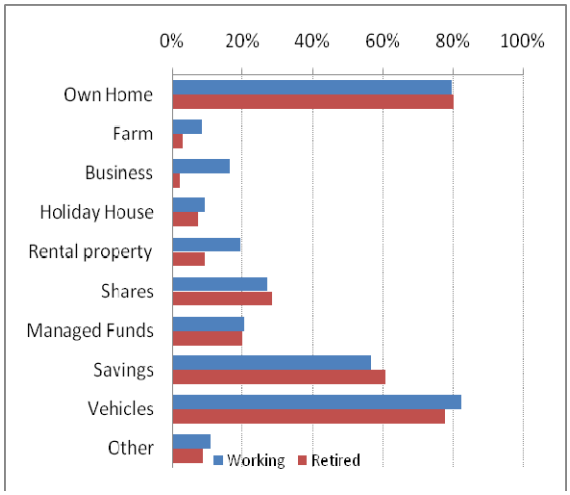
Figure 1-Asset ownership

a. Number of classes of assets owned



Source: Health, Work and Retirement Survey

b. Proportions owning assets of different classes



Source: Health, Work and Retirement Survey

Home ownership is at high levels for working and retired respondents. The ownership of farms, businesses and rental properties declines after retirement. This result is consistent with the findings of Coile and Milligan (2006) for the USA. They note that there are marked shifts in the composition of asset holdings with ageing. The share of assets held in banks and term deposits rises from 11% of total assets at ages 60 to 64 to 28% at ages 80 to 84. They find that the effect is more pronounced where the person has suffered a health shock. They conclude that the standard risk versus return models of portfolio selection need to be augmented with ageing and health status. Older people and those with physical or mental disabilities tend to hold their assets in a more liquid form to be able to more readily meet unexpected costs. In addition, older people place more emphasis on the ease of portfolio management.

5 See Scobie, Gibson and Le (2005) for estimates of the present value of NZS and its impact on savings behaviour.

6 Details of the classification for working and retired are given in Section 3.5.

However, Love and Smith (2007) have questioned whether in fact there is a *causal* relation between health status and portfolio choice, such that those in poorer health tend to chose less risky assets. They argue that both health status and financial decisions are "driven by characteristics such as risk preference and impatience that are unobserved by the researcher" (p2). The consequence of this unobserved heterogeneity, if inadequately accounted for, is to severely bias the estimates of the demand for different classes of assets. Using data from the Health and Retirement Study for the USA, they attempt to correct for this unobserved heterogeneity and as a result find no statistically significant relation between health status and asset choice. Their findings underscore the difficulties in establishing robust relations between health status and other variables of interest.

Respondents in the HWR survey were given an option of providing an approximate value for each of the asset classes they owned. These were summed to give an estimate of total wealth. As not all respondents either indicated which assets were owned or chose not to provide estimates of values, the total number of observations was 3,966. The means, medians and inter-quartile ranges by age groups are summarised in Table 3-1.

Table 3-1-Total wealth by age range

Age range	Recorded wealth ($'000) 3,966 observations			Including imputed wealth ($'000) 5,093 observations		
	Mean	Median	IQR	Mean	Median	IQR
55-59	684	353	747	699	443	760
60-64	620	300	647	633	400	746
65-70	417	215	473	430	278	566
All	595	300	630	608	374	735

Note: IQR is the inter-quartile range defined as the difference between the observations at the 25th and 75th percentile points of the distribution and is one measure of the dispersion of wealth.

In order to increase the sample size available for analysis, a value for total wealth was imputed for those cases where the values were missing. This was done by first estimating a regression of total wealth on an extended series of explanatory variables, and then using the estimated coefficients, values of total wealth were predicted for those individuals with missing values. This results in an expanded set of observations which are summarised in the right hand side of Table 3-1. Owing to not all variables in the imputation model being present for all observations, this increased the sample size to 5,093 out of the 5,339 observations available.

In making imputations there is a risk that the group who did not answer the question are systematically different from those who did. To test for this, a comparison was made of the characteristics of those with actual observations with the group for which total wealth was imputed by this method; for observable characteristics no significant differences were found.[7] The mean wealth level for the original and expanded samples is very similar, although the median is higher once the imputed values are included, indicating the distribution became somewhat more skewed toward higher wealth values.

In addition to the results in Table 3-1, total wealth levels for the working and retired groups were calculated. The average wealth is $676,000 for the working group and $427,000 for the retired group.

[7] The variability of the imputations will, however, be lower than that for the actual observations, implying that the estimated precision of regression coefficients will be overstated.

Unfortunately, it is not possible to compute net wealth based on the survey data as there is no corresponding estimate of total liabilities. The only information available is whether the respondent had a mortgage or a loan. This applied to 52% of the working group and 15% of the retired group, indicating that many people plan to pay off any outstanding debt by the time they retire.

3.2 Income

Total household income was estimated by summing the before tax income of the respondent and the combined income of all other members of the household over the previous 12 months.[8] The results are summarised by age range in Table 3-2, and by working status in Table 3-3. As the distributions of both income and wealth are typically highly skewed owing to a few high income or wealth individuals, the tables present both means and medians. Again, a similar procedure was used for imputation to expand the usable sample size to 5,054 where variables in the imputation model were present. In this case the means, medians and inter-quartile ranges for the original and expanded samples are strikingly close, in part owing to a smaller number of missing values.

Table 3-2-Income by age range

Age range	Recorded income ($) 4,311 observations			Including imputed income ($) 5,054 observations		
	Mean	Median	IQR	Mean	Median	IQR
55-59	114,000	85,000	90,000	114,000	90,000	87,000
60-64	109,000	63,300	75,000	107,000	65,000	80,000
65-70	59,000	40,500	48,000	58,000	41,000	50,000
Total	99,000	66,500	82,000	97,000	69,000	84,000

Table 3-3 Wealth and income by working status

Status		Sample size	Mean	Median
Working	Wealth ($'000)	3,744	676	406
	Income ($)	3,738	114,000	84,000
Retired	Wealth ($'000)	1,349	427	294
	Income ($)	1,316	49,000	36,000

The ratio of mean wealth to mean income rises almost 50% from around six times for those working to nine times for those who are retired. This is consistent with the widely recognised phenomenon "of asset rich but cash poor" that characterises many retired individuals. Income drops significantly with retirement, and while assets are run down (the "dissaving" phase of the life cycle), the decline is much less marked. This is accentuated by the fact that the principal residence is a major share of total assets and owner occupied rates remain high for many retirees in New Zealand.

The HWR survey also asked respondents for the sources of income. The categories were wages and salaries paid by an employer; self-employment; income from investments (interest, dividends, rent); regular payments from the Accident Compensation Corporation (ACC); New Zealand Superannuation (NZS) or veterans' and war pensions (VP); other superannuation; unemployment benefits (UB); domestic purposes benefit (DPB); invalids' benefit (IB); student allowance; other benefits and other sources; and an option to record

[8] An alternative to the observed household income is the use of an equivalised income which adjusts for the age composition of the household members. As the observations in this study are from individuals aged 55 to 70 this adjustment was not felt necessary.

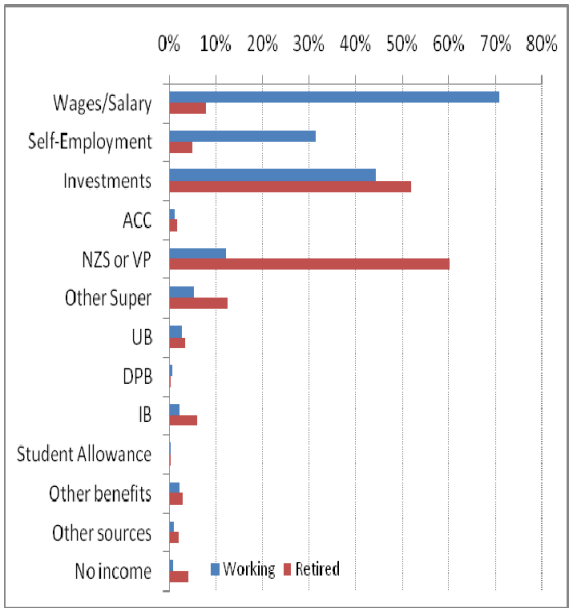
no source of income in the preceding 12 months. Respondents could indicate more than one source so the totals can exceed 100%. The results are depicted in Figure 2 (Panel a).

The majority of the working group received income from wages and salaries, while amongst retirees investment income and NZS were the most common sources. Very few of the retired group reported self-employment income. The average household income for the working group was found to be $114,000, while for the retired group the average income was $49,000. As this latter estimate is more than double the married allowance under NZS, it is apparent that investment income is an important source for many retirees.

Panel b of Figure 2 summarises the assessments of respondents in relation to the adequacy of their incomes. In large measure the results for both the working and retired groups are similar, with around 80% perceiving their current incomes to be adequate. The proportion of retired respondents who felt their income was not enough (about 10%) is comparable to the proportions reported by Fergusson *et al* (2001: Table 9) who found 12% of singles and 10% of older couples felt their income was not enough.

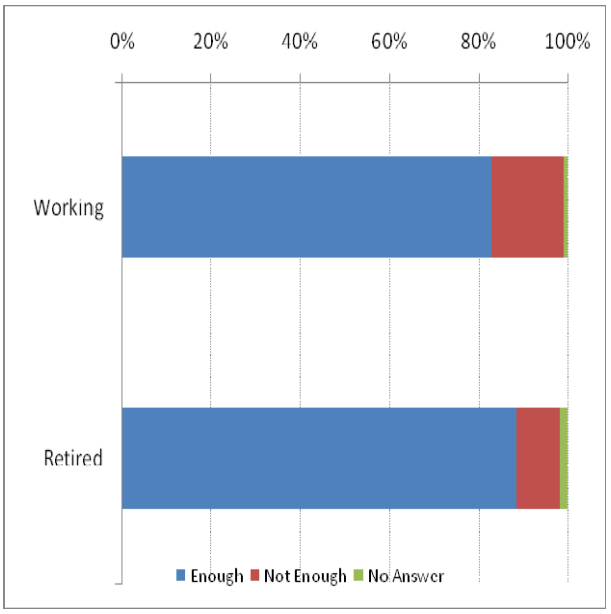
Figure 2-Income: sources and adequacy

a. Sources of income: percentage of recipients by source



Source: Health, Work and Retirement Survey

b. Adequacy of income



Source: Health, Work and Retirement Survey

3.3 Living standards

Standard of living was rated on two different scales. The first was self-assessment of the level of their material standard of living, while the second assessed the respondent's satisfaction with their living standards. Both measures are depicted in Figure 3. Just over half of both groups consider their standard of living to be at medium level, with more of the working group then the retired group rating their standard as high. Around the same percentage of the working and retired groups consider their living standard to be low. The results for respondent's satisfaction are very similar for all categories across the retired and working groups. These findings are consistent with those from a national survey in

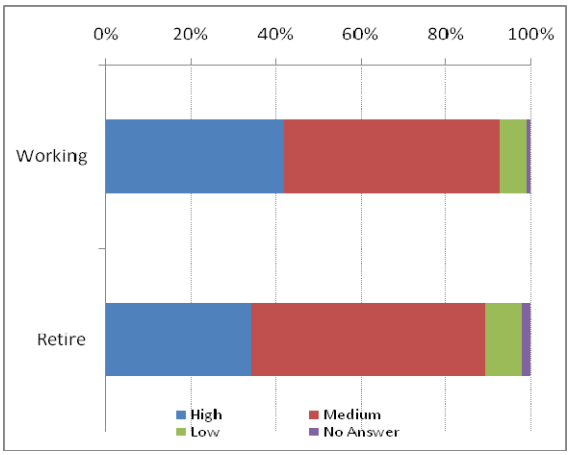
which only 8% of those over 65 years old reported any degree of hardship Jensen *et al* (2006).

The proportion of both the working and retired groups who regard their living standard as low or expressed dissatisfaction with their standard of living is typically less than 10%. This accords with the results of Fergusson *et al* (2001: Table 9) who reported that among older New Zealanders, 10% of singles and 5% of couples assessed their living standard as low or fairly low.

Respondents were asked how they expected their living standards might change when they retire. For those actually retired the question related to the perceptions of living standards as they approached retirement; ie the working group was asked: "How do you expect your living standards to change when you retire?" while the retired group was asked: "How did you expect your living standards to change when you retired?" The results are shown in Figure 4 (Panel a). Respondents were also asked how they saw their future retirement years in comparison to their working years, with the results in Figure 4 (Panel b). It is not immediately clear how retired people would view this question.

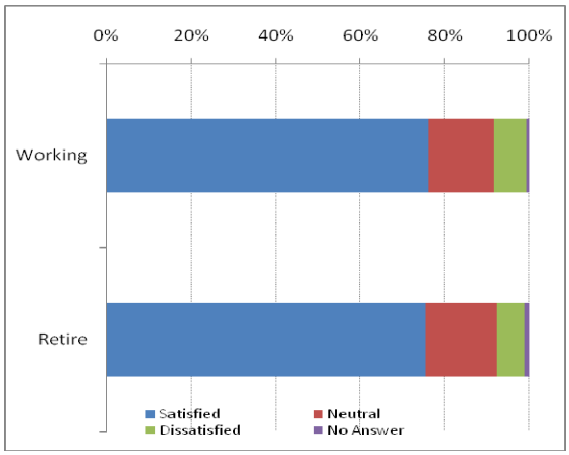
Figure 3-Standard of living

a. Material standard of living



Source: Health, Work and Retirement Survey

b. Satisfaction with living standards



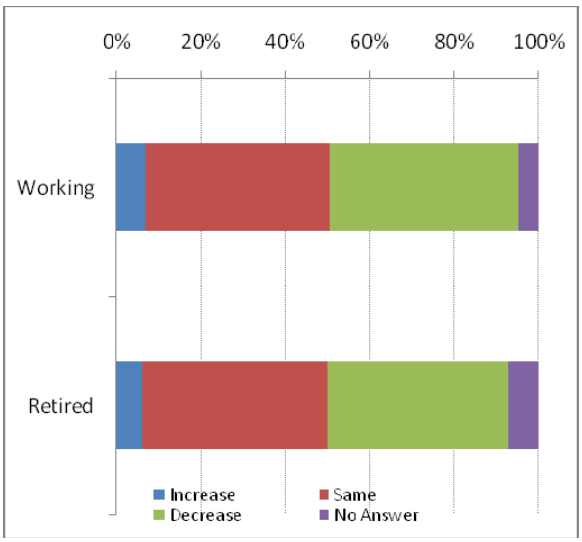
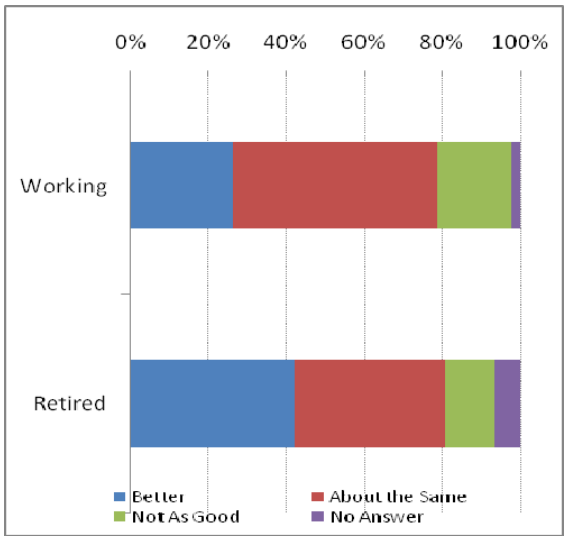
Source: Health, Work and Retirement Survey

Only a very small proportion of either the working or retired group anticipated a rise in their living standards at retirement. Over 40% of both groups expected their living standards to decline. Yet while they anticipated a decline, the majority of those actually retired expressed satisfaction with their living standards in retirement (Figure 3). This implies that in planning for retirement a large proportion of people expect to take a fall in living standards, but as it was anticipated, they do not subsequently express dissatisfaction when they actually experience a drop in living standards. An alternative explanation could be that the actual fall in living standards was less than anticipated.

The willingness to accept a fall in living standards may influence their decision to leave the workforce or reduce their hours. Those wishing to maintain a standard of living in retirement closer to that enjoyed in their working years could be expected to have higher rates of labour force participation.

However the results in Figure 4 (Panel b) provide an interesting contrast. The vast majority of respondents (around 80%) did not expect to see a fall in their living standards in future retirement years. This suggests that people adjust their expectations of living standards to match the reality of their circumstances.

Figure 4-Expected changes in living standards

a. Expected changes in living standards upon retirement	b. Expected living standards in future retirement years compared to working years
	
Source: Health, Work and Retirement Survey	Source: Health, Work and Retirement Survey

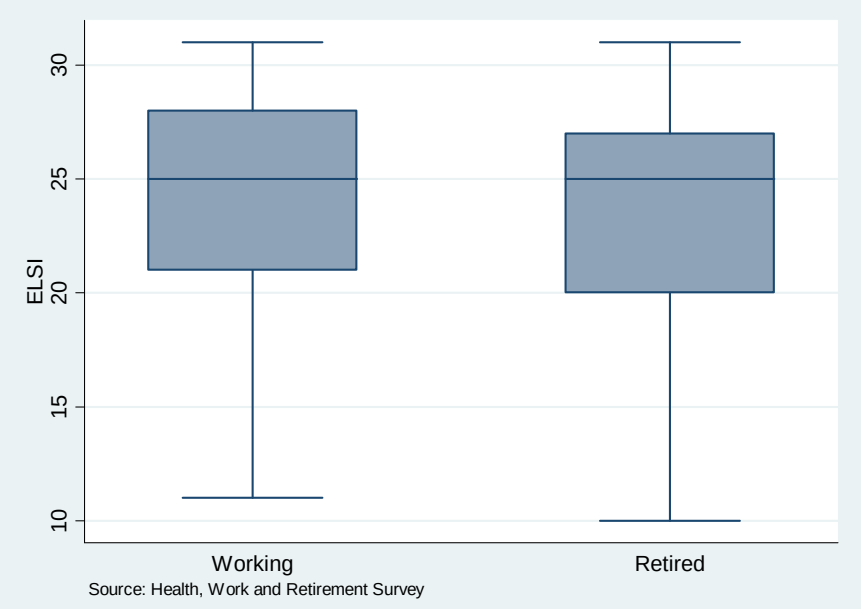
One way to summarise the overall standard of living is through the use of an Economic Living Standards Index (ELSI). A short form of this index is designed

> to measure levels of consumption, social activity, and asset ownership, rather than the economic resources that enable them. The scale assesses restrictions in ownership of assets (8 items), restrictions in social participation (6 items), the extent to which respondents economise (8 items), and a self-rated indicator of standard of living (3 items). The ELSI-SF scores on each of the items were combined to form a continuous variable ranging from 0 to 31 (higher scores reflect higher economic living standards) and as an ordinal variable with 7 levels from severe hardship to very good.[9] (Stephens *et al*, 2008)

Figure 5 summarises the distribution of the ELSI for the working and retired groups. While the working group has a little higher mean value (23.7) than the retired (22.9) (not shown on the figure), the medians were in fact the same and the overall range is broadly similar. Were it the case that ELSI were a truly objective measure, then this result would provide support for the argument that the actual fall was minimal. In contrast, if ELSI is viewed as a more subjective measurement, then this would tend to lend support to the argument that people adjust their expectations.

[9] For a complete description see Jensen, Spittal and Krishnan (2005).

Figure 5-Economic Living Standards Index



Source: Health, Work and Retirement Survey

3.4 Health

The HWR survey includes an extensive series of questions related to health. The following extract describes the use of this information:

> The measure of health used for the HWR study was the Australian and New Zealand version of the SF-36 which has become one of the most widely used (both in New Zealand and internationally) standard questionnaires for measuring physical and mental health status. The SF-36 includes 36 items measuring physical and mental health in relation to nine health scales: general health (self assessment of health overall), physical functioning, role physical (how much physical health has affected daily activities), mental health, role emotional (how much emotional health has affected daily activities), social functioning (how health has affected social activities), health transition (perceptions of health changes), bodily pain, and vitality. All scores have been weighted so that they may be interpreted in the same direction: higher scores mean better health. The subscales have also been combined to provide two summary scores for physical and mental health respectively. The general health status of this cohort is indicated by scores on the SF–36 which have been transformed using New Zealand population norms and standardised so that the population mean is 50. (Stephens and Noone, 2007: p3)

In the present study we focus on the summary measures for physical and mental health (see Figure 6).

> The SF-36 also yields two psychometrically-based physical and mental health summary measures: the Physical Component Summary (PCS) and the Mental Component Summary (MCS). The PCS and MCS are computed following a three-step standardised procedure. First, all eight domains are standardised using a linear z-score transformation. Z-scores are calculated by subtracting the domain means for the general population (by age and sex) from each individual's domain score and dividing by the standard deviation of the NZ population (Ministry of Health, 1999). Second, the z-scores are multiplied by the domain factor score coefficients for PCS and MCS and summed over all eight domains. Finally t-scores are calculated by multiplying the PCS and MCS sums by 10 and adding 50 to the product to yield a mean of 50 and a standard deviation of 10 for the NZ population.[10]

[10] This description was provided by Dr Kristie Carter of the University of Otago, Wellington.

Scott, Sarfati, Tobias and Haslett (2000) analyse the SF-36 health survey for New Zealand, to test whether the two-dimensional structure of physical and mental health is applicable to all major ethnic groups (European, Māori and Pacific). They find that while the structure applied to European and Māori aged less than 45, for Pacific peoples and older Māori the structure did not clearly differentiate between the physical and mental health components. For these groups the two components are not seen as independent. In subsequent analyses based on the HWR survey we have included ethnicity as an explanatory variable in an attempt to correct at least in part for this problem.

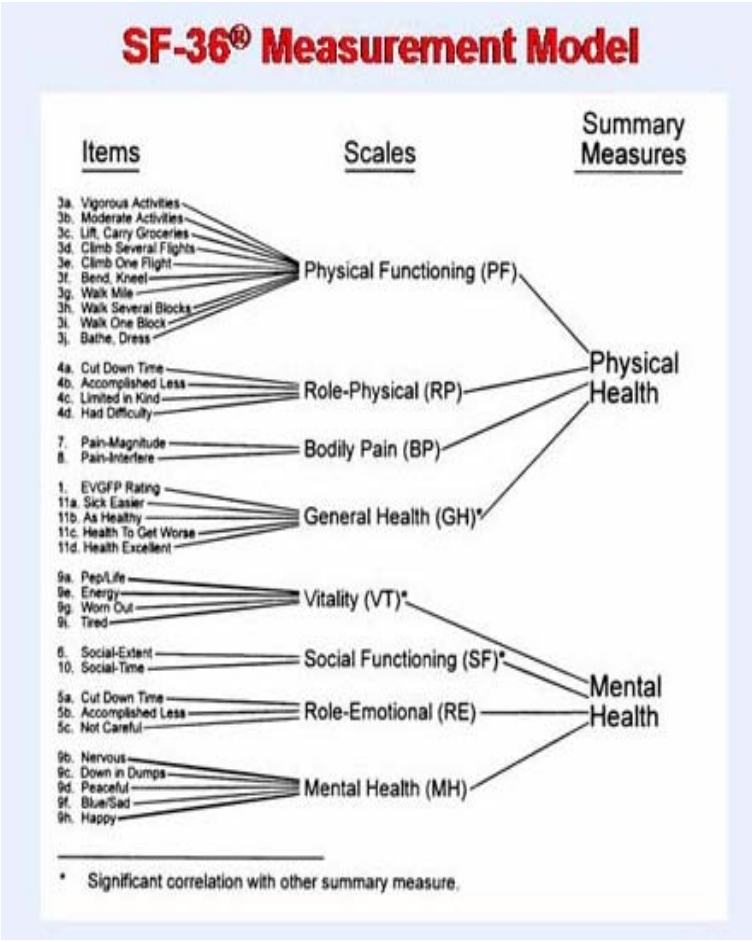
Table 3-4-summarises the pattern of the physical and mental health scores for the New Zealand population.

Table 3-4 SF-36 mean scores for New Zealand by age and sex, 1996-97

Age group (years)	Physical Component Score (PCS)		Mental Component Score (MCS)	
	Males	Females	Males	Females
15-24	52.9	52.2	50.2	46.1
25-44	51.5	52.3	50.6	47.7
45-64	48.9	49.2	51.9	51.2
65-74	45.5	45.3	53.8	51.9
75+	38.7	39.4	52.9	51.5
Overall	50.1		50.0	

Source: Scott, Sarfati, Tobias and Haslett.(1999).

Figure 6-Structure of the SF-36 scheme for the measurement of health



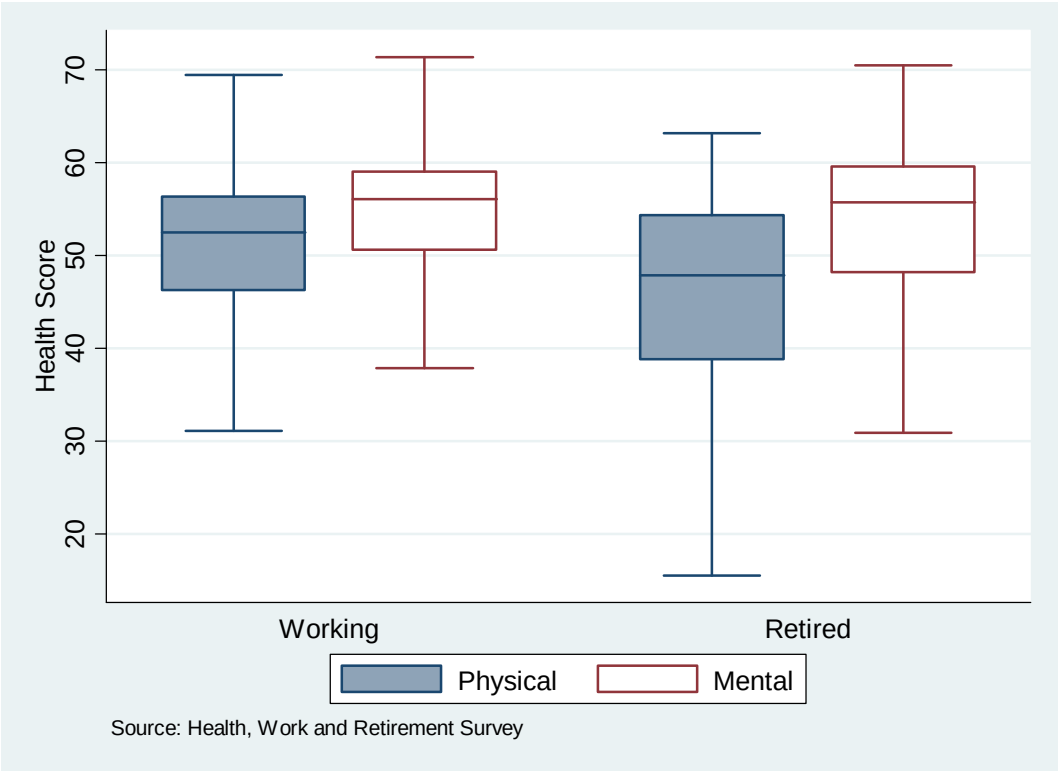
Source: Ware (2000).

Note: This figure does not include the category of health transitions referred to in the extract from Stephens and Noone (2007) cited above although these are in the summary measures used here.

A summary of the levels and distributions of the physical and mental health scores for both the working and retired groups is depicted in Figure 7. The average levels are similar for both groups although the ranges for the retired group are wider, especially in the case of the physical health measure.

As well as determining an objective measure of health, the survey asked respondents to self-assess their health. Table 3-5 reports this, broken down by sex and work status. The broad pattern of working aligning with better health is continued here.

Figure 7-Distribution of physical and mental health scores



Source: Health, Work and Retirement Survey

Table 3-5-Self-reported health status by gender and labour force status

Self-reported health status	Male				Female			
	Full-time	Part-time	Unem-ployed[1]	Retired	Full-time	Part-time	Unem-ployed[1]	Retired
	%	%	%	%	%	%	%	%
Excellent	18	13	8	13	22	19	0	10
Very good	42	42	19	29	40	44	19	34
Good	34	36	42	33	28	28	65	37
Fair	5	8	31	20	8	9	16	15
Poor	1	1	0	5	2	0	0	3
Total	100	100	100	100	100	100	100	100

Note:

1. The estimates for those unemployed are based on a small sample of approximately 40 observations for each gender.

3.5 Labour force participation

In the context of the present study, an important aspect of the HWR dataset is the split between those who are still working, and those who are retired. Unfortunately the distinction is not clear cut.[11] In part this reflects the fact that increasingly there is no universal "age of retirement" implying a clean break from the labour market. There are a number of possible criteria for defining "retirement". Banks and Smith (2006) identify the following:

- complete and permanent withdrawal from any paid employment
- being in receipt of a public or private pension
- a state of mind in which individuals perceive themselves as retired.

This section describes in some detail the classification of the data and the derivation of the working and retired subsets. There are two critical questions in the survey that could be used to define this split. The first is:

Do you consider yourself partially retired, completely retired or not retired? (Q49)

for which respondents were given the choice of:

- Not retired at all
- Partly retired
- Completely retired

At a later stage of the questionnaire respondents were asked:

What is your current work situation? (Q74)

to which they could respond according to the following options:

- Full-time paid employment including self-employment
- Part-time paid employment including self-employment
- Retired, no paid work
- Full-time homemaker
- Full-time student
- Unemployed and seeking work
- Not in the workforce

The results of these questions overlap significantly. Some of those who responded that they are *completely retired* subsequently recorded that they were in full- or part-time paid work. It is possible that they may have viewed *being retired* as meaning to have attained the age of eligibility for NZS. Furthermore, some who did not consider themselves retired were nonetheless retired as they undertook no paid work.

Table 3-6 summarises the responses from these two questions, and shows the population estimates in each cell.

[11] Hyslop and Dixon (2008) based their definition on an employment gap. Those who had no history of paid employment for at least two years were deemed to be "provisionally" retired. In the absence of detailed employment histories in the HWR survey we have employed a different approach.

Table 3-6-Classification by work and retirement status: 55 to 70 year olds

Work status (Q74)	Retirement status (Q49)				
	Not retired	Partly retired	Retired	No response	Total
Full-time	250,592	14,014	3,563	5,443	273,612
Part-time	52,759	72,967	1,646	2,245	129,617
Retired	1,021	19,974	109,738	4,672	135,405
Other	20,546	19,273	23,291	7,976	71,086
Total	324,918	126,228	138,238	20,336	609,720

Note: The unweighted counts are reported in Appendix Table A.1.

The category of "Other" includes: homemaker, student, unemployed and seeking work, not in the workforce and non-response.

We have used these data to form a split between working and retired, as follows:

Working = Full-time or part-time or unemployed but seeking work. Technically the correct term is "participating", although the more informal term of "working" will be used.

> = 273,612 + 129,617 + (those recorded as not retired (20,546) or partly retired (19,273) from the "Other" category of work status who were unemployed but seeking work = 8,830)
>
> = 412,059

Retired = Retired (no paid work) or those who recorded retired from the "Other" category of work status who were not unemployed but seeking work)

> = 135,405 + (22,311 out of 23,291)
>
> = 157,716

This leaves (609,720 – 412,059 – 157,716) = 39,945 people for whom we do not have information, other than they are not in the workforce. These people are dropped from the population considered in this paper, except for where needed to compare to other datasets (Section 9.7). However, the effect of their exclusion is explored in Section 9.2.

Having constructed the two groups, working and retired, it is instructive to compare some of their basic characteristics. Table 3-7 summarises the differences.[12] A higher proportion of retired people considered their health to be poor.

Table 3-7-Selected characteristics of the working and retired groups

Characteristic		Working %	Retired %
Average age (years)		59.5 years	64.7 years
Proportion who are male		53	40
Proportion with poor health (self-rated)		1	4
Change in health status in last 12 months	Improved	18	18
	Same	75	69
	Worse	8	13

The overall labour force participation rates for males and females in the age range 55 to 70 years appear high, both by historical and international standards.[13] As shown in

[12] It should be recalled that while the two groups are mutually exclusive they are not exhaustive.

Table 3-8, 76% of all males and 66% of all females in this age range are in either full-or part-time work. Remaining attached to the labour market is clearly an important aspect for those over 55 as they age. For males, almost one in four over 65 years old is in full-time work; one in four females over 65 is in either full-or part-time work. Females tend to have higher rates of part-time employment.

All respondents were asked whether or not they planned to continue some form of paid work after retirement. It is assumed that those currently working responded based on their intentions. However it is less obvious how those retired would have responded. On one hand their response could have been based on their intentions prior to retirement. Alternatively, their responses could reflect their current status. With this caveat in mind, the results are depicted in Figure 8.

Table 3-8-Proportions working and retired: by age and sex

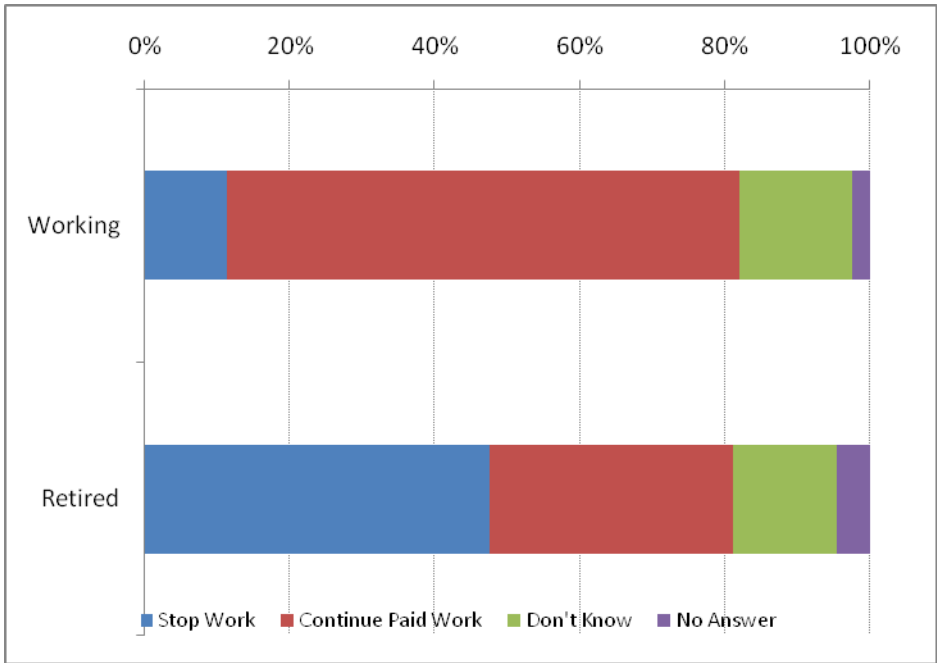
	Work status	Age range			Overall
		55-59	60-64	65-70	
		%	%	%	%
Male	Full-time	79	64	23	60
	Part-time	13	17	20	16
	Unemployed	2	3	0	2
	Retired	6	15	57	23
	Total	100	100	100	100
Female	Full-time	55	35	9	37
	Part-time	33	35	17	29
	Unemployed	2	1	0	1
	Retired	10	29	74	33
	Total	100	100	100	100

The growing trend toward a transition from full-time work to fully retired is strikingly evident, as over two-thirds of all those in the working group stated that their intention was to continue some paid work after “retirement”. Nearly 35% of those in the retired group stated they intended to work or were working after retirement. This accords with the earlier results presented in Table 3-6 where 35% of those who were partly or totally retired stated they were in some form of paid employment.

Both the working group (WK) and the retired group (RT) have broadly similar attitudes towards retirement. Retirement is largely seen as a time to slow down, start on a new part of life and nearly all of them have some idea of what they want to do. It is not seen as frustrating, nor unwanted, nor as a problem as a replacement for work (see Figure 9).

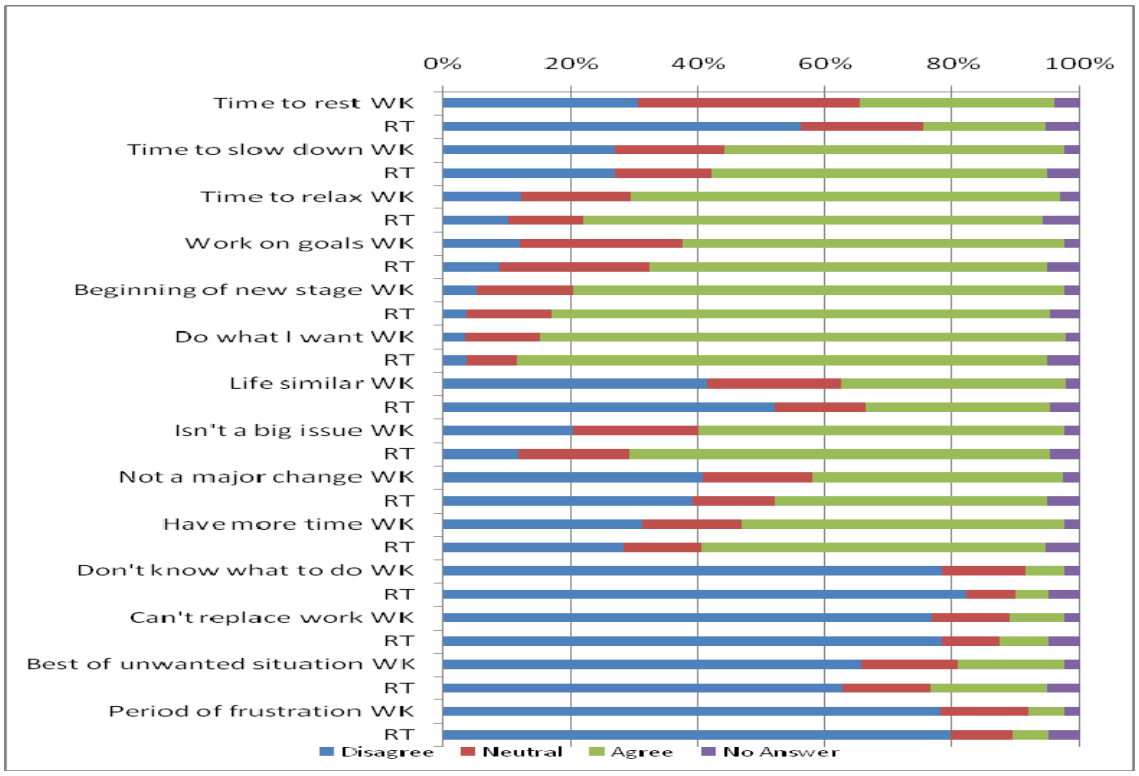
[13] The estimate of labour force participation shown here will exceed that in the standard statistical measures because in our case we have excluded those who are either working or retired.

Figure 8-Intentions with regard to paid work after retirement



Source: Health, Work and Retirement Survey

Figure 9-Attitudes toward retirement



Source: Health, Work and Retirement Survey

4 Modelling approaches

The preceding section presented some preliminary results from the survey. They were intended to capture the broad patterns; for example, the difference in wealth between the working and retired groups. The limitation of this type of analysis is that other factors might lie behind the observed differences and these are not being held constant. In this example it might be that the real reason for the differences lies in the health status of the two groups and is not directly related to their employment status. Regression models, a form of multi-variate analysis, can be used to test the effects of particular variables while holding constant the influence of other variables. In some cases there may be interaction effects between explanatory variables and these can be readily incorporated.

In this study we use two forms of regression: ordinary least squares (OLS) where the dependent variable is a continuous variable (eg, wealth or income) and logistical regressions where the dependent variable of interest is a binary variable (eg, working as distinct from retired; or self-rated good health as distinct from poor health). The next section provides a relatively non-technical discussion aimed at providing the reader with a basic understanding of the models employed.[14]

4.1 OLS regression models

OLS models are of the general form:

$$Y_i = \alpha + \sum_{j=1}^{k} \beta_j X_{ij} + \varepsilon_i \qquad (1)$$

where

Y_i = the value of the dependent variable for the i-th respondent

X_{ij} = the values of the explanatory variables for the i-th respondent

α, β_j = the regression parameters to be estimated

ε_i = a random error term assumed to follow a normal distribution.

4.2 Logistical regression models

The logistical or logit regression is applied when the dependent variable takes only the values of zero or one (eg, we could assign one to those in good health and zero to those in poor health). The OLS model could potentially be applied in this case with the continuous dependent variable on the left hand side merely replaced by a binary variable. Such a linear probability model, while generating the correct sign and significance of the coefficients, is generally not appropriate. There are at least three reasons for this. First, the variance of the dependent variable is not independent of the values of the explanatory

[14] For more detailed and technical discussions there is a wide range of texts available; a recommended starting point would be Wooldridge (2006).

variables (the problem of heteroskedasticity). Second, the predicted probabilities could be negative or greater than 1, which is counter-intuitive. Finally these models assume the marginal effects are constant. For these reasons it is preferable to employ a logit model.

Logit models are built on the notion of probability. Suppose the probability denoted by p, of some event is 0.8 (eg, the probability that a respondent is in good health). The probability that they are not in good health is then simply 1-p = 1-0.8 = 0.2. The odds of the event are defined as the ratio of the probability of "success" to the probability of "failure":

$$\text{Odds} = \frac{p}{1-p} \tag{2}$$

In the above example, this would be 0.8/(1-0.8) = 4. In other words, the odds of a person being in good health (relative to being in poor health) are four to one. Note that it is quite arbitrary which way round p and 1-p are assigned.

By working with the logarithm of the odds, we circumvent the problem of the restricted range for the probability. The transformation to logarithmic odds maps the underlying probability whose range is from zero to one, into a variable with range from negative infinity to positive infinity. This is referred to as a logit transformation.[15]

We now sketch the use of this transformation in the estimation of the coefficients associated with the independent or explanatory variables in the underlying model. Let p be the probability that a respondent is a member of the category of the dependent variable as assigned the code of 1. All the remainder who do not belong to this category are assigned zero. Then:

$$\Pr(\text{that respondent belongs to this category}) = p = \frac{1}{(1+e^{-Z})} \tag{3}$$

$$\text{where} \quad Z = \alpha + \sum_{i=1}^{k} \beta_i X_i \tag{4}$$

We can now show that Z is the log of the odds. Rearranging equation (3) to solve for Z yields:

$e^{Z} = \frac{p}{1-p}$, and taking natural logarithms of both sides gives:

$$\ln(e^{Z}) = Z = \ln\left[\frac{p}{1-p}\right] \tag{5}$$

Hence Z is the log odds or logit. Table 4-1 sets out the relation between probabilities, odds and log odds.

[15] An alternative approach, the probit transformation, is discussed below.

Table 4-1-The relation between probabilities, odds and log odds

Probability (p)	Odds [p/(1-p)]	Log Odds Ln[p/(1-p)]
0.001	0.001	-6.907
0.1	0.111	-4.595
0.15	0.176	-1.735
0.2	0.250	-1.386
0.25	0.333	-1.099
0.3	0.429	-0.847
0.35	0.538	-0.619
0.4	0.667	-0.405
0.45	0.818	-0.201
0.5	1.000	0.000
0.55	1.222	0.201
0.6	1.500	0.405
0.65	1.857	0.619
0.7	2.333	0.847
0.75	3.000	1.099
0.8	4.000	1.386
0.85	5.667	1.735
0.9	8.999	2.197
0.999	999.013	6.907
0.9999	9997.341	9.210

We can now proceed to estimate equation (4), in this case using Maximum Likelihood Estimation (MLE), an iterative procedure which searches for that set of values for α and the set of β such that the probability of observing the dependent variables in the sample of data is maximised.

4.3 Interpreting the logistical regression

We turn now to the interpretation of the coefficients in the logit equation. The estimated values of each of the coefficients describe the amount by which Z, the log odds, changes in response to a one unit change in the corresponding X_i, where X_i is continuous. In the event that X_j is itself a binary variable describing a particular category (eg, male or female) and taking only the values of zero or one, the value of the estimated coefficient on X_j (denoted $\hat{\beta}_j$) describes the change in the log odds of moving from the category coded 0 to the alternative category coded (1).

However, this interpretation is not especially intuitive. A preferable approach is to consider the impact of a unit change in a particular X_j on the odds rather than the log odds. The *odds ratio* is defined as

$$\text{Odds ratio} = \frac{\text{odds evaluted at a particular set of values}}{\text{odds evaluated at a different set of values}} \qquad (6)$$

ie, it is the ratio of two odds. Consider the following which involves finding the odds ratio for a one unit change in say X_1:

$$\text{Odds ratio} = \frac{e^{[\alpha+\beta_1(X_1+1)+\sum_{j=2}^{k}\beta_j X_j]}}{e^{[\alpha+\beta_1 X_1+\sum_{i=2}^{k}\beta_j X_j]}} \tag{7}$$

This expression reduces to e^{β_1} as all other terms cancel out. This result simply states that the ratio of the odds for a one unit increase in X_1 is given by e^{β_1}; ie, a one unit change in X_1 results in a e^{β_1} change in the odds ratio. It is constant; specifically it does not depend on the values of the other variables (X_j). Note that while the odds ratio is constant, this does not imply that the odds themselves are constant at various values of the X_j. In fact owing to the multiplicative effect, the actual change in the odds depends on the starting point. An odds ratio of two would increase odds of one to two, and odds of two to four.

Table 4-2 shows the direction of change in the odds of an event occurring for a one unit change in a variable, based on the sign of the corresponding coefficient.

Table 4-2-Relation between the estimated coefficient and the odds of an event

If the estimate of β_1 is:	**then the odds of the event will:**
Positive	Increase
Negative	Decrease
Zero	Unchanged

It is worth noting that while the distribution of the coefficients is symmetrical about zero, the odds have a lower bound of zero and so are not symmetrical (as shown in Table 4-1).

4.4 An example

Suppose the event of interest is the probability of females working full-time (W). This is coded (1) for those who are in full-time work and 0 if not working full-time (NW). For simplicity we postulate that whether a female is working depends solely on her age (A) and a continuous measure of health status (H), and that these variables are independent. The first step is to fit the logit model. Suppose this resulted in the following equation:

$$Z = \ln\left[\frac{p}{1-p}\right] = \alpha + \sum_{j=1}^{2}\beta_j X_j = 0.03 - 0.015A + 0.03H \tag{8}$$

Case A:

Let the means of the independent variables be A = 50 and H = 50 so that evaluating Z at the means yields:

$$Z = 0.03 - 0.015(50) + 0.006(50) = -0.42$$

so that $\Pr(W) = 1/(1+e^{-Z}) = 1/(1+e^{0.42}) = 0.40$

and Pr (NW) = 1 - 0.40 = 0.60 and

Odds = $\frac{\Pr(W)}{\Pr(NW)} = \frac{0.40}{0.60} = 0.66$ or the odds of an average 50-year-old female working are 0.66 to 1.

Log odds = ln(0.66) = - 0.42, where ln is the natural logarithm.

Case B:

Now consider the change when we allow the age to increase by one unit (a year in this case) from 50 to 51 while holding H at its original level of 50; ie, we are interested in estimating the effect of an increase in age on the probability of working holding constant a female's health score.

$$Z = 0.03 - 0.015(51) + 0.006(50) = -0.435$$

so that $\Pr(W) = 1/(1+e^{-Z}) = 1/(1+e^{0.435}) = 0.39$

and Pr (NW) = 1 - 0.39 = 0.61 and

Odds = $\frac{\Pr(W)}{\Pr(NW)} = \frac{0.39}{0.61} = 0.65$ or the odds of an average 51-year-old female working are 0.65 to 1.

So that the odds ratio = $\frac{\text{Odds for Case B}}{\text{Odds for Case A}} = \frac{0.65}{0.66} = 0.98$

which we can verify as $e^{\beta_1} = e^{-0.015} = 0.98$.

This implies that a one year increase in age decreases the odds of working by a factor of 0.98, or similarly decreases odds by 2%. In Case A, the odds of a 50-year-old female working full-time were 0.66 to 1. For a 51-year-old female the odds are (0.66*0.98) to 1, or 0.65 to 1. Note this is not the same as the probability of a female working full-time which, for a one year increase in age, fell from 0.40 in Case A to 0.39 in Case B. The difference in the latter probabilities is the marginal effect which we discuss in the following section.

Case C:

In some instances we might be interested in a non-marginal change. Consider the case of a 65-year-old female, again isolating the effect of a change in age by holding the health status constant at its initial mean level. In this case the predicted value of Z is given by:

$$Z = 0.03 - 0.015(65) + 0.006(50) = -0.645$$

so that $\Pr(W) = 1/(1+e^{-Z}) = 1/(1+e^{0.645}) = 0.34$

and Pr (NW) = 1 - 0.34 = 0.66 and

Odds = $\frac{\Pr(W)}{\Pr(NW)} = \frac{0.34}{0.66} = 0.52$ or the odds of an average 65-year-old female working are 0.52 to 1.

Log odds = ln(0.52) = - 0.645,

and the odds ratio = $\frac{\text{Odds for Case C}}{\text{Odds for Case A}} = \frac{0.52}{0.66} = 0.79$.

We can now compute the change in the log odds corresponding to a change in age from 50 to 65:

(Log Odds Case C) – (Log Odds Case A) = - 0.645 – (- 0.420) = - 0.225.

Note that this result is simply 15 times the value of β_1; ie, 15 * -0.015 = -0.225.

4.5 Measuring marginal effects in binary models

The impact of a unit change in one of the independent variables on the probability of an event is typically referred to as the *marginal effect.* The first step is to compute the value of the probability using equation (3) when all the values of the X_i are set at some predetermined value; ie, the marginal effect can be evaluated at different points depending on the set of X_i values chosen. Generally the mean values for the whole sample are used, but the choice is arbitrary.

The second step involves repeating the calculation of the probability with a different set of X_i values. Typically this will involve leaving all but the variable of interest at their mean values and incrementing the variable of interest by one unit.

In the above example (Case A) the probability of working with both independent variables set at their means:

$$\text{Prob}(W|X_i = \bar{X}_i) = 1/(1+e^{-Z}) = 1/(1+e^{0.42}) = 0.40$$

In the second stage we compute the probability of working when age is increased by one year and health status remains at its mean value:

$$\text{Prob}(W|X_1 = \bar{X}_1 + 1, X_2 = \bar{X}_2) = 1/(1+e^{-Z}) = 1/(1+e^{0.435}) = 0.39$$

The marginal effect is then given by

$$\text{Prob}\,(W|X_1=\bar{X}_1+1,\ X_2=\bar{X}_2)\ -\ \text{Prob}\,(W|X_i=\bar{X}_i) = 0.39 - 0.40 = -0.01$$

From this we conclude that the marginal effect of increased age is to reduce the probability of working by one percentage point.

To this point we have been using independent variables which are continuous. What happens when there is an independent variable that itself is binary? In the current context this could be a variable such as: does the female have a partner who is working (yes or no), or is the person a migrant (yes or no); or does the person have a tertiary qualification (yes or no). The presence of such variables has two implications. To calculate the marginal effect we would have to compute the value of Z setting the binary variable to zero and then to one. We then simply need to state clearly the base for the calculations. In addition, if there are other binary variables that we wish to hold constant, then there are a number of alternatives. We could (for apparent consistency with continuous variables) use the mean which is nothing more than the raw proportion. Alternatively we could assign the variable either zero or one. There is no "correct" way, and the option chosen will depend on the particular context being analysed. In the empirical work in later sections of this report we use the mean values.

We conclude this section with a summary in Table 4-3 of the different interpretations of a logistical regression coefficient.

Table 4-3-Interpreting logistical regression coefficients

When X_j. changes by one unit

(1) Z, the ***log odds***, changes by β_j where

Log odds = $\ln\left[\frac{\Pr(event)}{\Pr(not\,event)}\right]$, so odds = $\frac{\Pr(event)}{\Pr(not\,event)}$

(2) The odds ratio change by e^{β_j}

The ***odds ratio*** is defined as:

$$\frac{\text{odds evaluted at a particular set of values}}{\text{odds evaluated at a different set of values}}$$

When all values are held constant except for the one unit change in X_j, the odds ratio is equal to e^{β_j} where e^{β_j} is the expected change in the odds produced by a unit change in X_j.

(3) The ***marginal effect***[1] is estimated by the changes in the probability given by:

(3a) For the case where X_j is a continuous variable.

$$\Pr\,(\text{Event}|X_j=\bar{X}_j+1 \text{ and } X_i=\bar{X}_i\ \forall i \neq j) - \Pr\,(\text{Event}|X_i=\bar{X}_i\ \forall i=1...k)$$

Where $\Pr(Event)=\left[\frac{1}{1+e^{-Z}}\right]$ and $Z=\hat{\alpha}+\sum\hat{\beta}_i X_i$

(3b) For the case where X_j is a binary variable.

$$\Pr\,(\text{Event}|X_j=1 \text{ and } X_i=\bar{X}_i\ \forall i \neq j) - \Pr\,(\text{Event}|X_j=0 \text{ and } X_i=\bar{X}_i\ \forall i \neq j)$$

Note: 1. There is a third case for a categorical variable X_j which is not discussed here.

4.6 The logit vs. probit transformation

In formulating the logit model, an implicit assumption has been made about the variance of the error term. To arrive at equation (3) requires the var(ε) = $\pi^2/3$. An alternative assumption is that var(ε) = 1. In this case the model is referred to as a probit model. In short, while the assumption about the var(ε) is arbitrary, it does not affect the estimated values of the probabilities.[16] While the choice between the probit and logit models is to a large extent arbitrary, the effects in the logit model, unlike the case of the probit, can be interpreted as changes in the odds. Additionally, logit and probit models are generally asymptotically equivalent – so in a study such as this the coefficients should be effectively the same. We have chosen to use logit models in this study.

4.7 Potential problems

In addition to the usual problems that arise from missing observations, measurement error[17] and misspecification of the model, the models applied in this study are subject to the question of endogeneity. This arises when the assumption that the right-hand side variables are exogenous is violated. Exogenous variables are independent of the values of the dependent variable. For example, if health status is a variable to be used in a model to explain labour force participation, it is assumed that the values adopted by the health status variable are independent of labour force participation. The problem of endogeneity can arise for a number of reasons:[18]

1. While health status may in fact influence a person's decision to participate in the labour force, it may well be that their participation affects their health status; in short, health status and labour force participation are simultaneously determined and health status is no longer a truly exogenous variable.[19]

2. However comprehensive a set of survey data, there will be many variables that simply remain unobserved. Examples could include a person's attitude toward risk, or their preference for current over future consumption. To the extent that any one of a host of unobservable characteristics influences both the measured health status and the labour force participation, the problem of endogeneity is again present.

3. It is possible that some people not in the labour force might be inclined to report that their health status is poor as a way of rationalising their lack of participation both to themselves and to the interviewer. Once again, health status as observed is being influenced by the labour force participation and cannot be regarded as exogenous.

The presence of endogeneity may lead to the estimates of the coefficients in equation (4) to be biased from their true values, although typically the direction of the bias is uncertain. In addition the estimates may not be consistent; ie, their values may not necessarily converge to the unknown population value as the sample expands.

---

16 For a detailed discussion see Long and Freese (2006).

17 For example, self-reported health status may not be an accurate measure of true health status.

18 See Laplagne, Glover and Shomos (2007).

19 Recent evidence suggests that work can be good for health, reversing the harmful effects of long-term unemployment and prolonged sickness absence (Black, 2008).

While the existence of these problems and their implications is well known, it is much less clear as to the magnitude of the distortions, and even less certain about whether there are approaches to successfully mitigate the effects. Ideally one would address the problem of simultaneity by purging the health variable of the effect of the influence of current labour force participation. This leads to the simultaneous estimation of equations for labour force participation and for health status. What is required, however, is a variable that influences the health status but not the labour force participation decision. Such instruments are not easy to identify. For example, drinking or smoking might be argued to affect health but not labour force participation. As a consequence they would be included in a supplementary equation for health status but excluded from the labour force participation equation, the principal equation of interest.[20] In a comprehensive survey of studies of health and labour force participation, Currie and Madrian (1999) conclude:

> …estimates of the relationship between health and labour force outcomes vary widely and are sensitive to the identification assumptions employed. Many of the studies discussed above either ignore endogeneity issues altogether or rely on exclusion restrictions that are not easy to justify. (p. 3352)

In this study we tested a range of potential instrumental variables (including ethnicity and smoking) but concluded that none of the results obtained were satisfactory. We have therefore relied on a single equation approach. In the following sections we analyse the factors associated with key variables of interest with particular emphasis on the role of health. In each case we fit a regression model: an OLS in the case of continuous variables and a logit model where the dependent variable is binary.

Finally, a note of caution: whenever statistically significant associations are identified, these should not necessarily be taken to imply causation.

[20] For examples of this approach, see Stern (1989), Haveman (1994), Cai (2007), Cai and Kalb (2004 and 2006), and Laplagne *et al* (2007).

5 Wealth

In this section we analyse key factors associated with the level of total wealth based on an OLS regression model of the type shown in equation (1). As the survey did not collect data on liabilities, the results relate only to total, as distinct from net wealth.[21] A summary of the significant results is given in Table 5-1 while the complete results of the regression model are set out in Appendix Table C.1.

Of primary interest is the relation between health status and wealth accumulation. Clearly there is a likelihood that those with poorer physical health would tend to have less connection with the labour market. As a result of lower earnings and possibly higher medical expenses, they could be expected to have lower wealth accumulation. An advantage of the regression model used here is that it is possible to control for a wide range of other variables including specifically whether the person was working and whether in receipt of a benefit.

Table 5-1-The impact on wealth of significant explanatory variables

Dependent variable: Total wealth			
Explanatory variable	Description	Difference in wealth	Sig.
Physical health	1 unit improvement	+6,000	***
Male	Relative to female	+104,000	***
Māori	Relative to European	-169,000	***
Other ethnicities	Relative to European	-139,000	**
Years in New Zealand	1 additional year	+6,000	***
Main urban	Relative to rural	-300,000	***
Other urban	Relative to rural	-385,000	***
Secondary education	Relative to no qualifications	+109,000	*
Separated	Relative to married with non-working spouse	-164,000	***
Widowed	Relative to married with non-working spouse	-103,000	*
Never married	Relative to married with non-working spouse	-269,000	***
On a benefit	Relative to those not receiving a benefit	-133,000	***
Receiving NZ Super	Relative to those not receiving NZ Super	-208,000	***
Has a super scheme	Relative to those who do not	+83,000	**
Plans to stop work	Relative to those who do not plan to totally stop work after retirement	+133,000	***
Negative aspects of retirement	Relative to those who do not attach importance to negative aspects of retirement	-173,000	***
Income	A $5,000 increase in income	+9,000	***

Notes:

1. Only those explanatory variables that were statistically significant are shown in this table, rounded to the nearest thousand. The full results are in Appendix Table C.1.
2. *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level.

The results indicate that a one unit improvement in the physical health score is associated with an additional $6,000 of total wealth. It is considered that a five unit change in the score is clinically significant (Ware, 2000). Extrapolating from the regression results yields an estimate of an additional $28,000 in total wealth associated with a five unit improvement in the physical health score. This represents a 10% increase at the mean level of the health score.

[21] However, it should be noted that the questionnaire did not ask the respondent to distinguish between assets owned by the respondent and those owned jointly with a partner. This implies the potential for measurement error to have influenced the results. There is no obvious way to estimate the direction of any possible bias.

That those with better health have higher accumulated total wealth is not surprising. In the first place, those with poorer health may have had less working years and greater medical costs. Furthermore, poor health may be seen as signalling lower life expectancy, and with that less incentive to accumulate as much retirement wealth.

Males have significantly more wealth than females, and Māori and other ethnic groups have less wealth than NZ Europeans. Individuals who are separated or who never married have less wealth than those who are married with a non-working spouse. Those on a benefit have less wealth, and those with a superannuation scheme have higher wealth. Those planning to stop work totally at the time of retirement have higher wealth. Those who place importance on a range of negative aspects of retirement have significantly less wealth.

In the present study no association was found with mental health. Those with higher mental health scores did not report significantly higher levels of total wealth. It is possible that any relationship that might exist was obscured by the fact that in this study total, rather than net, wealth was measured. High levels of liabilities for a given level of total wealth may be associated with poorer mental health.

Carter *et al* (2008) examine the relation between mental health and net wealth using data from the SoFIE. They use a measure of psychological distress and explore the extent to which this is associated with the level of net wealth, after holding constant a range of socio-demographic characteristics. They find that the odds of reporting high psychological distress are much greater amongst those in the lowest wealth quintile compared to the highest. They conclude that policies which enhance wealth accumulation may have positive benefits for mental health. However, in drawing this conclusion the authors acknowledge that the potential exists for reverse causation such that those with poor mental health may accumulate less wealth through lower levels of labour force participation, lower earnings or higher levels of expenditure.

Anastasiadis (2010) has analysed the association between health and net wealth based on Waves 1 to 3 of the SoFIE data. He finds that poorer health is associated with lower net wealth after controlling for a range of other factors. Those with greater wealth are less likely to suffer health shocks.

Rich people tend to be healthier and live longer. With greater life expectancy they have more incentive to save for retirement and accumulate greater wealth. The finding in this study that better physical health is associated with higher wealth is consistent with this argument, and with similar findings for the USA by Nardi, French and Jones (2006).

6 Income

In this section, interest focuses on the association of a range of factors with both the level and adequacy of income. Three models were estimated. The first, a regression model, is for the level of reported income. The second, a logistic model, refers solely to those in the working group and relates to whether in their judgement they are satisfied with the level of family income they expect to have in retirement. The third model, a logistic model, relates to both working and retired groups, to whether the respondent felt his or her total income was enough to meet basic everyday needs (including accommodation, food and clothing and other necessities). The results of each of the three models are summarised in Table 6-1, while the complete results are given in Appendix Tables C.2 - C.4. The direction and level of significance of the association of each of the variables with income is indicated by plus and minus signs for a positive and negative association respectively. The number of signs indicated the degree of significance: three is associated with a variable whose regression coefficient was significant at the 1% level while two and one are associated with 5% and 10% significance levels respectively.

Table 6-1-A summary of factors associated with three measures of income

Explanatory variable	Level of income	Satisfied with what my family income will be in retirement (Working group only)	I have enough income to meet basic everyday needs
Working	+++	na	ns
Physical health	ns	---	+++
Mental health	ns	---	+++
Male	++	ns	ns
Māori	---	-	---
Other ethnicities	-	ns	---
Main urban	ns	+++	ns
Other urban	ns	ns	+
Tertiary education	++	-	++
Separated	--	ns	ns
Widow/er	--	ns	ns
Never married	---	--	ns
Married with working spouse	ns	ns	++
On a benefit	---	ns	---
Receiving NZ Super	---	--	ns
Receiving other super	ns	-	-
No. of dependants	++	ns	ns
Plans to stop work	ns	-	ns
Positive aspects of retirement	ns	++	---
Negative aspects of retirement	---	+++	---
Income	na	---	+++
Wealth	+++	---	+++

Notes:

1. Only those explanatory variables that were statistically significant are shown in this table.
   +++ or --- = significant at the 1% level; ++ or -- = significant at the 5% level; and + or - = significant at the 10% level.
2. The table of full results is given in Appendix Tables C.2-4.

For those in the working group, their income is higher than among the retired group by some $33,000. The results indicate that after controlling for other factors we fail to reject the

hypothesis that neither the physical nor mental health scores are associated with the level of income. While improved health, both physical and mental, is found to be positively related to income, the relationships are not statistically significant. Working respondents with better mental and physical health reported that they are less likely to be satisfied with their expected income in retirement. This could imply they were more concerned to increase their retirement savings to achieve a better standard of living in retirement. However, in contrast, amongst all respondents, there was a strong positive association between their health scores and the ability to meet basic needs with their current income. While higher health scores were not associated directly with higher incomes, better health was associated with a positive view of the ability to meet basic needs.

While there is a highly significant association between better health and the respondent reporting they had enough income to meet basic needs, it is important to assess the absolute magnitude of the effect. In some cases this might be very modest even though it is statistically significant. One way to assess this is by the use of the odds ratio. Based on this measure, a five point increase in the physical and mental health scores would result in an increase in the odds of being able to meet basic needs of 11% and 14% respectively.

In a similar manner, one can compute the impact of being on a benefit. For those on a benefit, the odds of claiming to have enough income to meet basic needs is 65% lower than the odds for those not on a benefit. Likewise, being Māori implies that the odds of claiming to be able to meet basic needs from reported income is 25% less than for NZ Europeans, after controlling for a wide range of other variables.

7 Living Standards

In this section we summarise the key factors associated with a range of measures designed to capture overall living standards. Table 7-1 reports two measures: the Economic Living Standard Index (ELSI) described in Section 3.3, and a measure of hardship. The latter is defined in terms of the number of measures taken to reduce costs in the previous year and includes elements such as staying in bed to reduce heating costs, postponing visits to a doctor, not buying fresh fruits, etc.

Table 7-1-A summary of factors associated with two measures of living standards

Explanatory variable	Economic Living Standard Index	Number of measures taken to reduce costs in the last 12 months
Working	--	+
Physical health	+++	---
Mental health	+++	---
Male	ns	---
Age 65 or over	+	ns
Māori	---	+++
Years in NZ	++	ns
Secondary education	+++	ns
Tertiary education	+++	ns
Married with working spouse	+++	---
On a benefit	---	+++
No. of dependants	---	+++
Receiving NZ Super	--	+++
Receiving other super	+++	ns
Plan to stop work	+++	---
Positive aspects of retirement	---	+++
Negative aspects of retirement	---	+++
Income	+++	---
Wealth	+++	---

Notes:
1. Only those explanatory variables that were statistically significant are shown in this table.
+++ or --- = significant at the 1% level; ++ or -- = significant at the 5% level; and + or - = significant at the 10% level.
2. The table of full results is given in Appendix Tables C.5-6.

Better physical and mental health are strongly associated with higher living standards as captured by these two measures. Māori have a significantly lower ELSI than NZ European, and take significantly more measures to control household expenses than do NZ Europeans. Recipients of NZS have a significantly lower score for the ELSI, in contrast to those with other forms of superannuation. Higher incomes and wealth predictably are associated with higher living standards and less deprivation.

Table 7-2 summarises the most salient results associated with a person's self-rated standard of living and the extent to which they are satisfied with their current material standard of living, expanding on the results in Figure 3. Both measures are binary variables formed from categorical responses. Those rating their living standards as high, fairly high or medium were coded as 1, while a 0 was assigned to those responding that they rated their living standards as fairly low or low. Similarly, those who were very

satisfied or satisfied with their material standard of living were assigned 1, while those who were neutral, dissatisfied or very dissatisfied were coded as 0.[22]

Table 7-2-A summary of factors associated with satisfaction with living standards

Explanatory variable	How do you rate your material standard of living?		How satisfied are you with your material standard of living?	
	Working	Retired	Working	Retired
Physical health	++	ns	++	+++
Mental health	ns	+++	+++	+++
Age 65 or over	ns	ns	ns	+
Māori	ns	ns	+	++
Years in NZ	+++	ns	ns	ns
Main urban	+	ns	ns	ns
Other urban	++	ns	ns	ns
Secondary education	ns	ns	+	ns
Married with working spouse	+	+	ns	ns
On a benefit	---	---	---	--
Receiving NZ Super	ns	ns	ns	---
Receiving other super	++	-	+++	ns
No. of dependants	ns	++	ns	ns
Plan to stop work	ns	ns	ns	+++
Own health important	ns	ns	ns	-
Positive aspects of retirement	ns	ns	ns	+++
Negative aspects of retirement	ns	--	---	---
Income	+++	+++	+++	+++
Wealth	+++	++	+++	ns

Notes:
1. Only those explanatory variables that were statistically significant are shown in this table.
   +++ or --- = significant at the 1% level; ++ or -- = significant at the 5% level; and + or - = significant at the 10% level.
2. The table of full results is given in Appendix Tables C.7-8.

A person's assessment of their living standards is a subjective judgement and depends on a wide set of personal attributes, many of which are unobservables. Of the variables included in the models represented in Table 7-2, many are found to have no significant association with how an individual views their standard of living. The main exceptions are that higher income and wealth are strongly associated with a higher assessment of living standards. Better physical and mental health are associated with greater satisfaction with an individual's material standard of living. In short, health and wealth matter. Other observable attributes show no systematic association with subjective assessment of living standards.

The next analysis relates to the impact of retirement. This is based on two questions. First, all respondents were asked whether they expected their living standards in retirement years to change (relative to their current living standards). Those expecting increased or similar living standards were coded 1, while those expecting their living standards to decline were assigned a code of 0. The results are presented separately for those who are working, and for respondents who were retired at the time of the survey. In the case of working respondents, the question relates to their expectations about their future retirement. In the case of those who are retired, the responses refer to the expectations they held before retirement. Highlights of the results for both groups are summarised in Table 7-3.

[22] For simplicity we constructed a binary indicator of living standards from the categorical responses in the survey. An alternative procedure, albeit more complex, is the use of ordered logistic regressions.

Table 7-3-Factors associated with an expected change in living standards following retirement

Explanatory variable	When you retire(d) do you expect your living standards to change? Increase or same = 1; Decline = 0		Compared to your working years do expect your retirement years to be different? Better or same = 1; Not as good = 0
	Working	Retired	Working
Physical health	+++	+++	+++
Mental health	+++	ns	++
Age 65 or over	ns	+	+++
Māori	++	ns	-
Main urban	++	ns	ns
Other urban	+++	ns	ns
Secondary education	ns	ns	+
Tertiary education	-	ns	+++
Never married	+		ns
On a benefit	+	ns	+
Receiving NZ Super	ns	---	+++
Plan to stop work	ns	++	+++
Own health important	ns	-	ns
Positive aspects of retirement	ns	ns	+++
Negative aspects of retirement	---	---	---
Income	ns	+	ns
Wealth	+	ns	+++

Notes:
1. Only those explanatory variables that were statistically significant are shown in this table.
   +++ or --- = significant at the 1% level; ++ or -- = significant at the 5% level; and + or - = significant at the 10% level.
2. The table of full results is given in Appendix Tables C.9-10.

For both the working and retired groups the expectations of an increase in living standards was positively associated with better physical health. In the case of those working at the time of the survey, those with better mental health expected an increase in living standards. Working Māori respondents expected an increase in living standards, compared to NZ Europeans. Those placing weight on negative aspects of retirement expected a decline in living standards compared to those who did not.

Among the working respondents there was no significant effect of income and only a marginally significant effect of wealth on their expected living standards. This finding is consistent with the implications of a life cycle model of consumption smoothing in which individuals are assumed to adjust their spending and saving during their working years so as to avoid a major drop in living standards following retirement.

The second question asked whether retirement years would be better, the same (coded 1) or not as good (coded 0). The results of this model for the working group are given in the last column of Table 7-3. Given that this question is closely allied to the previous one relating to changes in living standards, it is not surprising that the results are very similar. Physical and mental health matters – better health is associated with a higher expectation that retirement years will be better. Māori expected a decline in retirement years, while those currently on a benefit or receiving NZS expected an improvement in retirement years. Positive and negative feelings towards retirement correlate with positive and negative impacts on expectations. Respondents reporting higher levels of total current wealth expect retirement years to be better.

8 Health

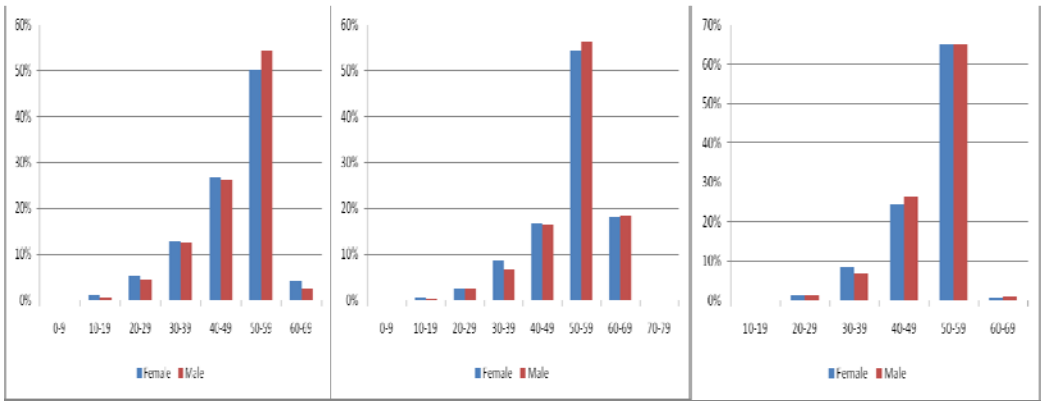
In the first part of this section we present summary measures of health status (Section 8.1). The second part analyses the factors associated with health status.[23]

8.1 Measures of health status

As described in Section 3.4, the HWR has extensive coverage of health. From these questions a physical and mental score can be computed as well as a combined, or overall, score. In addition, respondents were asked to rate their health as *excellent, very good, good, fair* or *poor*.

We first consider the component scores for mental and physical health. Figure 10 summarises the distribution of these health status scores for males and females. Overall there is little difference between the sexes. Considering both genders together, and taking the mean as 50, 45% of all respondents are below the mean physical score, 37% are below the mean mental score and 35% below the mean overall, combined score.

Figure 10-The distribution of health status scores: by sex



Source: Health, Work and Retirement Survey

(a) Physical score (b) Mental score (c) Overall score

Second, we examine the extent to which there is a systematic pattern of these component scores in relation to the self-reported health categories. Table 8-1 summarises the mean scores for each self-reported health category from the HWR survey respondents.

The mean scores for both mental and physical health decline systematically with poorer self-reported health status. For those whose self-reported health is given as poor, the component scores for mental and physical health fall to 80% or below of the overall mean values.

[23] For an overview of the health status and needs of older New Zealanders, see Ministry of Social Development (2007).

Table 8-1-Mean physical and mental health component scores by self-reported health status

Self-reported health status	Physical health component scores (H^p)		Mental health component scores (H^m)	
	Males	Females	Males	Females
Excellent	57	57	57	56
Very good	53	52	56	55
Good	47	46	52	52
Fair	36	35	48	46
Poor	30	27	43	38
Overall mean	50	49	54	53

Source: Health, Work and Retirement Survey

Clearly these various measures are related and to the extent they were highly correlated their use as separate independent measures would be compromised. However, as indicated in Table 8-2, the cross-correlations with the self-rated measure are modest, as is the correlation between the mental and physical component scores. Logically, the component scores are more highly correlated with the overall score.

Table 8-2 Correlation coefficients for four health status measures

	Self-rated	Physical score	Mental score	Overall score
Self-rated	1.00			
Physical score	0.36	1.00		
Mental score	0.27	0.25	1.00	
Overall score	0.40	0.80	0.78	1.00

8.2 Factors associated with health status

In this section we analyse factors associated with health status. In each case (physical, mental and overall) the continuous score (H^p, H^m and H^o) was regressed on a common set of explanatory variables (Z_i), with a view to identifying the factors that are most strongly associated with health status, either positively or negatively.

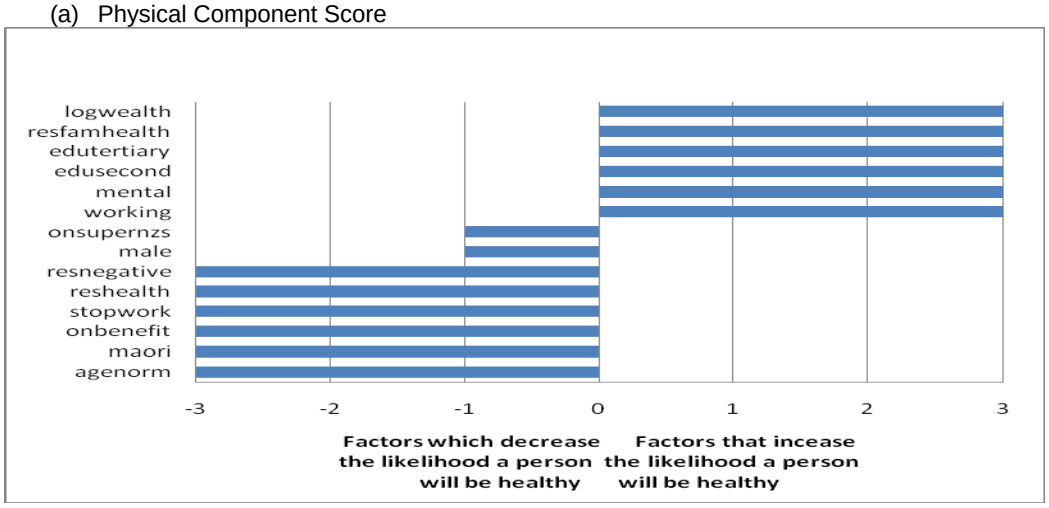
$$H^p = \beta^m H^m + \Sigma \beta_i^p Z_i + \varepsilon^p \quad (9)$$

$$H^m = \beta^p H^p + \Sigma \beta_i^m Z_i + \varepsilon^m \quad (10)$$

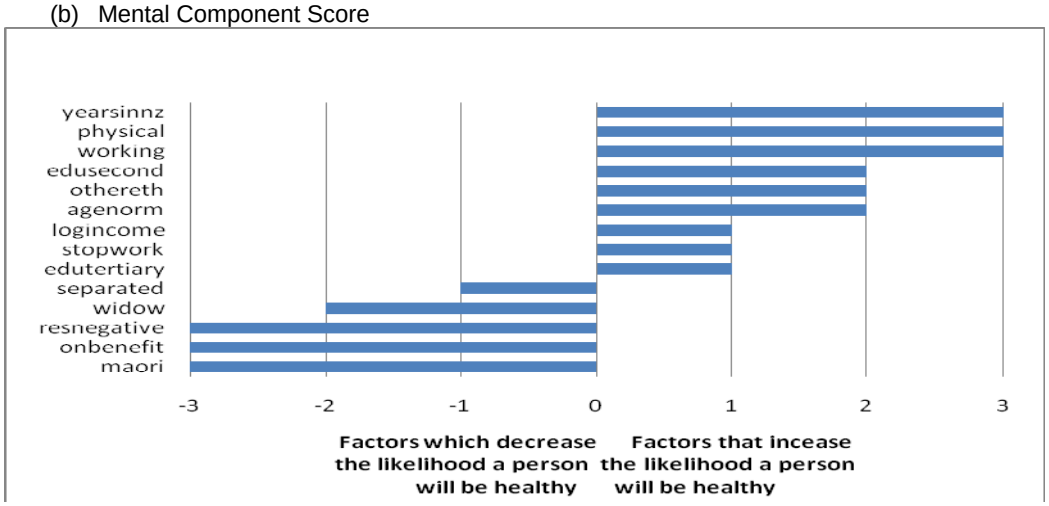
$$H^o = \Sigma \beta_i^o Z_i + \varepsilon^o \quad (11)$$

Figure 11-Factors associated with health status

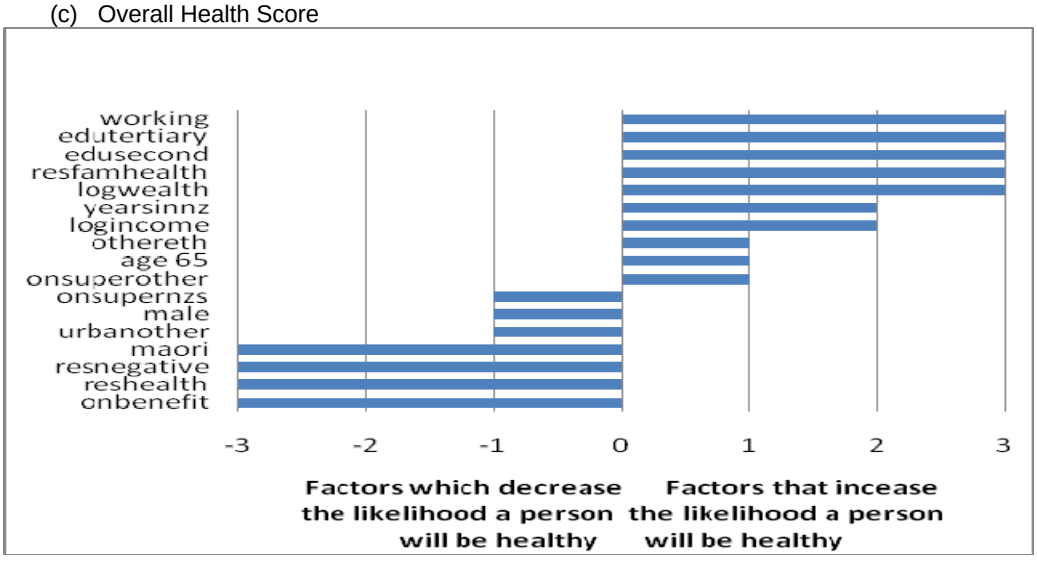
(a) Physical Component Score



(b) Mental Component Score



(c) Overall Health Score



Source: Health, Work and Retirement Survey

Notes:

1. The numerical scores refer to positive and negative effects at the 1% (=3), 5% (=2) and 10% (=1) levels of statistical significance.
2. A summary of the regression results is given in Appendix Tables C. 11-13. Complete results are available on request.

Summary results from these three regression models for the different health scores, for the working group[24] and broken down by male and female are in Appendix Tables C.11-13.

[24] As the retired group is simply the inverse, it is not reported.

The overall results are summarised in Figure 11 where bars to the right are factors that are associated with better health and those to the left with poorer health. The length of the bars is proportional to their statistical significance, so that a bar of three units in length is associated with a variable whose regression coefficient was significant at the 1% level. Bars of lengths one and two refer in turn to the 10% and 5% significance levels.

More education and labour force participation are associated with a higher probability an individual will have better physical and mental health. Finding such associations does not carry implications of causality. Working is significantly associated with better health, but, as we will show in Section 9, those with better mental and physical health are more likely to be working. In short, poorer health is associated with a lowering of the likelihood of working, but working is associated with better health. Those individuals with higher income and wealth are more likely to be healthy. Again, however, their ability to accumulate wealth may well be associated with their health status (recall Table 5-1). In each of the three models reported in Figure 11, being Māori relative to NZ European increases the likelihood of poorer health.

Stephens *et al* (2008) report similar findings based on the HWR data. In particular they find wealth is positively associated with physical but not mental health. They also report that retirement is associated with poorer scores for both mental and physical health.

Benzeval and Judge (2001) use longitudinal data from the British Household Panel Survey to study the relation between income and health. They distinguish between permanent and transitory income as well as addressing the possibility of reverse causation. They find that long-term income is more important for health than current income; that the level of income is more important than changes in income; that decreases in income are more important than increases; and persistent poverty is more harmful to health than occasional episodes.

The question of causation between health and income has been the subject of extensive debate. A clearer understanding of the relationship is important for public policy. Would policies that improved the incomes of a target group be expected to lead to improved health status? The possibility always exists that the measured effect of income on health might be owing to reverse causality; ie, those with better health will have higher labour force participation and command higher wages, resulting in greater income. The standard approach to dealing with this endogeneity has been to use a two stage instrumental variables model. It is expected that this would purge income of the effect of health status. The challenge has always been to find suitable instruments; ie, variables associated with income but not health. Ettner (1996) uses the state unemployment rate from cross-sectional data for the USA, together with work experience, parental education and spouse characteristics. Her results support the hypothesis that the direction of causality is from income to health. However, such models remain susceptible to the choice of instruments, and as Currie and Madrian (1999).note, the evidence remains mixed

Dave, Rashad and Spasojevic (2006) use longitudinal panel data from the Health and Retirement Study in the USA to examine the effects of retirement on physical and mental health. Partly as a result of changes in lifestyle after retirement, including less physical activity and fewer social interactions, they report robust evidence that both physical and mental health deteriorates. Complete retirement is associated with 5% to 16% increase in difficulties of mobility and daily activity, a 5% to 6% increase in illnesses and a 6% to 9% decline in mental health.

9 Labour Force Participation

This section analyses the labour force participation patterns of older people. What are the factors associated with continuing in the workforce on a full- or part-time basis as distinct from retirement? In particular we are interested in the extent to which a respondent's health status influences the decision to remain in the workforce.

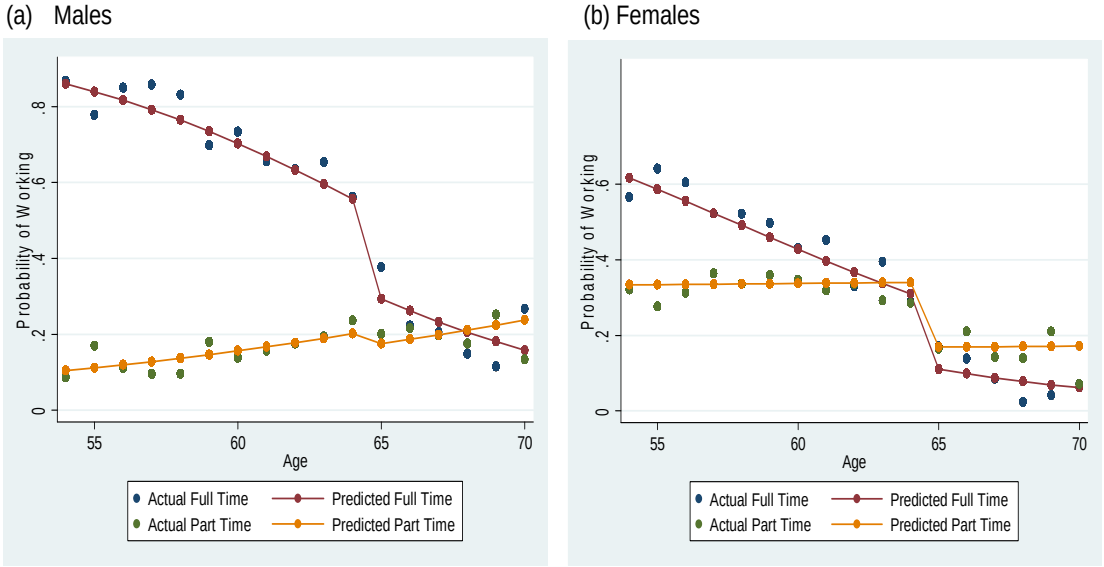
9.1 Overview of the probabilities of being in the labour force

The initial analysis presents the results of a simple model relating the probability of working to age. Formally the logit model is of the form:

$$\Pr(W) = \alpha + \beta(age) + \varepsilon \tag{12}$$

Figure 12 provides a snapshot of the probabilities that an individual of a given age will be in full- or part-time work. Recall from Section 3.5 that those not in the workforce are classified as retired (with the exception of a small residual for whom the data was incomplete). The figure plots the predicted probabilities derived by regressing full- or part-time participation solely on age and an indicator as to being age 65 or over (no other variables were involved), with all points lying on the continuous line joining them. The actual probabilities for each age group are shown and imply an over- or underestimate of the probability of working, based on age alone.

Figure 12-Unconditional probabilities of working full- or part-time: by age and sex



Source: Health, Work and Retirement Survey

For males, the probability of participation in full-time work falls with increasing age. Despite the predictable drop at age 65 (given eligibility for NZS), almost 20% of males remain in full-time employment at the age of 70. In contrast, part-time work by males rises with increasing age, with only a slight fall at age 65. Even so, by age 66, more than 40% of all males remain in full-time or part-time work. Clearly, while eligibility for NZS has a notable impact, a significant share still participates in the labour force after age 65.

The underlying pattern for females is broadly similar. The principal difference is in the absolute levels. The probability of being in part-time work is higher than for males, up to age 65. The corollary is that full-time rates for females are some 20 percentage points lower up to age 65, but they show the same downward trend as was the case for males.

Smeaton and McKay (2003) report a similar deterrent effect on labour force participation of the British state pension. They find a drop in participation of some 10 percentage points once an individual reaches the age of eligibility. This contrasts with a drop in the New Zealand participation rates at age 65 of more than twice that amount. This reflects the more generous level and universal eligibility for NZS compared to the British state pension.

Many factors other than age contribute to the decision to remain in the workforce. Critical amongst these is health. Table 9-1 summarises the population estimates of labour force status by self-reported health status.[25] There is a very marked decline in labour force participation for both males and females in the poorer health categories. While 82% of all males aged 55 to 70 reporting excellent health are working (either in full-time, part-time or seeking employment), only 53% in fair health and 28% in poor health remain working. A striking finding is that while only 28% of males who state they are in poor health are working, 45% of females in poor health are reported as working. This could arise as a result of different expectations about health and working being applied by males and females, or by males having a greater preponderance of conditions that result in both a self-rating of poor health and preclude labour force participation.

Table 9-1-Distribution of health and labour force status: by sex

Health Status	Male			Female		
	Total %	Working %	Retired %	Total %	Working %	Retired %
Excellent	16	82	18	17	80	20
Very good	39	83	17	39	71	29
Good	34	78	22	32	62	38
Fair	10	53	47	10	53	47
Poor	2	28	72	2	45	55
Total	100%	77%	23%	100%	67%	33%

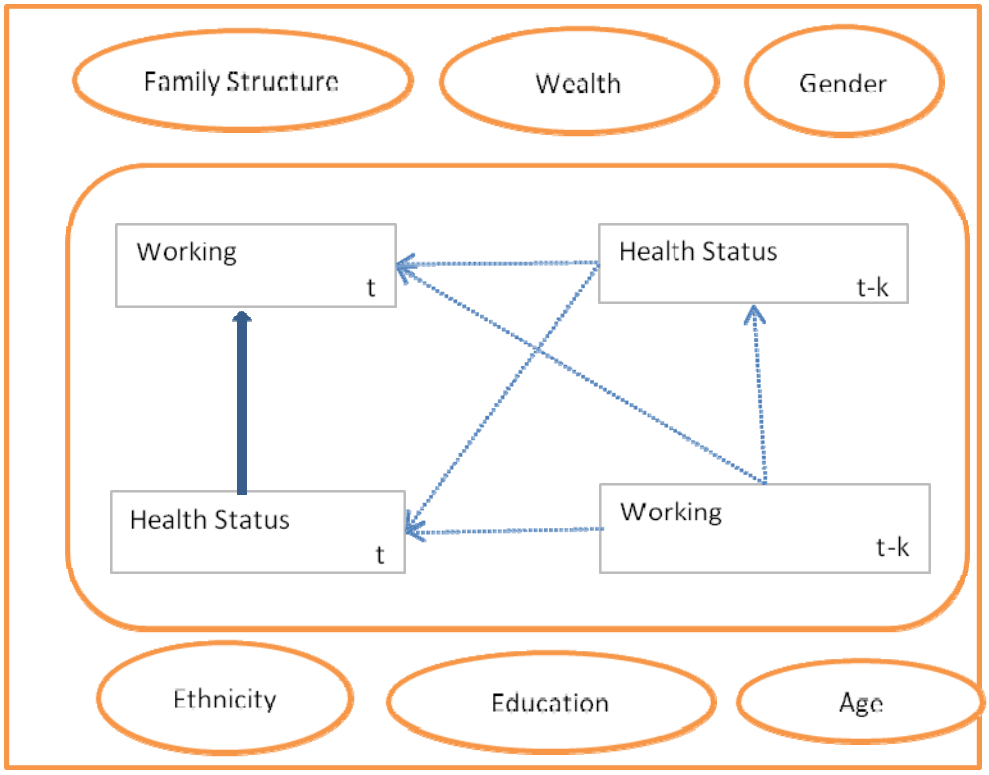
9.2 Factors influencing the labour force: retirement choice

It is well recognised that the decision to leave the workforce and retire is influenced by a wide range of personal and family circumstances. In this study we are particularly concerned to identify the extent to which an individual's health status influences that decision.

Figure 13 illustrates schematically the process of modelling the effect of health on the decision to work. The principal avenue explored in this study is the contemporaneous effect of health status on working (as indicated by the bold arrow). The models endeavour to isolate this effect while holding constant a range of other "confounding" variables indicated around the periphery. The dashed arrows indicate potentially important linkages from both previous health states and earlier labour market experience. However, as the data used here are cross-sectional, inclusion of these lagged effects will need to await data from future waves of the HWR survey so that longitudinal observations can be incorporated.

[25] Self-reported health is discussed further in Section 9.5.

Figure 13-Modelling the effect of health on labour force participation



A key message from this schematic view is that health status may influence the decision to work in a number of ways, as argued by Dwyer and Mitchell (1998). Poorer health may result in lower earnings owing either to reduced productivity or fewer hours worked, or some combination of the two. Poorer health may alter the preferences for leisure versus consumption, or make work more demanding. All these factors would tend to raise the utility of leisure and lead to earlier retirement.

In contrast, the needs of a person with poorer health might be such that they opt to continue working at least part-time to maintain consumption, thereby postponing retirement. The onset of a decline in health may lead an individual to alter the perception of their life expectancy. This may lead to an earlier retirement than would otherwise have occurred had their health not deteriorated. However, for some, continuing to work may provide a psychological boost which itself could mitigate, at least in part, the effects of poorer health.[26] In short, the effect of health on the decision to remain in the labour force is theoretically ambiguous. We are left to appeal to the evidence, recognising that the limitations of both the data and the models may not necessarily result in an unequivocal outcome.

There has been a long-run trend throughout the 20th century toward earlier retirement. Clearly, many factors shape the final decision. What effect does better health have? Does it mean that life expectancy is extended and hence the retirement date is shifted out so that working life simply remains proportional to life expectancy? Bloom, Canning and Moore (2004) extend the standard life cycle model to show that improved health has been associated with a less than proportional increase in working life; ie, more time is spent in retirement as life expectancy rises. On one hand, better health means that the disutility of work is less, so retirement age could be expected to rise. But these authors note that a longer working life means a greater effect of compound interest earnings on savings, creating

[26] In a study of Danish males, there was no evidence that redundancy led to hospitalisation for stress-related disease (Browning, Dano and Heinesen, 2006).

a wealth effect leading to more leisure (earlier retirement) and higher consumption (implying lower savings).

In a UK study, adverse health shocks are found to be an important predictor of individual retirement behaviour (Disney, Emmerson and Wakefield, 2003). This study relied on self-rated health status, but attempted to deal with the problem of endogeneity by using a constructed measure of a health stock Similar findings are reported by Banks and Tetlow (2008) who demonstrate that it is the onset of a major health condition rather than a chronic illness that increases the odds a person will leave full-time work.

Clearly, many factors shape the final decision to continue participating in the labour force. The final decision is an amalgam of health status (including that of family members), wealth levels, interest rates, the disutility of work, the extent of publicly provided pensions, health services and long-term care, and the strength of the bequest motive.[27] For this reason, it is important to use a multi-variate framework, if there is to be any chance of isolating the effect of a particular variable on the decision to retire.

We now turn to the application of logit models whose aim is to isolate the effect of health on the decision to remain in the labour force, while holding constant the influence of a wide range of other factors that may potentially influence the decision taken by an individual. These effects were estimated by fitting a logit model of the form:

$$\Pr(W) = W(H^p, H^m, \underline{Z}) + \varepsilon \tag{13}$$

where the probability of working is postulated to depend on the physical and mental health component scores (H^p, H^m respectively) and a vector ($\underline{Z}$) of control variables (including age, gender, marital status, region, migrant status, education level, benefit status, income, wealth, etc) plus a random error term (ε).

A summary of the main significant factors associated with the decision to work (defined as either full-time, part-time or seeking work) for males and females is given in Table 9-2. Estimates of the marginal effects are given in Section 9.3. Both physical and mental health are critical factors influencing the decisions by males whether or not to work. However, only their physical health status appears to influence the decisions of females.

While Māori men and women were less likely to be in the workforce, the differences were not significant. Having a tertiary education significantly raised the probability that both males and females would be in the labour force.

Relative to being married with a non-working spouse, virtually all other marital categories are associated with a higher chance of being in work. For both men and women, being separated or widowed significantly raised the probability of working, as did having a working spouse.

The receipt of a benefit or NZS lowers significantly the chance of being in the workforce for both males and females. While the level of total wealth typically has no effect, males are more likely to be in work (full- or part-time or seeking) when the income of other household members is higher. For males this is also true if they are in receipt of other sources of retirement income. Only half as many women as men have other superannuation schemes, and the effect for females, while still negative, is very much smaller and not significant.

[27] For added insights into the factors influencing retirement decisions based on qualitative evidence from the HWR survey, see Davey (2008).

It is notable that the effect of wealth is not significant. One might have expected that those with a taste for work are likely to have accumulated a greater stock of wealth. If this were the case, we would expect to find a positive relation. While it is true that the effect is typically found to be positive in this study, the coefficients for wealth are not statistically significant. There are at least three issues, however, that may have mitigated against finding a significant role for wealth. Ideally, we require a measure of the net stock of wealth but as the HWR survey did not collect estimates of liabilities we are restricted to using gross wealth. Second, the response rate on estimates of the value of major assets was relatively low, as respondents were invited to provide this information only if they so wished. Third, the NZS system provides a lifetime defined benefit on a universal basis, free of income or asset testing. As shown by Scobie *et al*, (2005) the implied stock of wealth associated with NZS forms a major share of the total retirement wealth of many New Zealanders. The incentive to accumulate other forms of wealth is reduced, relative to that which would prevail in the absence of such a state pension scheme. As a consequence it is possible that some of what is actually a wealth effect is being picked up by the highly significant effect of receiving NZS. We found some tentative evidence to support this explanation. As shown in Table 9-2, both males and females in receipt of NZS tend to have a lower probability of working, after controlling for their level of wealth and an extensive set of other variables.

A notable finding is that health status, as measured by the mental component score, has no significant effect on the labour force participation decisions of women. This stands in marked contrast to the results for males, whose decision to work is strongly related to both their physical and mental health scores.

Table 9-2-Factors associated with the decision to work: by sex

Explanatory variable	Male	Female
Physical health	+++	+++
Mental health	+++	ns
Age	---	---
Secondary education	ns	+++
Tertiary education	+	+++
Years in New Zealand	+++	+
Separated	+++	+++
Widow/er	+++	+++
Never married	ns	+++
Married with working spouse	+++	+++
On a benefit	ns	--
Receiving NZ Super	--	--
Receiving other super	---	ns
No. of dependants	+++	++
Plan to stop work	---	---
Family health important	+	ns
Positive retirement reasons important	-	ns
Negative retirement reasons important	+	++
Income of other family members	ns	ns
Wealth	ns	ns

Notes:
1. Only those explanatory variables that were statistically significant are shown in this table.
2. +++ or --- = significant at the 1% level; ++ or -- = significant at the 5% level; and + or - = significant at the 10% level.
3. The table of full results is given in Appendix Table C.14.

To explore further this apparent anomaly the labour force equation for women was re-run including only physical and mental health scores. Again, mental health was not significant. We conclude that this is a robust finding; however, the reasons for it remain as a matter for further research.

In Section 3.5, a group of people amounting to some 40,000 out of 609,000 were dropped from the analysis as there was insufficient information about their status. A comparison of their characteristics with those who identified as retired, revealed that they tended to have a higher proportion of females, be less healthy, have lower median income and almost no wealth. When the logistic model for working was re-run including this group the results remained broadly as shown in Table 9-2. The only notable changes were that for males on a benefit, there was a significant reduction in the probability of working, and for females, wealth became a significant factor positively associated with working.

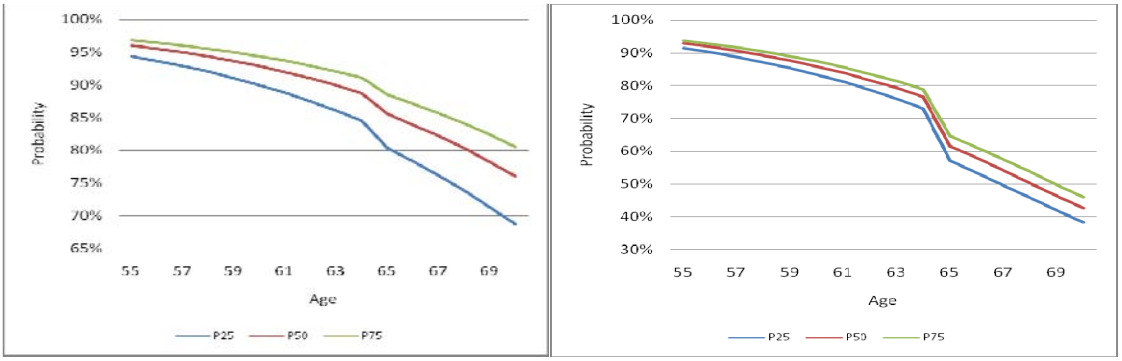
The question as to when to retire (ie, withdraw from paid employment) is a critical decision that older workers must make. One of the shortcomings of many studies of retirement choices is that they potentially suffer from a bias when subjective measures of health are used. This arises when the respondent provides a more pessimistic assessment of their health status in part to justify their decision to retire.

As people age, the probability that they will choose to retire increases. Clearly it is expected that the decision to retire will, at any given age, be influenced by the person's physical health status. To explore this, Figure 14 shows the declining pattern of labour

force participation for three points taken from the range of physical component scores.[28] These correspond to the 25th percentile, the median and the 75th percentile. Those at the 25th percentile of the physical health score have, unsurprisingly, the lowest rates of labour force participation. At age 55, males at the 25th percentile of the physical health score are 3 percentage points less likely to be working than those at the 75th percentile. However, by age 70, the effect of health status is considerably more pronounced and the inter-quartile range is 12 percentage points. For females, a similar pattern holds; however, the decline with age owing to poorer health is less marked. At age 55 the difference is 2 percentage points rising to almost 8 percentage points at age 70.

Figure 14-Probability of working at three quartile levels of physical health: by sex

(a) Males (b) Females



Source: Health, Work and Retirement Survey

Note: P25, P50 and P75 refer to the 25th percentile, the median and the 75th percentile of physical health respectively.

There are two steps that can be taken to overcome this problem. The first is to restrict the analysis to those who are currently in the labour force, and focus on their expectations about their retirement age. The second is to use more objective measures of health status. The HWR survey allows us to incorporate both these steps. A logit regression of the following form was fitted:

$$\Pr(\textit{Working at } 62 \text{ or } 65) = \alpha + \beta_p H^p + \beta_m H^m + \beta_z Z + \varepsilon \qquad (14)$$

where the probability of expecting to be still working full-time at age 62 (or 65) is expressed as a function of health measures (H^p and H^m) and a set of conditioning variables (Z).

Table 9-3 summarises an analysis based on the expectations of respondents about future retirement plans. Males are significantly more likely to expect to remain in full-time employment through age 65 than females. Again, marital status is an important factor affecting the decision to continue in full-time work. Attitudes to retirement clearly matter; those with positive attitudes being less likely to plan on being in full-time work at 62 or 65.

It is to be expected that a worker's health will influence the expected retirement age. While better health as measured by the physical and mental health scores does increase the likelihood that a person will remain in employment at 62 or 65, the effect was not statistically significant. In contrast, while the health scores do not appear to directly affect

[28] Recall, from Section 3.5, that our population of interest is those who are working and those who are retired. There are other people not in the workforce whom we exclude, leading to our rates being higher than for the full population.

retirement expectations, respondents considered that their own health and that of their family members did have a bearing on their retirement plans.

Table 9-3-Factors associated with the expectation to continue working full-time at age 62 or 65

Explanatory variable	I plan to continue working full-time when I reach:	
	62	65
Male	+++	+++
Māori	++	ns
Other ethnicities	ns	+
Main urban	+++	++
Other urban	++	ns
Separated	+++	+++
Widow/er	+++	+++
Never married	+	ns
Married with working spouse	+	++
On a benefit	--	---
Receiving NZ Super	ns	---
Receiving other superannuation	-	---
No. of dependants	++	ns
Plan to stop work	---	---
My health will be an important factor	---	-
Health of family members will be important	+++	++
Positive aspects of retirement	-	---
Negative aspects of retirement	+	+++
Income of other household members	-	ns

Notes:
1. Only those explanatory variables that were statistically significant are shown in this table.
2. *** = significant at the 1% level; *** = significant at the 5% level; * = significant at the 10% level.
3. The complete results are given in Appendix Table C.19.

McGarry (2002) reports similar findings for the USA based on an analysis of data from the Health and Retirement Study (HRS).[29] She finds that health is a more critical factor in retirement expectations than income and wealth, a result paralleled in the present study. A UK study reports that the main reason both men and women give for early retirement is their health or that of others (Banks and Smith 2006).

Cobb-Clark and Stillman (2006) use the first three waves of the Household Income and Labour Dynamics in Australia (HILDA) survey, covering the years 2001 to 2003, to examine the retirement plans of middle-aged men (aged 45 to 55) and women (aged 45 to 50) in their prime working ages. It is of note that these results for Australia, like the present study, found no effect of health status. Because the authors were able to use Waves 1 and 3 of HILDA they could further explore the effect of a change in health status; here, a deterioration in women's health between the two waves did result in a significant reduction in the age of expected retirement. Poorer health is likely to lead to reduced life expectancy and deteriorating health tends to be associated with reduced consumption expenditures (Olsho, 2005). As a result, individuals are likely to leave the workforce earlier with lower accumulated retirement savings.

The HWR survey asked those respondents whether, when they retire, they wish to stop any paid work or continue with some paid work. It is of interest to ask whether the characteristics of those who plan to continue differ from those of the respondents who plan to stop entirely. A summary of some elected characteristics is given in Table 9-4.

[29] For details of the HRS, see: http://hrsonline.isr.umich.edu/

Tertiary-educated males are more likely to continue in paid work, as are respondents who were separated or widowed. Those whose self-assessed health was poor are more likely to stop entirely, although the objective physical and mental health scores are virtually the same for the two groups.

Table 9-4-A comparison of the characteristics of those currently working who plan to stop paid work entirely with those who plan to continue some paid work

Characteristic	Plan to stop paid work entirely	Continue some paid work
Proportion who are male	41%	54%
Proportion with tertiary education	47%	51%
Proportion who are separated	10%	14%
Proportion who are widowed	5%	7%
Proportion reporting poor health	2%	1%
Median physical health score	51	53
Median mental health score	57	56
Median wealth ($000)	450	400
Median income ($)	84,000	85,000
Proportion who are receiving a benefit	7%	9%

9.3 Measuring the marginal effects on labour force participation

Table 9-2 provided a ready overview of those factors significantly related to the decision to work. However, these results, taken alone, do not indicate the magnitude of the effects. It is possible that a variable has a significant effect, yet compared to another, its absolute effect on the probability of working might be quite small. To assess the magnitudes, we calculate the marginal effects.[30]

The probability of remaining in the workforce (either full- or part-time or actively seeking work) as distinct from being retired (with no paid work) is calculated by setting all variables except the one of interest to their mean values in the case of continuous variables, and to zero in the case of binary variables. The mean values were chosen to correspond to the group of interest (eg, mean values for male and female splits are different).

The calculation is then repeated with a change made in the variable of interest. In the case of a continuous variable such as age, the second calculation is made with age increased by one year while all other variables are held at their means. In the case of a binary variable such as whether or not the respondent was separated, the variable is set to one. Exceptions to this apply in the case of the physical and mental health scores (both continuous) where the results are reported for a five unit change deemed to be clinically significant. In addition, for migrants the number of years in New Zealand is increased by five rather than one, simply to scale up what would otherwise be a very small, but significant, effect.

[30] See Section (3) of Table 4-3.

Table 9-5-Factors that change the probability of males remaining in the workforce

Variable	Unit change	Probability of remaining in the workforce (%)		
		Initially	After the change	Marginal effect (percentage points)
Married with working spouse	Binary	76	94	+18
Widowed	Binary	76	93	+16
Separated	Binary	76	91	+14
No. of dependants	1	85	90	+5
Tertiary education	Binary	88	91	+4
Family health important	Binary	88	92	+4
Negative aspects of retirement important	Binary	89	92	+3
Physical health	5 units	90	92	+2
Mental health	5 units	90	91	+1
Years in New Zealand	5 years	90	91	+1
Age	1 year	90	89	-1
Positive aspects of retirement important	Binary	92	88	-4
Receiving NZ Super	Binary	92	76	-16
Receiving other superannuation	Binary	91	75	-16
Plans to stop work entirely once retired	Binary	93	63	-29

Notes:
1. Only variables whose coefficients were statistically significant are listed in the table.
2. The complete results are given in Appendix Table C.14(a).

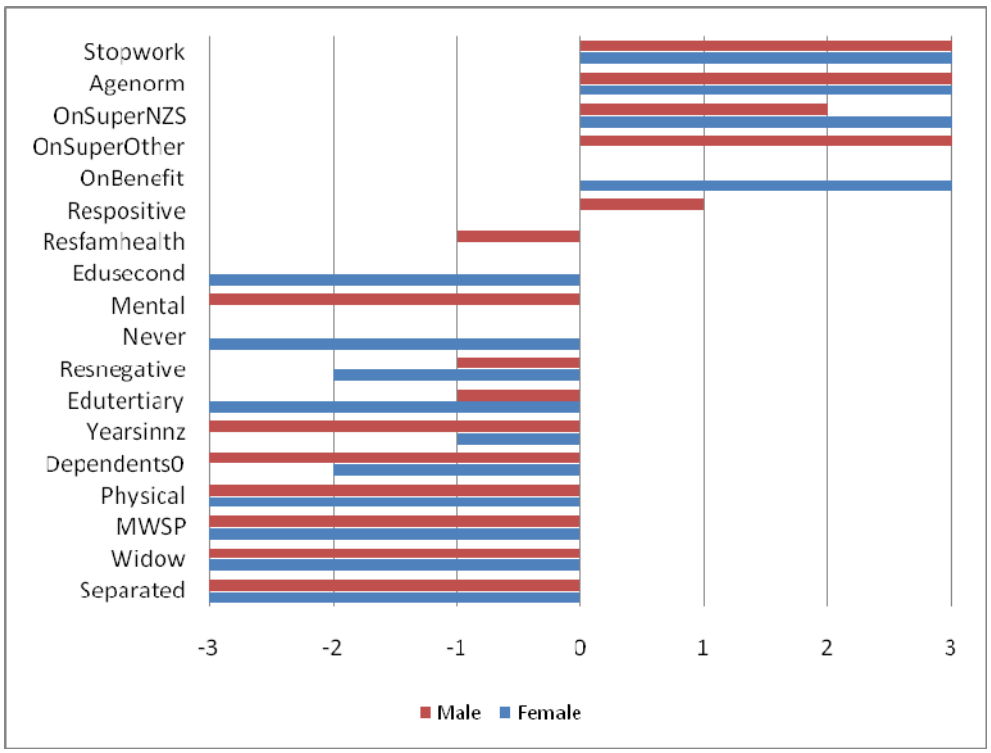
Table 9-6-Factors that change the probability of females remaining in the workforce

Variable	Unit change	Probability of remaining in the workforce (%)		
		Initially	After the change	Marginal effect (percentage points)
Separated	Binary	50	92	+42
Married with working spouse	Binary	50	87	+37
Widowed	Binary	50	84	+34
Tertiary education	Binary	73	84	+11
No. of dependants	1	78	86	+8
Negative aspects of retirement important	Binary	79	85	+7
Physical health	5 units	81	83	+2
Years in New Zealand	5 years	81	82	+1
Age	1 year	83	81	-2
Receiving NZ Super	Binary	85	68	-16
Receiving a benefit	Binary	83	61	-22
Plans to stop work entirely once retired	Binary	87	56	-31

Notes:
1. Only variables whose coefficients were statistically significant are listed in the table.
2. The complete results are given in Appendix Table C.14(b).

The results for males and females are shown in Table 9-5 and Table 9-6 respectively, and shown graphically in Figure 15. Overall, the pattern of results is broadly similar for males and females. The largest absolute effects on increasing the probability of working stem from a respondent's marital status and whether the spouse is in the workforce. For example, the probability that males who are not separated or divorced are in the workforce is 76%. For those who are separated or divorced the probability of working rises to 91%, so the marginal effect is +14 percentage points. The corresponding figures for females are 50% rising to 92% for those separated or divorced, a marginal effect of +42 percentage points.

Figure 15-A summary of the factors that change the probability that a person will be retired: by sex



Source: Health, Work and Retirement Survey

Note: The numerical scores refer to positive and negative effects at the 1% (=3), 5% (=2) and 10% (=1) levels of statistical significance.

In contrast a clinically significant unit improvement in physical health only raises the probability by +2 percentage points for both males and females. However, it is not surprising that improvements in health above the mean level have a modest effect on participation, which is already reasonably high. Also, given that there is some correlation between mental and physical health scores, it is reasonable to expect that the combined effect would be greater than changes in either alone.

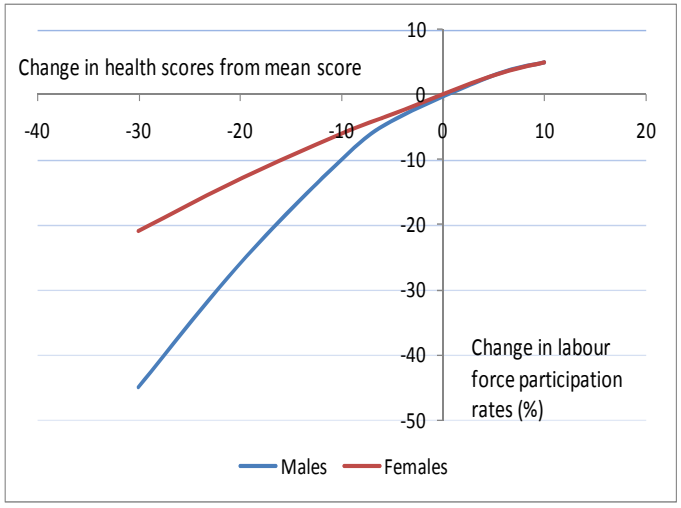
To more fully explore the effect on participation rates we estimated the impact of simultaneous changes in physical and mental health scores above and below their respective means. The results are given in Table 9-7 and Figure 16. An increase of five units in both scores now leads to a 3 percentage point increase in participation rates for males and females. In contrast, consider a 20 point decrease in the health scores. This corresponds approximately to a change in self-reported health from excellent to poor. At this level, male participation rates fall by 26 percentage points, from 90% to 64% (assuming all other variables are set at their mean values). The corresponding fall for females is from 81% to 68%.

Participation rates drop off at an increasing rate as health scores deviate further below their mean values. However, the decline is much more marked for males. For example, if the mean health scores fall from 10 to 20 units below their means, female participation rates decline only by 7 percentage points. In contrast, male participation for the same decline in health scores falls by 16 percentage points. So while male participation rates are higher than those for females, they decline more rapidly as health scores fall further below their means (Figure 16).

Table 9-7-Changes in labour force participation rates as health scores deviate from their mean values

Simultaneous change in both the physical and mental health scores relative to their respective means	Percentage point changes in labour force participation	
	Males	Females
A 10 unit increase	+5	+5
A 5 unit increase	+3	+3
A 5 unit decrease	-4	-3
A 10 unit decrease	-10	-6
A 20 unit decrease	-26	-13
A 30 unit decrease	-45	-21

Figure 16-Health scores and participation rates



9.4 The choice between full- and part-time work

The decision to work rather than retire can be broken down into two stages. The first is whether the person chooses to be in the labour force at all; the second, having decided that they will be in the labour force, the subsequent decision is that of working full- or part-time.

Given that a person is employed, what factors are associated with their choice to work either full- or part-time? To analyse this, a logit regression model was estimated with a binary dependent variable set at 1 = full-time and 0 = part-time, and restricting the sample to those who were employed (as distinct from seeking employment). In broad measure the results (Table 9-8) were similar to those reported in Table 9-5 and Table 9-6. The notable exception was the health measures. The probability that a person in the workforce would chose full-time employment was not significantly related to either the physical or mental health scores. While physical health status has a significant effect on whether to work or retire, the evidence is that, given a person is employed, their choice about full- or part-time work is not a function of their health status.

Table 9-8-Factors influencing the choice of full- rather than part-time work amongst those remaining in the workforce

Variable	Male	Female
Physical health	ns	ns
Mental health	ns	ns
Age	---	---
Main urban	ns	+
Tertiary education	-	ns
Māori	ns	+++
Separated	ns	+++
Widowed	++	++
Married with working spouse	+++	ns
Receiving a benefit	---	---
Receiving NZ Super	---	--
Receiving other superannuation	---	--
Has a super scheme	ns	+++
No. of dependants	+++	++
Income of other members of household	---	ns

Notes:
1. ns = not significant at the 10% level; ++ = significant at the 5% level; +++ = significant at the 1% level.
2. Complete results are given in Appendix Table C.18.

Both males and females have a lower probability of working full-time as they age, receive a benefit or have income from superannuation. In contrast they are more likely to be in full-time employment if they are widowed or have dependants. For men, having a working spouse increases the probability of working full-time (compared to having a non-working spouse), and having a tertiary education or higher income from other household members decreases their probability. For females, they are more likely to be in full-time employment if they are Māori, are separated or have a superannuation scheme.

The phasing of retirement has been documented in a survey conducted by the Equal Employment Opportunities Trust of workers in New Zealand aged between 45 and 64 (2006). Almost 50% of those surveyed chose doing part-time work as their ideal transition to retirement. Finances and health were given as the two most prevalent factors affecting the decision when to retire.

9.5 Using a self-reported health measure

To this point we have analysed the impact of health status on labour force participation using the SF-36 measures of physical and mental health. An alternative approach is to use the self-reported health measure based on the response to the question:

In general would you say your health is: Excellent; Very Good; Good; Fair; or Poor?

Previous researchers have undertaken studies aimed at assessing the relative merits of so-called “objective” measures and self-rated measures. Bound (1989) identifies four reasons to be suspicious of the survey responses to a question soliciting the indivdual’s own rating of their health status. First, as this is a subjective judgement, there is no reason to suppose that each person would use the same subjective scale, thus raising the possibility that the results are not strictly comparable across respondents. Second, the responses may be influenced by the very labour market outcomes that are to be explained. Third, a person may use limitations owing to health as a reason for their not participating (the so-called justification

bias). Finally, some may have a financial incentive to qualify for a disability allowance as a means of taking early retirement.[31]

A number of studies have explored the justification bias. Anderson and Burkhauser (1985) use early mortality data derived from longitudinal panel data, and find this more objective measure had a smaller effect on labour supply than did self-rated health status.

One approach has been to use objective measures as an instrumental variable, hoping thereby to overcome the problem of endogeneity; eg, Stern (1989). However Bound (1989) reports that while this has appeal, it leads to understating the effect of economic variables on retirement. He concludes that neither of the measures of health status will generate reliable estimates of the effect of health on labour force attachment of older males. However, as each tends to produce estimates biased in opposite directions, results from utilising both measures may well bound the actual effect.

Arguably, the risk of justification bias is lower with the SF-36 measures, given they are based on an extensive set of questions. In contrast, the single question soliciting self-reported health status may be subject to a much greater risk of bias by those who feel they need to justify their withdrawal from the labour force on health grounds. In other words the apparent health status based on a self-reported measure may not necessarily be the true underlying health status of the respondent.

Notwithstanding, it is of interest to test whether labour force participation is associated with the self-reported health measure. The results are summarised in Table 9-9. The estimated coefficients show that there is a significant association between health status and the probability of working. This reinforces the results obtained using the SF-36 measures. In both cases, health status has a significant association with the decision to retire or remain in the workforce.

For each health status, bar "excellent", there is an odds ratio based on the estimated coefficients from the logit regressions. These ratios give the amount by which the odds of working must be discounted relative to the odds of working when self-reported health is excellent. For example, the odds of a female in fair health being in the workforce are 0.36 times those of a female in excellent health. Both males and females reporting either fair or poor health have significantly lower odds of working than those with excellent health. In the case of males, those reporting good health the odds are only half those in excellent health. Recall that these estimates are based on holding all other factors constant (eg age, income, education, marital status, ethnicity, etc).

Table 9-9-Odds ratio of participating in the labour force: by health status

Self-reported health status	Odds ratios			
	Male		Female	
Excellent	na		na	
Very good	0.98	(ns)	0.85	(ns)
Good	0.50	**	0.69	(ns)
Fair	0.19	***	0.36	**
Poor	0.08	***	0.27	**

Notes:
1. ns = not significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level.
2. The odds ratios are found as $e^{\hat{\beta}_k}$ where $\hat{\beta}_k$ is the estimate of the k-th coefficient from the logit regression.
3. Complete results are given in Appendix Table C 15.

[31] In contrast, Idler and Benyamini (1997) review a wide range of studies and conclude that self-rated health adds to the ability to predict mortality relative to objective measures. They conclude self-ratings are "a source of very valuable data on health status" (p. 34).

We now supplement our earlier analysis of the marginal effects on participation (Section 9.3) by incorporating self-reported health measures. Recall that while the marginal effects of a five unit change in the component scores for physical and mental health were typically significant, their magnitude was apparently small (of the order of 1 to 2 percentage points).

As a first step we repeat the estimation of equation (13) replacing the health scores with the self-reported measures (denoted SR):

$$\Pr(W) = W(SR, \underline{Z}) \tag{15}$$

while maintaining the same set of control variables (Z). As the self-reported measures are a set of categorical variables, it is necessary to delete one category (in this case Excellent) such that the estimates for the remaining categories are measured with respect to the deleted category. The results are summarised in Table 9-10, showing that males in poor health have a participation rate 11 percentage points lower than those in excellent health with a corresponding 12 points for females.

We now estimate the marginal effects on labour force participation by utilising the changes in health scores associated with the self-reported categories, and applying these changes to the logit model estimated on the basis of health component scores (ie, equation (13)). For example, for males, the average physical health component score for those reporting excellent health is 57 (see the first cell of Table 8-1), while those reporting very good health have a mean score of 53.

Table 9-10-The marginal effects on participation of self-reported health categories

Relative to excellent	Percentage point decline in participation relative to excellent health	
	Males	Females
Very Good	0	-1
Good	-1 **	-2
Fair	-5 ***	-8 **
Poor	-11 ***	-12 **

Note: ** = significant at the 5% level; *** = significant at the 1% level.

Based on this four point fall in the physical component score, participation would fall by an estimated 2 percentage points (Table 9-11). Note that this result closely mirrors that found for the five point change in the physical score described in Section 9.5. In the right-hand panel of Table 9-11, the marginal effects on participation are shown for the combined effect of both physical and mental scores. This is done as when respondents provide an estimate of their self-reported health status they presumably give an assessment derived from their perception of both their mental and physical health.

Table 9-11-The marginal effects on participation using the changes in component scores associated with self-reported health status

Relative to excellent	Based on changes in the physical health component scores		Based on changes in the combined physical and mental health component scores	
	Males	Females	Males	Females
Very good	-2	-2	-2	-2
Good	-4	-4	-5	-5
Fair	-12	-9	-15	-11
Poor	-17	-14	-23	-17

9.6 Using estimated wage rates

It is critical that the effect of the economic variables be captured accurately in order that the underlying relation between health and participation in the labour force is correctly revealed. If the model is misspecified, some of the effect owing to economic forces might be incorrectly attributed to health status. Up to this point the analysis has used either respondent income or the income of other family members.

Anderson and Burkhauser (1984) demonstrate that different measures of health status can alter the interpretation of economic variables. In this case they were concerned with the effect of wage rates. Two questions arise: Are wage rates an alternative to the income measures we have used to this point? Is the effect of wage rates modified by using different health measures?

To incorporate wage rates in our analysis we undertook the following steps. First we estimated an average hourly rate (w) based on the respondent's reporting of hours worked (h) and their total pre-tax income (Y).

$$w = \frac{Y}{h} \tag{16}$$

We then fitted a wage equation of the form

$$w = \alpha + \sum \beta_k Z_k + \varepsilon \tag{17}$$

to all observations that reported non-zero hours, and from this used the predicted values ($\hat{w}$) as the reservation wage for those not in the workforce. The vector Z of explanatory variables included age, education, marital status, etc. The final step was to use the log wage as an independent variable in the univariate logistic model for labour force participation.

On theoretical grounds alone, it is not certain whether a higher wage would increase or decrease the probability of working as distinct from retirement. There is both an income and a substitution effect. A higher wage raises the opportunity cost of leisure and would therefore tend to diminish the demand for leisure (ie, increase the propensity for labour market work). However, a higher wage also implies a higher income (for any given hours worked) with a greater opportunity to accumulate wealth for retirement. Whether the phenomenon of the "backward bending supply of labour" prevails is then an empirical question.

Table 9-12-Influence of health on labour force participation: alternative health measures

		Male		Female	
		Using estimated wage rate			
		SF-36 measures	Self-reported	SF-36 measures	Self-reported
Physical health		0.06 ***		0.02 **	
Mental health		0.03 ***		0.01 ns	
	Very good		0.01 ns		-0.22 ns
Self-reported(a)	Good		-0.74 **		-0.40 **
	Fair		-1.70 ***		-1.05 **
	Poor		-2.61 ***		-1.49 ***
Wage rate		-1.3 ***	-1.2 ***	-1.6 ***	-1.6 ***
		Using income of other family members			
Physical health		0.06 ***		0.03 **	
Mental health		0.03 ***		0.01 ns	
	Very good		0.02 ns		-0.17 ns
Self-reported(a)	Good		-0.68 **		-0.37 ns
	Fair		-1.67 ***		-1.02 **
	Poor		-2.49 ***		-1.30 **
Income of other family members		-0.02 ns	-0.02 ns	0.03 ns	0.03 ns

Notes:
1. ns = not significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level.
2. Complete results are given in Appendix Tables (C.14-17
   (a) The results are relative to excellent health.

The results are summarised in Table 9-12. Four separate logit regressions for labour force participation were run for both males and females. The first two, reported in the upper half of the table, used the estimated wage rate as the economic variable. It is intended to capture the effect of the wage on the decision to retire or not. In addition, separate runs were made using the SF-36 health measures and the self-reported health status. The latter results are given relative to excellent.

In the lower half of the table the runs of the logit model are repeated but this time using the income of other family members as a proxy for the effect of economic incentives on the decision to retire. There are a number of important conclusions to be drawn from this analysis. First, in all cases health has a significant influence on the decision to remain in the workforce or retire. Second, when the health measures from the SF-36 are used, both physical and mental health scores are significant for males; higher scores (meaning better health) are associated with a higher probability of remaining in the workforce. However for females, there is no significant effect on labour force participation from mental health scores. Third, based on the self-reported health status, both males and females reporting good (when the wage rate model is used for females), fair or poor health are significantly less likely to be in the workforce than those reporting excellent health.

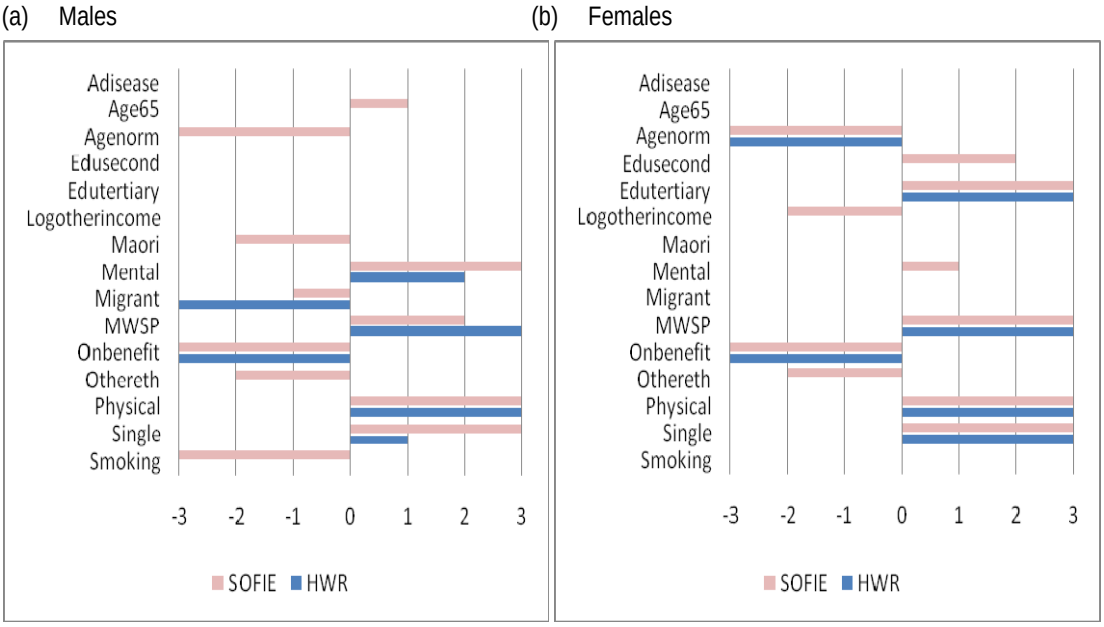
Fourth, the wage effects are similar regardless of which measure of health status is used. For both males and females, higher wage rates lower the probability that the person would remain in the workforce. Finally, the overall conclusion that health has a significant influence on the decision to remain working holds for males and females regardless of which measure of health or which economic variable is used. It appears to be a robust finding.

9.7 Comparisons with results from SoFIE

In this section we present a brief comparison of the factors that affect the probability of working drawn from the present study based on the HWR survey and a similar study using data from the Survey of Family Income and Employment (SoFIE).[32] Data in SoFIE cover a wide range of ages so that the first step was to select only those respondents aged 55 to 70 years, thereby matching the sample in the HWR survey. Similarly, using SoFIE it is not easy to distinguish between "not in the labour force" and "retired". As a result, the HWR population was widened to include the others in the survey, who were all placed in the "not in labour force" group with the retired group. This involved those identifying themselves as students, homemakers and others. A logit regression for the probability of working was estimated for this group using a set of explanatory variables common to both surveys. This inevitably meant that some of the explanatory variables used earlier in this study could not be included, as there was no comparable measure in the SoFIE data set.

In broad measure the results, summarised graphically in Figure 17, are comparable. Marital status (having a working spouse and being single), better health (physical and mental) and being educated to the tertiary level significantly increase the probability that a person will remain in the workforce. Being on a benefit reduces the probability in both surveys.

Figure 17-Factors influencing the probability of working: a comparison of HWR (Massey) with SoFIE



Sources: Health, Work and Retirement Survey and Survey of Family, Income and Employment

Notes:

1. The numerical scores refer to positive and negative effects at the 1% (=3), 5% (=2) and 10% (=1) levels of statistical significance.
2. The complete results are given Appendix Tables C.21 and C.22

[32] The results for the SoFIE survey presented here were developed as part of a major study of the effect of health on labour force participation using SoFIE. See Holt (2010).

10 Chronic diseases

As well as the measures for physical and mental health, the HWR survey records whether a respondent has ever been told by a health professional that have any one of 19 separate so-called "chronic" conditions. The purpose of this section is to explore the extent to which the presence of any one or more of the 19 chronic diseases are associated with a lower probability of an individual being in the labour force. A secondary objective is to assess the overall impact on the labour supply of older workers from particular chronic diseases. This will depend not only on the lower probability that an individual sufferer will be in the workforce but, in addition, the prevalence of the condition in the population.

10.1 Extent of chronic disease

A summary of the chronic diseases, their prevalence rates amongst this sub-population of 55 to 70 year-olds and the distribution of the self-rated health status for each illness is given in Table 10-2. Of those reporting no disease, nearly three-quarters of respondents rate their health as excellent or very good. However, in the presence of any one or more of the 19 conditions, this proportion drops sharply to under 40%. Stroke together with liver and kidney disorders are the conditions that lead to the lowest health rankings based on those reporting fair and poor health. In addition, 16% of respondents suffering from chronic liver conditions rate their health as poor, the highest proportion of any condition.

Although correlation is not considered, Appendix Table C.23 has the correlation matrix for the chronic diseases. The largest is 30% between asthma and respiratory conditions, the second largest is 21% between high blood pressure and heart conditions and the third largest is 18% between high blood pressure and diabetes.

Heavy drinking and smoking are associated with a much lower proportion of respondents reporting excellent or very good health, compared with those who have no chronic disease.

The effect of a chronic disease on the distribution of self-rated health status is only one measure of its importance. Prevalence as well as severity matters. So while stroke and kidney and liver conditions are severe in their impact on health status, their prevalence is low relative to skin cancer, heart conditions, asthma, high blood pressure, arthritis and hearing loss. Figure 18 summarises data on prevalence by ethnicity. It is notable in all but four of the 19 conditions that Māori respondents report higher rates of prevalence. The two largest differences are for blood pressure and diabetes.

Figure 19 summaries data on prevalence by work status. The retired group reports a greater prevalence of all diseases relative to the working group (with the exception of hepatitis, where the sample size is very small). Again, arthritis, high blood pressure and heart conditions are the most prevalent conditions and the ones where the difference between the retired and working groups is most marked.

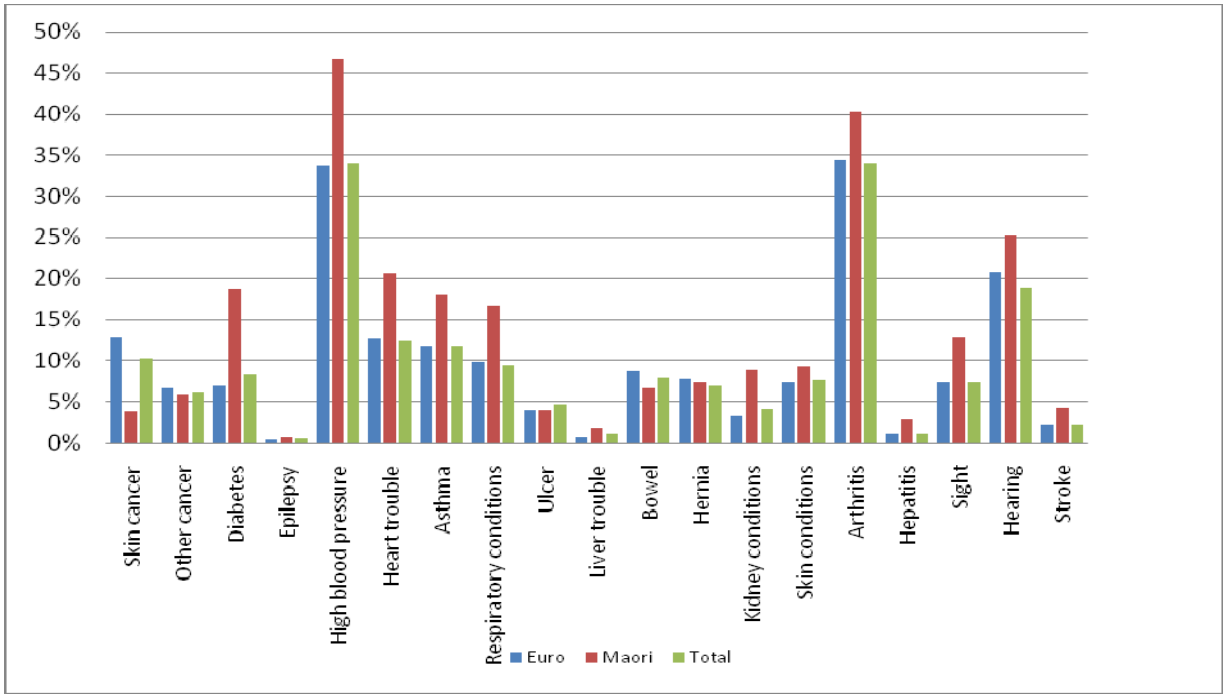
Table 10-1-Distribution of number of diseases by sex

Number of diseases	Males		Females	
	Number	Percentage	Number	Percentage
None	64,033	23%	64,598	22%
One	71,473	25%	80,340	28%
Two	63,973	23%	57,938	20%
Three	39,469	14%	40,443	14%
Four	17,990	6%	20,323	7%
Five or more	24,586	9%	24,608	9%
Total	281,525	100%	288,250	100%

Table 10-2-Distribution of self-rated health status by chronic disease

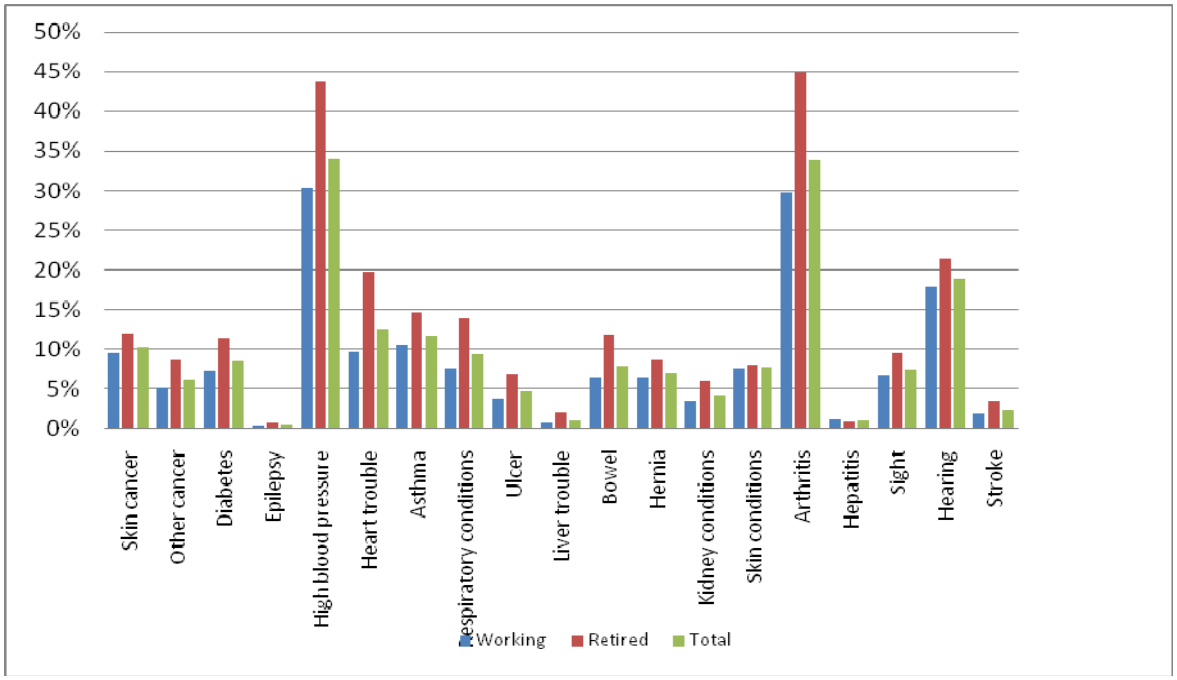
Chronic disease		Self-rated health status				
	Prevalence rate %	Excellent %	Very good %	Good %	Fair %	Poor %
No disease	49	27	45	23	3	0
Any disease	51	6	31	42	18	4
Skin cancer	10	15	38	36	9	3
Other cancer	6	7	26	39	21	7
Diabetes	9	4	19	47	24	5
Epilepsy	1	0	38	32	16	14
High blood pressure	34	7	29	44	17	3
Heart trouble	12	2	22	42	30	5
Asthma	12	4	29	35	27	6
Respiratory cond.	9	3	26	36	27	8
Ulcer	5	3	24	41	27	5
Liver trouble	1	0	14	31	39	16
Bowel	8	6	31	37	22	5
Hernia	7	5	30	39	21	6
Kidney conditions	4	1	15	47	27	10
Skin conditions	8	6	27	46	18	4
Arthritis	34	6	31	41	18	4
Hepatitis	1	9	32	39	16	4
Sight	8	9	35	32	18	6
Hearing	19	12	36	36	13	3
Stroke	2	2	22	40	30	6
Heavy drinker	12	11	34	37	14	4
Smoker	24	14	39	34	11	3

Figure 18-Disease prevalence by ethnicity



Source: Health, Work and Retirement Survey

Figure 19-Disease prevalence by work status



Source: Health, Work and Retirement Survey

Of those reporting no chronic conditions, 80% are working. However, in the presence of any one or more of the diseases listed (Table 10-3) the proportion working falls to 65%. The three most significant conditions seemingly associated with reduced labour force participation are liver conditions, arthritis and heart trouble. However, a truer measure of the importance of diseases on labour force participation requires that the fall in participation be weighted by the prevalence; for example, skin cancer is (0.67-0.80)*10%= -13. When this is done, arthritis, high blood pressure and heart trouble are the three largest prevalence-weighted conditions reducing aggregate labour force participation

amongst those aged 55 to 70. Note, however, the estimates of prevalence made by this method have not controlled for the influence of other factors. We return to the question of prevalence in Section 10.3.

To this point the results have been based on simple bivariate comparisons. However, it is important to hold other factors constant and this was done in a logit model for the presence of any disease. Formally we fitted the following:

$$\Pr(\textit{respondent has any chronic disease}) = \alpha + \beta^{o} H^{o} + \beta^{a}(age) + \Sigma \beta_{k} Z_{k} + \varepsilon \qquad (18)$$

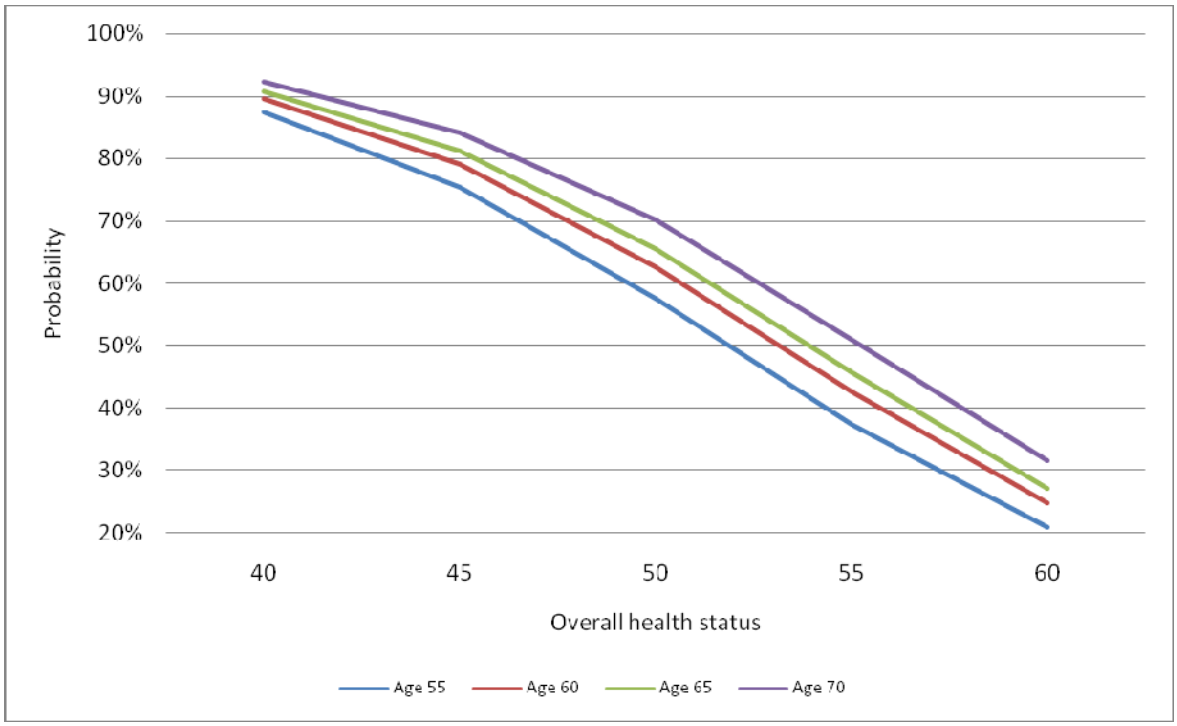
where H^o is the overall health score, and Z_k a series of control variables.

The results are presented in Figure 20. As overall health status improves the likelihood of reporting the presence of any chronic condition falls markedly. However, at any given overall health score, the likelihood increases with age.

Table 10-3-Prevalence of chronic illness and labour force status

Chronic disease	Labour force status			
	Prevalence rate %	Working %	Retired %	Weighted difference %
No disease	49	80	20	
Any disease	51	65	35	
Skin cancer	10	67	33	-13
Other cancer	6	61	39	-12
Diabetes	9	63	37	-144
Epilepsy	1	63	37	-10
High blood pressure	34	64	36	-54
Heart trouble	12	56	44	-30
Asthma	12	65	35	-18
Respiratory cond.	9	59	41	-20
Ulcer	5	59	41	-10
Liver trouble	1	46	54	-4
Bowel	8	59	41	-17
Hernia	7	66	34	-10
Kidney conditions	4	61	39	-8
Skin conditions	8	71	29	-7
Arthritis	34	37	63	-146
Hepatitis	1	79	21	-1
Sight	8	65	35	-11
Hearing	19	69	31	-21
Stroke	2	59	41	-5
Smoker	12	76	24	
Heavy drinker	24	76	24	

Figure 20-Likelihood of a chronic condition by age and overall health status



Source: Health, Work and Retirement Survey

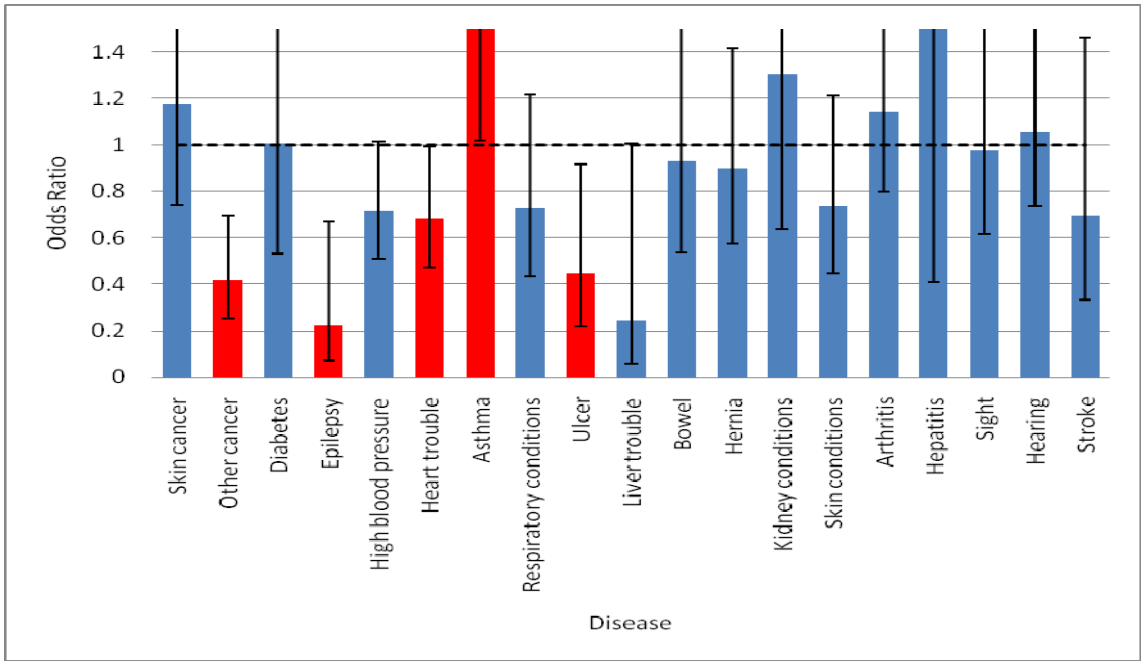
10.2 Influence of chronic diseases on participation

We turn now to the impact that the presence of chronic diseases have on the likelihood that an individual is in the labour force. One way to assess this is to calculate the odds of working. These findings are summarised in Figure 21. In each case the bar represents the odds ratio, where if the confidence interval includes one, then the odds ratio is not significant. This is interpreted as the factor by which the odds of working are changed owing to the presence of the particular illness. For example, the odds that a woman with high blood pressure would be working are only 70% of the odds of a woman with identical characterisitics who is not afflicted with high blood pressure. In this context this means that there is no specific allowance for the presence of multiple illnesses or the possible impact of interaction effects between various illnesses in the one individual.

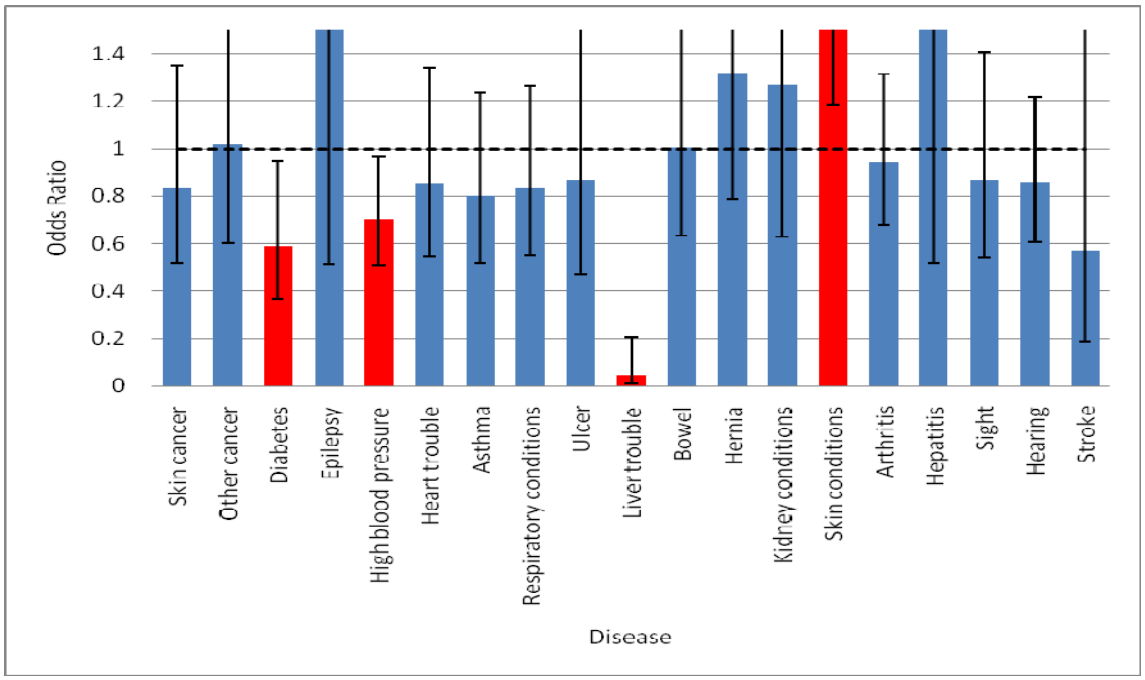
For males the presence of cancer (other than skin), epilepsy, heart problems and epilepsy all lower the odds that the individual would be working relative to the odds that an individual with identical characteristics who did not suffer from the chronic illness in question would be working. Perhaps perversely, asthmatics are more likely to be working relative to those who do not have asthma. For females the conditions that lower the odds of working are diabetes, high blood pressure and liver conditions. Those with skin conditions are more likely to be working.

Figure 21-Odds ratios for working and retired: by chronic illness and sex

(a) Males



(b) Females



Source: Health, Work and Retirement Survey
Notes:
1. Bars coloured red are based on statiistically significant coefficients in the underlying logistic regressions. For each illness, the upper and lower 90% confidence intervals are plotted.
2. The graph is stopped after 1.5, although the value and confidence intervals may have larger values.
3. The data for the odds ratios are given in Appendix Table C. 20.

In a USA study using males aged 51 to 61, Dwyer and Mitchell (1998) find that severe physical limitations, stroke and heart problems reduce the expected age of retirement by one to two years. Paralleling the present study, a wide range of other chronic conditions had no significant effect.

Some caution is needed in interpreting these results. In addition to the fact that for both males and females the confidence intervals are in many cases relatively wide, there can be questions about the accuracy of the self-reported incidence. Baker, Stabile and Deri (2004) examine Canadian data in an attempt to assess the accuracy of self-reported disease incidence. They match the self-reported answers to data for the corresponding individual held by the Ontario Health Insurance Plan. They take the medical records in the insurance plan as their reference point (the "truth") and quantify the incidence of false positives and false negatives in the self-reports for all the major disease categories. False positives are cases where the individual reports the presence of an illness but there is no corresponding entry in the insurance records. In contrast, false negatives are those cases in which the presence of the disease is recorded in the insurance files but not in the self-reported response. Their findings are somewhat disturbing – for many diseases the error rate in the self-reports was up to 50%. They demonstrate that this can lead to significant biases when using these measures as explanatory variables in regression models.

We conclude this section by analysing the marginal impact of particular chronic conditions on the probability of being in the workforce. The results are summarised in Table 10-4. Note that only those variables whose underlying coefficients were significant are included. These results demonstrate the absolute magnitudes of effect on labour force participation of up to 19 chronic conditions. For males, epilepsy, cancer (other than skin) and ulcers are three conditions that have the greatest impact in reducing the probability of working. Table 10-4 also includes two other conditions for males which were almost significant; namely liver conditions and high blood pressure. For females, liver problems, diabetes and high blood pressure are the chronic conditions that had a significant depressing effect on the probability of working.

Table 10-4-Chronic conditions that change the probability of remaining in the workforce

Condition	Probability of remaining in the workforce (%)			
	Initially	After the change	Marginal effect (percentage points)	Marginal effect (weighted count)
		Males		
Epilepsy	91	68	-23	-629
Cancer (other than skin)	91	81	-10	-1,603
Ulcer	91	82	-9	-1,244
Heart problems	91	87	-4	-1,674
Asthma	90	94	+4	
		Marginally significant		
Liver conditions	91	70	-20	-708
High blood pressure	91	89	-3	-2,737
		Females		
Liver	82	17	-66	-1,744
Diabetes	83	74	-9	-2,182
High blood pressure	84	78	-5	-5,129
Skin conditions	81	89	+8	

Notes:
1. Only variables whose coefficients were statistically significant are listed in the table.
2. The full results are in Appendix Tables C.20(a) and (b).

In interpreting the findings in Table 10-4 it must be emphasised that the marginal effects on labour force participation of a particular disease are calculated holding all other variables at their mean values. This allows for the effect of multiple disease occurrence at the population level. In other words the marginal effect of epilepsy in males is to reduce the probability of working by 23 percentage points, assuming that the occurrence of other conditions is at their average levels. An alternative approach is to measure the marginal effect of a given disease by assuming no other diseases are present. This method was tested, and the differences were found to be minor, typically of the order of 1 to 2 percentage points.

Finally in this section we report the multiple occurrence of disease for those diseases that had a significant depressing effect on labour force participation. The results are summarised in Table 10-6 and Table 10-5 for females and males respectively. The bold numbers on the diagonal are the percentages of those reporting that they have or have had a given disease but report no other disease. The remaining numbers in the columns are the percentages of those with a given disease who also have another condition. For example, of all the females who report having a liver condition, 10% also have diabetes and 45% also have high blood pressure. The tables do not show those with more than two conditions.

Table 10-5-Multiple disease occurrence among females

Percentage of those with a given condition who also report having another condition			
	Liver	Diabetes	High blood
Liver	**55**	1	1
Diabetes	10	**29**	17
High blood	45	71	**82**

Note: The bold numbers on the diagonal refer to those who report solely having the given condition.

Table 10-6-Multiple disease occurrence among males

Percentage of those with a given condition who also report having another condition						
	Epilepsy	Liver	Cancer	Ulcer	Heart	High blood
Epilepsy	**35**	18	1	5	2	1
Liver	23	**23**	4	4	2	3
Cancer	6	17	**50**	11	10	7
Ulcer	23	15	10	**49**	8	5
Heart	25	29	25	24	**39**	25
High blood	30	69	39	34	54	**67**

Note: The bold numbers on the diagonal refer to those who report solely having the given condition.

10.3 Assessing the impact on the total labour supply of older workers

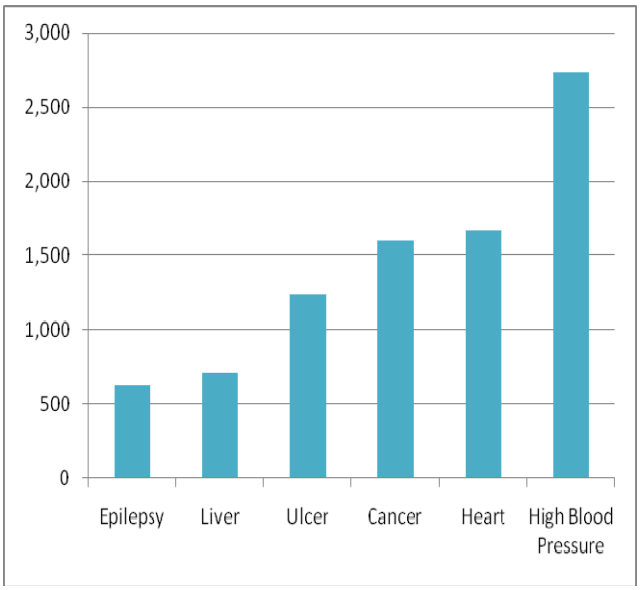
While it is important to identify which diseases have significant marginal effects, a more complete picture of the effect of the disease on the overall level of the labour force requires that we allow for the prevalence of the disease. A disease could have a very debilitating effect leading to a massive drop in labour force participation amongst the afflicted, but the number of sufferers could be very small.

For each of the significant diseases identified in Table 10-4, the marginal effects were weighted by the estimated number of sufferers. This latter number was obtained by using the observed prevalence in the HWR survey multiplied by the marginal percentage. The

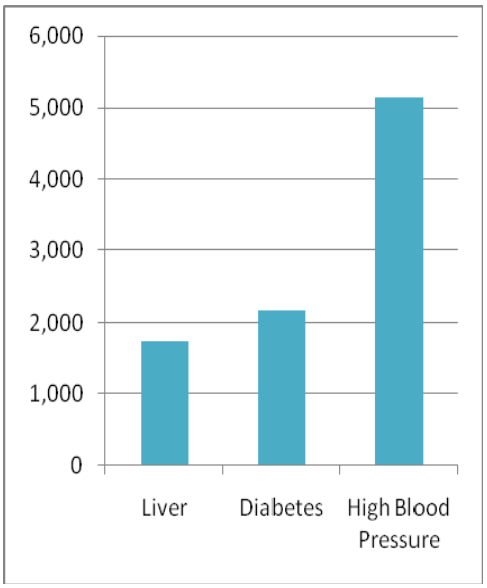
results are summarised in Figure 22; for example, for males, cancer (other than skin cancer) and heart problems reduce the labour force population by 1,600 each. Note that this does not take any possible correlations into account, as some people report multiple conditions.

Figure 22-Impact of chronic illnesses on labour force participation

(a) Males



(b) Females



11 Conclusions and discussion

This study has drawn on the first wave of the Health, Work and Retirement survey (HWR). The comprehensive nature of the data collected in this survey has allowed an extensive analysis of the factors that influence labour supply decisions and by implication retirement decisions of older New Zealanders. The survey has national coverage of those aged 55 to 70 and has heavy over-sampling of Māori.

The primary objective of the study is to assess the effect of health and wealth on the retirement decisions of older workers. In addition, the rich data set allowed for a range of other questions to be explored.

Analysis of living standards was undertaken using a range of measures. Higher values of the Economic Living Standards Index (ELSI) were associated with higher income, wealthier, better educated people with better health. The results confirm that those working had a lower living standard than those retired (Ministry of Social Development, 2007). Those who were Māori, those working and those on NZ Superannuation (NZS) had lower scores on this measure. Likewise, Māori, those working, on a benefit or NZS and in poorer health were forced to reduce costs on essential items more frequently. Among both working and retired, better health measures are associated with greater satisfaction with current material living standards. Similarly, better health is associated with the expectation of higher living standards in retirement. Furthermore, relative to working Europeans, working Māori expect to have higher living standards in retirement. This reflects the fact that moving from a low wage to NZS for many in the lower income brackets constitutes a rise in real income.

The study makes extensive use of logit regression models to analyse the factors associated with whether or not a respondent is in the labour force. The objective is to isolate the effects of health and wealth while controlling for a wide range of other influences. The overall pattern of results is broadly similar for males and females. In all the estimated models, health status is significantly associated with the decision to work. This result holds regardless of which measure of health was used. In contrast, wealth was not identified as having a significant effect, although this may reflect the limitations of the data more than the true underlying effect of net wealth.

A 10% decline in health below the mean score is associated with a fall in labour force participation of 3 to 4 percentage points. A decline of this magnitude is clinically significant. At 20% below the mean score, participation falls by 10 points for males and 6 for females. A 40% fall in the health scores would correspond approximately to a self-reported assessment of poor health. At this level, male participation falls 26 percentage points and females by 13 percentage points. The drop in participation is more than proportional for males, but less for females; in other words, while male participation rates are higher, they decline more rapidly as health deteriorates.

In addition to the effect of health, substantial absolute effects on the probability of working stem from a respondent's marital status. Being divorced, separated or widowed, or having a spouse working all increase the probability that a person remains in the workforce.

The probability that a person in the workforce would chose full-time over part-time employment was not significantly related to either the physical or mental health scores. While physical health status has a significant effect on whether to join the workforce, the evidence is that, given a person is employed, their choice about full- or part-time work is not a function of their health status.

Both males and females have a lower probability of working full-time as they age, receive a benefit or have income from superannuation. In contrast they are more likely to be in full-time employment if they are widowed or have dependants.

There is a marked reduction in labour force participation when respondents receive NZS, typically at age 65. The results suggest that there is a significant "deterrence effect" on labour force participation of NZS, once the effect of a wide range of other influences has been controlled for.

A core model on labour force participation was estimated using data from the HWR survey as well as similar data from SoFIE. In broad measure the results are consistent; for males, both surveys confirm that poorer physical and mental health reduces the probability of labour force participation. Notably, mental health conditions do not appear to influence the labour force participation decisions of females.

There is wide debate about the appropriate measure of health status. In large part this study has used the physical and mental scores from the international standard SF-36 survey. In addition, however, self-reported health status was tested as an alternative. It is generally argued that this measure may suffer from a reporting bias as those not in the workforce may justify their decision by reporting a health status worse than their actual condition. While acknowledging this drawback, the results indicated that for both males and females, those reporting lower standards of health were less likely to remain in the workforce. The odds of a person working if they report fair or poor health status are very much lower than those reporting excellent health. This finding was repeated using two different measures of the key economic variable: the respondent's wage rate and the income of other family members.

Another approach to measure health status is to ascertain if the respondent had ever been diagnosed with a particular chronic condition. The HWR survey identified 19 such illnesses. This measure is unlikely to be biased by the so-called "justification" effect. For males the probability of being retired is much greater where they report cancer (other than skin), epilepsy, blood pressure, heart conditions, ulcers or liver conditions. For females the critical chronic conditions influencing labour force participation are diabetes, high blood pressure and liver conditions.

The impact on the probability of an individual working and the impact on the labour supply of older workers are related but distinct questions. The latter requires information about the prevalence of each chronic illness. From the perspective of health policy, it is important to recognise the extent of the illness in the population as well as its effect on labour force participation. A given illness might be highly debilitating but only affect a very small proportion of the population. When the marginal effects of chronic illnesses were weighted by their prevalence in the survey sample, it was found that high blood pressure was the single most significant condition for males and females. For males, cancer and heart problems were important while, for females, diabetes was the next most important condition reducing the overall labour supply of older females. A limitation of the chronic disease measure is that the person responding positively to having once been diagnosed,

may or may not be currently inflicted. No information on the date of diagnosis or whether the condition persisted was available.

Underlying the debate about appropriate measures of health status is the fact that what is really required is a measure of an individual's capacity for work. Their physical and mental health status and the presence of chronic illness are all attempts to provide a proxy for the unobservable capacity to work.

A further way to measure the effect of health is to ask whether a respondent expects to be in full-time employment once they reach a certain age. Two ages were specified: 62 and 65. Key factors that were associated with a significantly greater probability of expecting to be in the labour force at these ages were: being male; separated or widowed, Māori and the health of family members.

Few studies of retirement decisions capture the effects of the macroeconomic and policy environment. For example, how does the expected rate of inflation or the parameters of a public pension scheme influence individual decisions? French (2005) finds that the tax structure of the Social Security system in the USA has a greater effect on explaining the age of retirement than do the level of the pension or the health status of the individual. The experience in New Zealand of raising the age of eligibility from 60 to 65 and the resulting increase in the labour force participation rates of older workers is a clear reminder that the retirement decision is strongly influenced by social policies (Hurnard, 2005).

In all studies of the effect of health on retirement there is a question of causality; specifically is it possible that workforce status influences health. If so health status cannot be treated as a truly independent explanatory variable. Undoubtedly there is some reverse influence; the challenge is whether or not it can be corrected for by appropriate statistical methods. As in many other studies, attempts were made to find suitable instrumental variables that might determine health status but not influence the labour supply decision. These attempts proved unsuccessful. However, unless an unequivocally robust instrumental variable can be identified, it is unclear that the statistical properties of the resulting estimates are necessarily superior to those from a single equation.

This study has been based on the first wave of a longitudinal panel study. As a consequence it is a cross-sectional analysis. This has at least two consequences. First, it is possible that health status in earlier periods may be associated either directly or indirectly with current labour force status. In absence of data over time it has not been possible to allow for this effect. A better understanding of the relationship requires the use of longitudinal panel data.

Clearly there is an association between contemporaneous health status and labour force participation. The interaction between health and retirement is potentially a complex and dynamic process. The work of Bound, Schoenbaum, Stinebrickner and Waidman. (1998) shows that it is the decline in health status that has an equally important effect. The response to a decline could reflect the nature and rapidity of the decline, the expected persistence of a lower health status and the individual's preference for consumption over leisure time together with their family and financial position.

Second, the results reported here for individuals of different ages assume no cohort effects; ie, a 60-year-old today is assumed to behave in 10 years time as a 70-year-old observed today. Soldo, Mitchell, Tfaily and McCabe (2006) find that, using USA data, there are significant differences in the health status prior to retirement of different cohorts. Hyslop and Dixon (2008) use the Linked Employee-Employer Dataset (LEED) to analyse

the employment activity of older New Zealanders born in 1937, 1938, 1939 and 1940. Wage employment rates at age 63 rose consistently across the four one-year birth cohorts, suggesting that even within this short span there may well be significant cohort effects. Fortunately, as the present study is focused on a relatively narrow age range, this problem is minimised. Again, future waves of the HWR survey will allow the use of longitudinal panel data which largely overcomes this limitation.

A further strength of longitudinal data is its value in reducing or eliminating the effect of unobserved individual heterogeneity. In any cross-sectional survey, there are inevitably many personal characteristics of individuals which, while important in shaping their decisions, are simply not observed. By using longitudinal panel data one compares the same individuals through time, largely removing the effect of the unobservable characteristics.

A potentially important influence on the health status of an individual as a child is the socio-economic status (education, income and occupation) of their parents. A second related question is the extent to which childhood health status influences the subsequent education and labour market outcomes of adults. Currie (2009) finds strong evidence of both these links, "suggesting that health could play a role in the intergenerational transmission of economic status." Clearly only with extensive longitudinal data sets is it possible to address these questions.

References

Anastasiadis, Simon (2010) " Health and Wealth". Wellington, The Treasury, Working Paper No. 10/05.

Anderson, Kathryn H. and Richard V. Burkhauser (1984) "The importance of the measure of health in empirical estimates of the labour supply of older men." *Economic Letters* 16: 375-380.

Anderson, Kathryn H. and Richard V. Burkhauser (1985) "The retirement-health nexus: A new measure of an old puzzle." *Journal of Human Resources* 20: 315-330.

Baker, Michael, Mark Stabile and Catherine Deri (2004) "What do self-reported, objective, measures of health measure?" *Journal of Human Resources* 34(4): 1067-1093.

Banks, James and Sarah Smith (2006) "Retirement in the UK." *Oxford Review of Economic Policy* 22(1): 40-56.

Banks, James and Gemma Tetlow (2008) "Extending working lives." in James Banks, Elizabeth Breeze, Carli Lessof and James Nazroo eds *Living in the 21st century: Older people in England* (London: Institute for Fiscal Studies): 19-56.

Benzeval, Michaela and Ken Judge (2001) "Income and health: The time dimension." *Social Science & Medicine* 52: 1371-1390.

Black, Carol (2008) "Working for a healthier tomorrow: Review of the health of Britain's working age population." London, Presented to the Secretary of State for Health and the Secretary of State for Work and Pensions. <http://www.workingforhealth.gov.uk/Carol-Blacks-Review/Default.aspx>

Bloom, David E., David Canning and Michael Moore (2004) "The effect of improvements in health and longevity on optimal retirement and saving." Cambridge, MA, National Bureau of Economic Research, Working Paper No. 10919. <http://www.nber.org/papers/w10919>

Bound, John (1989) "Self-reported vs. Objective measures of health in retirement models." Cambridge, MA, National Bureau of Economic Research, Working Paper No. 2997.

Bound, John, Michael Schoenbaum, Todd R. Stinebrickner and Timothy Waidman (1998) "The dynamic effects of health on the labour force transitions of older workers." Cambridge, MA, National Bureau of Economic Research, Working Paper No. 6777.

Browning, Martin, Anne Moller Dano and Eskil Heinesen (2006) "Job displacement and stress-related health outcomes." *Health Economics* 15: 1061 - 1075.

Cai, Lixin (2007) "The relationship between health and labour force participation: Evidence from a panel data simultaneous equation model." Melbourne, Melbourne Institute Working Paper No. 01/2007.

Cai, Lixin and Guyonne Kalb (2004) "Health status and labour force participation: Evidence from the HILDA data." Melbourne, Melbourne Institute Working Paper No. 04/2004.

Cai, Lixin and Guyonne Kalb (2006) "Health status and labour force participation: Evidence from Australia." *Health Economics* 15(3): 241-261.

Carter, Kristie N, Tony Blakely, Sunny Collings, Fiona Imlach Gunasekara and Ken Richardson (2008) "What is the association between wealth and mental health?" Wellington, Otago University.

Cobb-Clark, Deborah A. and Steven Stillman (2006) "The retirement expectations of middle-aged individuals." Bonn, Institute for the Study of Labour, IZA Discussion Paper No. 2449.

Coile, Courtney and Kevin Milligan (2006) "How household portfolios evolve after retirement: The effect of aging and health shocks." Cambridge, MA, National Bureau of Economic Research.

Currie, Janet (2009) "Healthy, wealthy, and wise: Socioeconomic status, poor health in childhood, and human capital development. *Journal of Economic Literature* 47(1): 87–122.

Currie, Janet and Brigette C. Madrian (1999) "Health, health insurance and the labor market." in O. Ashenfelter and D. Card eds *Handbook of labor economics* (New York and Oxford: Elsevier Science): 3309-3416.

Dave, Dhaval, Inas Rashad and Jasmina Spasojevic (2006) "The effects of retirement on physical and mental health outcomes." Cambridge, MA, National Bureau of Economic Research, Working Paper No. 12123.

Davey, Judith (2008) "What influences retirement decisions?" *Social Policy Journal of New Zealand* 33: 110-125.

Disney, Richard, Carl Emmerson and Matthew Wakefield (2003) "Ill health and retirement in Britain: A panel data analysis." London, Institute for Fiscal Studies, Working Paper WP03/02.

Dwyer, Debra Sabatini and Olivia S. Mitchell (1998) "Health problems as determinants of retirement: Are self-rated measures endogenous?" Cambridge, MA, National Bureau of Economic Research, Working Paper No. 6503.

Equal Employment Opportunities Trust (2006) "Work and age report: 2006." Wellington, Equal Employment Opportunities Trust.

Ettner, Susan L. (1996) "New evidence on the relationship between income and health." *Journal of Health Economics I5*: 67-85.

Fergusson, David, Bev Hong, John Horwood, John Jensen and Peter Travers (2001) "Living standards of older New Zealanders." Wellington, Ministry of Social Policy.

French, Eric (2005) "The effects of health, wealth, and wages on labour supply and retirement behaviour." *Review of Economic Studies* 72(2): 395-427.

Haveman, R. (1994) "Market work, wages and men's health." *Journal of Health Economics* 13(2): 163-182.

Holt, Heather (2010) "Health on labour force participation.".Wellington, The Treasury, Working Paper No. 10/03.

Hurnard, Roger (2005) "The effect of New Zealand superannuation eligibility age on the labour force participation of older people." Wellington, The Treasury, Working Paper No.05/09. <http://www.treasury.govt.nz/publications/research-policy/wp/2005/05-09>

Hyslop, Dean and Sylvia Dixon (2008) "The employment and retirement transitions of New Zealanders aged in their 60s: Evidence from Leed." Wellington, Statistics New Zealand. <http://www.stats.govt.nz/leed/reports/the-employment-and-retirement-transitions-of-new-zealanders-aged-in-their-60s.htm>

Idler, E. L. and Y. Benyamini (1997) "Self related health and mortality: A review of twenty-seven community studies." Journal of Health and Social Behaviour 38: 21-37.

Jensen, J., Spittal, M., & Krishnan, V. (2005). ELSI Short Form: User Manual for a Direct Measure of Living Standards (Wellington: Ministry of Social Development).

Jensen, John, Vasantha Krishnan, Rob Hodgson, Sathi G Sathiyandra and Robert Templeton (2006) "Living standards of older New Zealanders 2004: An overview." Wellington, Centre for Social Research and Evaluation, Ministry of Social Development. <http://www.dsw.govt.nz/publications/docs/livingstandardssummary.pdf>

Laplagne, P., M. Glover and A. Shomos (2007) "Effects of health and education on labour force participation." Melbourne, Productivity Commission, Staff Working Paper. <http://www.pc.gov.au/research/staffworkingpaper/healthandeducation>

Long, J. Scott and Jeremy Freese (2006) *Regression models for categorical dependent variables using Stata*. (College Station, TX: StataCorp LP).

Love, David A. and Paul A. Smith (2007) "Does health affect portfolio choice?" Washington DC, Federal Reserve Board, Finance and Economics Discussion Series: 2007-45 <http://www.federalreserve.gov/pubs/feds/2007/200745/>

McGarry, Kathleen (2002) "Health and retirement: Do changes in health affect retirement expectations?" Cambridge, MA, National Bureau of Economic Research, Working Paper No. 9317. <http://www.nber.org/papers/w9317>

Ministry of Social Development (2007) "Positive ageing indicators." Wellington, Ministry of Social Development.

Nardi, Mariacristina De, Eric French and John Bailey Jones (2006) "Differential mortality, uncertain medical expenses, and the saving of elderly singles." Chicago, Federal Reserve Bank of Chicago, WP 2005-13.

Olsho, Lauren (2005) "Spend it while you can still enjoy it: Health, longevity, aging and consumption." Madison WI, University of Wisconsin- Madison, Unpublished draft.

Scobie, Grant M., John K. Gibson and Trinh Le (2005) *Household wealth in New Zealand*. (Wellington: Institute of Policy Studies, Victoria University of Wellington).

Scott, Kate M., Diana Sarfati, Martin I. Tobias and Stephen J. Haslett (2000) "A challenge to the cross-cultural validity of the SF-36 health survey: Factor structure in Māori, Pacific and New Zealand European ethnic groups." *Social Science and Medicine* 51: 1655-1664.

Scott, Kate M., Martin I. Tobias, Diana Sarfati and Stephen J. Haslett (1999) "SF-36 health survey reliability, validity and norms for New Zealand." *Australian and New Zealand Journal of Public Health* 23(4): 401-406.

Smeaton, Deborah and Stephen McKay (2003) "Working after state pension age: Quantitative analysis." London, Department of Work and Pensions, Research Report No. 182. <http://www.dwp.gov.uk/asd/asd5/report_abstracts/rr_abstracts/rra_182.asp>

Soldo, Beth J., Olivia S. Mitchell, Rania Tfaily and John F. McCabe (2006) "Cross-cohort differences in health on the verge of retirement." Cambridge, MA, National Bureau of Economic Research, Working Paper No. 12762.

Stephens, Christine, Fiona Alpass, Andy Towers, Jack Noone, Jamas Enright, Brendan Stevenson and Eljon Fitzgerald (2008) "Socioeconomic inequalities and health in early old age in New Zealand." Palmerston North, Massey University.

Stephens, Christine and Jack Noone (2007) "Health, work and retirement survey: Summary report for the 2006 data wave: Health." Palmerston North, Massey University. <http://hwr.massey.ac.nz/surveys.htm>

Stern, Steven (1989) "Measuring the effect of disability on labor force participation." *Journal of Human Resources* 24(3): 361-395.

Towers, Andy (2007) "Health, work and retirement survey: Summary report for the 2006 data wave: Methodology." Palmerston North, Massey University. <http://hwr.massey.ac.nz/surveys.htm>

Ware, John E. (2000) "SF-36 health survey update." *Spine* 25(24): 3130-3139.

Wooldridge, Jeffrey M. (2006) *Introductory econometrics: A modern approach*. (Mason, OH: Thomson South-Western).

Appendix A: Work and retirement status: sample numbers

Appendix Table A.1-Classification of work and retirement: sample numbers

Work	**Retirement status**				
Status	Not retired	Partly retired	Retired	No response	Total
Full-time	2,283	95	6	38	2,422
Part-time	530	621	19	22	1,192
Retired	5	180	924	34	1,143
Other	349	276	323	135	1,043
Total	3,167	1,172	1,272	229	5,840

Appendix B: Variable dictionary

Appendix Table B.1-Variable definitions of explanatory variables

Explanatory variables	Description	Question	Notes
Working	True if participant is working (full-time or part-time)	Q74	
Male	True if participant is male	Q64	
Health			
Physical	Physical index	Q1-22	Based on US methodology
Mental	Mental index	Q1-22	Based on US methodology
HealthAverage	Average of the two health indices		
Age			
AgeNorm	Age of participant minus 65	Q63	Some imputation based on year of birth
Age65	True if participant is 65 or more	Q63	
Ethnicity	Default is NZ European		
Māori	True if participant is Māori	Q66	
Other	True if participant is not European nor Māori	Q66	
YearsinNZ	Number of years in New Zealand	Q67b	Age if NZ born, years in NZ if not NZ born
UrbanMain	True if participant lives in a main urban area	Q71	Default is rural
UrbanOther	True if participant lives in another urban area	Q71	
Education	Default is no education		
EduSecond	True if highest achieved qualification is secondary	Q72	Default is no education
EduTertiary	True if highest achieved qualification is tertiary	Q73	
Marriage Status	Default is married/partnered with a non-working spouse		
Separated	True if participant is separated	Q65	
Widow	True if participant is a widow/widower	Q65	
Never	True if participant was never married	Q65	
MWSP	True if participant is married and spouse is working	Q65	
Benefit			
OnBenefit	True if participant receives a benefit	Q78	
OnSuper	True if participant receives NZ Super	Q78	
OnSuperOther	True if participant receives other super	Q78	
Super	True if participant has a super scheme	Q81a,b	
Dependants0	Number of financial dependants	Q69	If no information provided, assume no dependants

Explanatory variables	Description	Question	Notes
Stopwork	True if participant plans to stop working entirely on retirement	Q55	
Attitudes to Retirement			
ResHealth	True if participant considers own health as important retirement factor	Q58a	True if responded either "Very important" or "Moderately important" to question
ResFamHealth	True if participant considers family health as important retirement factor	Q58b	True if responded either "Very important" or "Moderately important" to question
ResPositive	True if participant considers the positive benefits of retirement important	Q59a-h	True if responded "Very important" or "Moderately important" on average
ResNegative	True if participant considers the negative benefits of retirement important	Q60a-f	True if responded "Very important" or "Moderately important" on average
Income			
LogIncome	Log(NewIncome+1)[33]		
LogWealth	Log(NewTotalWealth+1)		
LogOtherIncome	Log(NewOtherIncome+1)	Q80	Household income of people other than participant
Disease			
Smoker	True if the participant considers themselves a regular smoker	Q22a	
Adisease	True if the participant has a chronic illness	Q12	

[33] The addition of 1 to these variables is to circumvent taking the logarithm of zero.

Appendix Table B.2-Summaries of explanatory variables

Explanatory variables	Obs	Type	Mean	Median	IQR
Working	5339	Binary	0.7231958	1	1
Male	5339	Continuous	0.490898	0	1
Health					
Physical	5339	Continuous	49.0238	51.4692	12.00142
Mental	5339	Continuous	53.31684	55.94527	9.410233
HealthAverage	5339	Binary	51.17032	53.17675	8.314747
Age					
AgeNorm	5339	Continuous	-4.01582	-5	8
Age65	5339	Binary	0.2702343	0	1
Ethnicity					
Māori	5339	Binary	0.0737732	0	0
Other	5339	Binary	0.2260775	0	0
YearsinNZ	5325	Continuous	52.163	58	16
UrbanMain	5245	Binary	0.5328133	1	1
UrbanOther	5245	Binary	0.2568109	0	1
Education					
EduSecond	5278	Binary	0.2431213	0	0
EduTertiary	5278	Binary	0.4648999	0	1
Marriage Status					
Separated	5337	Binary	0.1209087	0	0
Widow	5337	Binary	0.0743705	0	0
Never	5337	Binary	0.0344925	0	0
MWSP	5337	Binary	0.4775014	0	1
Benefit					
OnBenefit	5202	Binary	0.1048618	0	0
OnSuper	5202	Binary	0.2616152	0	1
OnSuperOther	5202	Binary	0.0748895	0	0
Super	5339	Binary	0.7437557	1	1
Dependants0	5339	Continuous	0.6758815	0	1
Stopwork	5171	Binary	0.2203502	0	0
Attitudes to Retirement					
ResHealth	5339	Binary	0.606861	1	1
ResFamHealth	5339	Binary	0.5015504	1	1
ResPositive	5185	Binary	0.6453614	1	1
ResNegative	5165	Binary	0.2883647	0	1

Explanatory variables	Obs	Type	Mean	Median	IQR
Income					
LogIncome	5054	Continuous	4.755994	4.838855	0.522388
LogWealth	5093	Continuous	2.080659	2.574455	1.556418
LogOtherIncome	5054	Continuous	3.625928	4.533688	0.9004941
Disease					
Smoker	5339	Binary	0.1210137	0	0
Adisease	5339	Binary	0.5077962	1	1

Appendix Table B.3-Definitions of response variables

Name	Description	Question	Notes
Response variables - Linear regression			
TotalWealth	Sum of assets	Q81c	Values are set to zero if some values missing
Income	Household Income	Q79, Q80	
ELSI	Economic Living Standards Index Short Form Score	Q82-85	
Cost	Number of items that a person has taken cost measures for	Q85	
Retirement Age	Age person plans to retire	Q50	Set to missing if participant is older than given age
Response variables - Logit regression			
Enough	True if participant considers they have enough basic income	Q84c	
Response variables - Logit regression, with subgroup analysis by working/retired			
StdLiving	True if participant rates their material standard of living as not low	Q84a	Includes high, fairly high and medium
LivingChange	True if participant expects their living standards to not decrease	Q54	Includes increases and stays the same
EnoughIncome	True if participant considers they have enough income for retirement	Q56f	Includes increases and stays the same
Ready to Retire	True if participant has positive expectation to adjustment to retirement	Q56g-i	Includes increases and stays the same
Satisfied	True if participant is satisfied with current material standard of living	Q84b	
Retirement Years	True if participant thinks retirement will not be worse than working	Q61e	Includes better and same
Response variables - Logit regression, with subgroup analysis by male/female			
Retired	True if participant is retired	Q74	
AtWork62	True if participant likely to be retired at age 62	Q48a	If responded, but age is older, set to missing
AtWork65	True if participant likely to be retired at age 65	Q48b	If responded, but age is older, set to missing

Appendix Table B.4-Summaries of response variables

Name	Obs	Type	Mean	Median	IQR
Response variables - Linear regression					
TotalWealth	5093	Continuous	608.4677	374.3661	735.2017
Income	5054	Continuous	96852.25	69000	83960
ELSI	4774	Continuous	23.48604	25	7
Cost	5294	Continuous	1.348387	1.25	0.5
Retirement Age	3049	Continuous	66.86052	65	5
Response variables - Logit regression					
Enough	5339	Binary	0.8442669	1	0
Response variables - Logit regression, with subgroup analysis by working/retired					
StdLiving	5274	Binary	0.9279173	1	0
LivingChange	4979	Binary	0.5335795	1	1
EnoughIncome	5339	Binary	0.586096	1	1
Ready to Retire	5189	Binary	0.7949379	1	0
Satisfied	5288	Binary	0.7640398	1	0
Retirement Years	5149	Binary	0.8223631	1	0
Response variables - Logit regression, with subgroup analysis by male/female					
Retired	5339	Binary	0.2768042	0	1
AtWork62	2919	Binary	0.5950647	1	1
AtWork65	3838	Binary	0.4852247	0	1

Appendix C: Regression results

Appendix Table C.1-Estimated coefficients for wealth regression

Dependent variable: Wealth ($'000)	No. of observations = 4,848		R^2 = 0.10
Explanatory variable	Coefficient	Significance	Standard error
Working (base = retired)	-16.05		50.08
Health			
Physical health	5.61	***	2.00
Mental health	1.27	ns	1.95
Male (base = female)	104.20	***	35.99
Age			
Age normalised (= age minus 65)	-5.31	ns	8.26
Age 65 or over (base = less than 65)	-23.69	ns	66.06
Ethnicity (base = New Zealand European)			
Māori	-168.53	***	27.97
Other	-138.86	**	70.74
Migrant status (years in New Zealand)	5.59	***	1.22
Region (base = rural)			
Urbanmain	-299.80	***	71.42
Urbanother	-384.96	***	64.02
Education (base = no qualifications)			
Edusecond	109.01	*	60.32
Edutertiary	51.50	ns	53.28
Marital status (base = married with non-working spouse)			
Separated	-164.49	***	62.68
Widow/er	-103.02	*	58.49
Never married	-268.80	***	67.28
Married with working spouse	-22.36	ns	64.12
Benefit status			
Onbenefit	-133.41	***	42.31
Onsupernzs	-207.96	***	52.89
Onsuperother	-22.31	ns	89.90
Super (has a super scheme)	83.39	**	38.49
Dependants (number)	25.44	ns	29.89
Attitudes to retirement			
Stopwork (plans to stop totally)	132.96	**	51.98
Reshealth (own health important factor)	-66.43	ns	51.74
Resfamhealth (health of family member important factor)	59.38	ns	47.37
Respositive (positive benefits of retirement important)	35.70	ns	43.86
Resnegative (negative benefits of retirement important)	-172.61	***	35.36
Income (log)	263.65	***	
Intercept	-1042.58	***	351.11

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant

Appendix Table C.2-Estimated coefficients for income regression

Dependent variable: Income ($)	No. of observations = 4,848		R^2 = 0.03
Explanatory variable	Coefficient	Significance	Standard error
Working (base = retired)	32802.28	***	10016.51
Health			
Physical health	178.81	ns	292.69
Mental health	618.12	ns	406.03
Male (base = female)	24801.94	**	9760.67
Age			
Age normalised (= age minus 65)	-895.09	ns	2149.29
Age 65 or over (base = less than 65)	2789.26	ns	16796.62
Ethnicity (base = New Zealand European)			
Māori	-14951.12	***	5318.61
Other	-12067.42	*	7288.36
Migrant status (years in New Zealand)	243.69	ns	232.17
Region (base = rural)			
Urbanmain	-9572.49	ns	22127.31
Urbanother	-25399.41	ns	20931.06
Education (base = no qualifications)			
Edusecond	5789.49	ns	6004.97
Edutertiary	26326.25	**	10513.66
Marital status (base = married with non-working spouse)			
Separated	-39738.79	**	18389.77
Widow/er	-31235.48	**	13609.27
Never married	-46647.28	***	18109.37
Married with working spouse	-10106.42	ns	25469.33
Benefit status			
Onbenefit	-29665.27	***	6108.82
Onsupernzs	-34337.98	**	12510.02
Onsuperother	-8564.20	ns	10171.68
Super (has a super scheme)	6675.70	ns	5309.54
Dependants (number)	8624.73	**	3520.59
Attitudes to retirement			
Stopwork (plans to stop totally)	-6341.17	ns	5433.73
Reshealth (own health important factor)	-253.39	ns	7695.77
Resfamhealth (health of family member important factor)	8736.33	ns	7813.74
Respositive (positive benefits of retirement important)	5798.30	ns	9034.61
Resnegative (negative benefits of retirement important)	-20854.96	***	7359.98
Wealth (log)	11300.11	***	3152.55
Intercept	-6716.94	ns	22400.65

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.3-Estimated coefficients from a logit regression on the expected adequacy of income in retirement amongst those working

Dependent variable: enough income for retirement	No. of observations = 3,608		R^2 = 0.12
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	-0.0189	***	0.0071
Mental health	-0.0374	***	0.0072
Male (base = female)	-0.1920	ns	0.1228
Age			
Age normalised (= age minus 65)	-0.0142	ns	0.0200
Age 65 or over (base = less than 65)	0.0457	ns	0.3189
Ethnicity (base = New Zealand European)			
Māori	-0.1574	*	0.0895
Other	0.0014	ns	0.2287
Migrant status (years in New Zealand)	0.0005	ns	0.0056
Region (base = rural)			
Urbanmain	0.3544	***	0.1327
Urbanother	0.1967	ns	0.1581
Education (base = no qualifications)			
Edusecond	-0.2268	ns	0.1488
Edutertiary	-0.2093	*	0.1273
Marital status (base = married with non-working spouse)			
Separated	-0.0688	ns	0.2171
Widow/er	0.2535	ns	0.2938
Never married	-0.5945	**	0.2958
Married with working spouse	0.0643	ns	0.1481
Benefit status			
Onbenefit	-0.1314	ns	0.2645
Onsupernzs	-0.3618	ns	0.2939
Onsuperother	-0.5107	**	0.2390
Super (has a super scheme)	-0.0166	ns	0.1415
Dependants (number)	0.0653	ns	0.0560
Attitudes to retirement			
Stopwork (plans to stop totally)	-0.2711	*	0.1638
Reshealth (own health important factor)	0.0424	ns	0.1260
Resfamhealth (health of family member important factor)	-0.0382	ns	0.1243
Respositive (positive benefits of retirement important)	0.2360	**	0.1135
Resnegative (negative benefits of retirement important)	1.2786	***	0.1273
Income (log)	-0.7310	***	0.1698
Wealth (log)	-0.1488	***	0.0532
Intercept	6.9554	***	1.0381

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.4-Estimated coefficients from a logit regression on the adequacy of income to meet basic needs: all respondents

Dependent variable: enough basic income	No. of observations = 4,848	R^2 = 0.16	
Explanatory variable	Coefficient	Significance	Standard error
Working (base = retired)	0.0871		0.1972
Health			
Physical health	0.0205	***	0.0072
Mental health	0.0267	***	0.0068
Male (base = female)	-0.0452	ns	0.1463
Age			
Age normalised (= age minus 65)	0.0143	ns	0.0251
Age 65 or over (base = less than 65)	0.3410	ns	0.3050
Ethnicity (base = New Zealand European)			
Māori	-0.2899	***	0.1063
Other	-0.9209	***	0.2691
Migrant status (years in New Zealand)	-0.0074	ns	0.0071
Region (base = rural)			
Urbanmain	0.1719	ns	0.1607
Urbanother	0.3084	*	0.1811
Education (base = no qualifications)			
Edusecond	0.1431	ns	0.1709
Edutertiary	0.3836	**	0.1534
Marital status (base = married with non-working spouse)			
Separated	0.2323	ns	0.2351
Widow/er	0.1687	ns	0.3081
Never married	0.3650	ns	0.3178
Married with working spouse	0.3522	**	0.1829
Benefit status			
Onbenefit	-1.0529	***	0.1825
Onsupernzs	-0.2418	ns	0.2632
Onsuperother	0.5110	*	0.3023
Super (has a super scheme)	-0.0882	ns	0.1678
Dependants (number)	-0.0667	ns	0.0598
Attitudes to retirement			
Stopwork (plans to stop totally)	0.1809	ns	0.1863
Reshealth (own health important factor)	0.0218	ns	0.1510
Resfamhealth (health of family member important factor)	-0.0351	ns	0.1480
Respositive (positive benefits of retirement important)	-0.4343	***	0.1538
Resnegative (negative benefits of retirement important)	-0.5908	***	0.1356
Income (log)	0.3496	***	0.0911
Wealth (log)	0.2664	***	0.0540
Intercept	-1.9536	**	0.7693

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.5-Economic Living Standards

Dependent variable: ELSI	No. of observations = 4,445	R^2 = 0.37	
Explanatory variable	Coefficient	Significance	Standard error
Working (base = retired)	-0.6765	**	0.3339
Health			
Physical health	0.1149	***	0.0131
Mental health	0.1318	***	0.0137
Male (base = female)	0.3509	ns	0.2238
Age			
Age normalised (= age minus 65)	-0.0124	ns	0.0440
Age 65 or over (base = less than 65)	1.3505	*	0.7303
Ethnicity (base = New Zealand European)			
Māori	-0.4444	**	0.1927
Other	-0.2845	ns	0.4380
Migrant status (years in New Zealand)	0.0275	**	0.0111
Region (base = rural)			
Urbanmain	0.2374	ns	0.2508
Urbanother	0.2828	ns	0.2865
Education (base = no qualifications)			
Edusecond	0.7406	***	0.2688
Edutertiary	0.7157	***	0.2486
Marital status (base = married with non-working spouse)			
Separated	-0.5068	ns	0.4566
Widow/er	0.3170	ns	0.5174
Never married	0.2950	ns	0.5125
Married with working spouse	0.8849	***	0.2994
Benefit status			
Onbenefit	-3.7148	***	0.4685
Onsupernzs	-1.4600	**	0.6713
Onsuperother	1.2091	***	0.3760
Super (has a super scheme)	0.0231	ns	0.2711
Dependants (number)	-0.4153	***	0.1084
Attitudes to retirement			
Stopwork (plans to stop totally)	1.4150	***	0.2533
Reshealth (own health important factor)	0.2610	ns	0.2316
Resfamhealth (health of family member important factor)	0.0623	ns	0.2223
Respositive (positive benefits of retirement important)	-0.6058	***	0.2169
Resnegative (negative benefits of retirement important)	-1.4903	***	0.2416
Income (log)	1.9997	***	0.2731
Wealth (log)	0.6641	***	0.1013
Intercept	-1.5860	ns	1.6804

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.6-Estimated coefficients for number of measures taken to reduce costs regression

Dependent variable: Cost	No. of observations = 4,837	R^2 = 0.30	
Explanatory variable	Coefficient	Significance	Standard error
Working (base = retired)	0.0425	*	0.0218
Health			
Physical health	-0.0085	***	0.0009
Mental health	-0.0091	***	0.0009
Male (base = female)	-0.0530	***	0.0146
Age			
Age normalised (= age minus 65)	-0.0020	ns	0.0028
Age 65 or over (base = less than 65)	-0.0593	ns	0.0452
Ethnicity (base = New Zealand European)			
Māori	0.0392	***	0.0129
Other	0.0098	ns	0.0291
Migrant status (years in New Zealand)	-0.0012	ns	0.0007
Region (base = rural)			
Urbanmain	-0.0236	ns	0.0159
Urbanother	-0.0250	ns	0.0185
Education (base = no qualifications)			
Edusecond	-0.0226	ns	0.0173
Edutertiary	-0.0165	ns	0.0163
Marital status (base = married with non-working spouse)			
Separated	0.0273	ns	0.0293
Widow/er	-0.0135	ns	0.0332
Never married	-0.0297	ns	0.0358
Married with working spouse	-0.0662	***	0.0198
Benefit status			
Onbenefit	0.1787	***	0.0287
Onsupernzs	0.0599	ns	0.0425
Onsuperother	-0.0321	ns	0.0246
Super (has a super scheme)	0.0005	ns	0.0173
Dependants (number)	0.0353	***	0.0074
Attitudes to retirement			
Stopwork (plans to stop totally)	-0.0916	***	0.0164
Reshealth (own health important factor)	-0.0124	ns	0.0152
Resfamhealth (health of family member important factor)	-0.0018	ns	0.0148
Respositive (positive benefits of retirement important)	0.0612	***	0.0141
Resnegative (negative benefits of retirement important)	0.0943	***	0.0159
Income (log)	-0.0978	***	0.0142
Wealth (log)	-0.0327	***	0.0065
Intercept	2.8111	***	0.1014

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.7-Estimated coefficients for logit regression for rating overall living standards

(a) Working

Dependent variable: Overall living standards	No. of observations = 3,595		R^2 = 0.28
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0269	**	0.0128
Mental health	0.0071	ns	0.0111
Male (base = female)	-0.1972	ns	0.2632
Age			
Age normalised (= age minus 65)	-0.0225	ns	0.0457
Age 65 or over (base = less than 65)	0.4390	ns	0.7680
Ethnicity (base = New Zealand European)			
Māori	-0.1067	ns	0.2093
Other	-0.2863	ns	0.3569
Migrant status (years in New Zealand)	0.0294	***	0.0103
Region (base = rural)			
Urbanmain	0.5104	*	0.2767
Urbanother	0.8237	**	0.3471
Education (base = no qualifications)			
Edusecond	0.4697	ns	0.3521
Edutertiary	0.1173	ns	0.2962
Marital status (base = married with non-working spouse)			
Separated	-0.3153	ns	0.3524
Widow/er	-0.1351	ns	0.4950
Never married	-0.3543	ns	0.4756
Married with working spouse	0.6832	*	0.3592
Benefit status			
Onbenefit	-1.2799	***	0.3330
Onsupernzs	-0.2355	ns	0.7219
Onsuperother	4.5556	**	1.7886
Super (has a super scheme)	0.1579	ns	0.2577
Dependants (number)	0.1991	ns	0.1331
Attitudes to retirement			
Stopwork (plans to stop totally)	-0.1329	ns	0.3912
Reshealth (own health important factor)	-0.1542	ns	0.2670
Resfamhealth (health of family member important factor)	0.2534	ns	0.2647
Respositive (positive benefits of retirement important)	-0.0004	ns	0.2625
Resnegative (negative benefits of retirement important)	-0.1959	ns	0.2434
Income (log)	1.2094	***	0.3813
Wealth (log)	0.3186	***	0.0949
Intercept	-7.5367	***	2.1078

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

(b) Retired

Dependent variable: Overall living standards	No. of observations = 1,234	R^2 = 0.30	
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0218	ns	0.0155
Mental health	0.0604	***	0.0143
Male (base = female)	0.2086	ns	0.3268
Age			
Age normalised (= age minus 65)	0.0560	ns	0.0619
Age 65 or over (base = less than 65)	0.0014	ns	0.5659
Ethnicity (base = New Zealand European)			
Māori	0.4165	ns	0.2988
Other	-0.0418	ns	0.7007
Migrant status (years in New Zealand)	-0.0112	ns	0.0144
Region (base = rural)			
Urbanmain	-0.2260	ns	0.3679
Urbanother	0.0150	ns	0.4039
Education (base = no qualifications)			
Edusecond	0.4652	ns	0.4442
Edutertiary	-0.0225	ns	0.3507
Marital status (base = married with non-working spouse)			
Separated	0.0819	ns	0.5020
Widow/er	0.4057	ns	0.4931
Never married	0.0804	ns	0.6941
Married with working spouse	0.9140	*	0.4958
Benefit status			
Onbenefit	-0.9993	***	0.3482
Onsupernzs	-0.2319	ns	0.5550
Onsuperother	-0.8445	*	0.4651
Super (has a super scheme)	0.1973	ns	0.3680
Dependants (number)	0.1581	**	0.2027
Attitudes to retirement			
Stopwork (plans to stop totally)	0.5890	ns	0.2971
Reshealth (own health important factor)	-0.2859	ns	0.3182
Resfamhealth (health of family member important factor)	0.3025	ns	0.3073
Respositive (positive benefits of retirement important)	0.4458	ns	0.2817
Resnegative (negative benefits of retirement important)	-0.8300	**	0.3488
Income (log)	0.4009	***	0.1162
Wealth (log)	0.3131	***	0.1178
Intercept	-3.2771	**	1.4165

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.8-Estimated coefficients for logit regression for satisfaction with living standards

(a) Working

Dependent variable: satisfaction with living standards	No. of observations = 3,599		R^2 = 0.16
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0151	**	0.0073
Mental health	0.0426	***	0.0076
Male (base = female)	-0.1185	ns	0.1402
Age			
Age normalised (= age minus 65)	0.0079	ns	0.0237
Age 65 or over (base = less than 65)	-0.0120	ns	0.4164
Ethnicity (base = New Zealand European)			
Māori	0.1753	*	0.1060
Other	-0.2035	ns	0.2548
Migrant status (years in New Zealand)	0.0087	ns	0.0065
Region (base = rural)			
Urbanmain	-0.2536	ns	0.1701
Urbanother	-0.0583	ns	0.1924
Education (base = no qualifications)			
Edusecond	0.3693	**	0.1805
Edutertiary	0.0141	ns	0.1538
Marital status (base = married with non-working spouse)			
Separated	-0.0902	ns	0.2489
Widow/er	0.2557	ns	0.3420
Never married	0.1746	ns	0.3304
Married with working spouse	-0.0851	ns	0.2001
Benefit status			
Onbenefit	-1.0213	***	0.2411
Onsupernzs	-0.0834	ns	0.3903
Onsuperother	0.9850	***	0.3656
Super (has a super scheme)	-0.0492	ns	0.1646
Dependants (number)	0.0058	ns	0.0604
Attitudes to retirement			
Stopwork (plans to stop totally)	0.1395	ns	0.2080
Reshealth (own health important factor)	0.1576	ns	0.1461
Resfamhealth (health of family member important factor)	0.0119	ns	0.1393
Respositive (positive benefits of retirement important)	0.1131	ns	0.1334
Resnegative (negative benefits of retirement important)	-0.5951	***	0.1351
Income (log)	1.4383	***	0.2560
Wealth (log)	0.1874	***	0.0578
Intercept	-9.2527	***	1.3987

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

(b) Retired

Dependent variable: Satisfaction with living standards	No. of observations = 1,235	R^2 = 0.22	
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0313	***	0.0093
Mental health	0.0386	***	0.0096
Male (base = female)	0.2763	ns	0.2376
Age			
Age normalised (= age minus 65)	-0.0408	ns	0.0535
Age 65 or over (base = less than 65)	0.7694	*	0.4449
Ethnicity (base = New Zealand European)			
Māori	0.5192	**	0.2052
Other	0.1710	ns	0.4696
Migrant status (years in New Zealand)	-0.0046	ns	0.0091
Region (base = rural)			
Urbanmain	0.0101	ns	0.3071
Urbanother	.01808	ns	0.3032
Education (base = no qualifications)-			
Edusecond	-0.4187	ns	0.2575
Edutertiary	0.1801	ns	0.2428
Marital status (base = married with non-working spouse)			
Separated	0.0824	ns	0.3707
Widow/er	0.2353	ns	0.3945
Never married	-0.3206	ns	0.4900
Married with working spouse	0.3244	ns	0.2744
Benefit status			
Onbenefit	-0.7663	**	0.3140
Onsupernzs	-0.9181	***	0.3480
Onsuperother	0.2960	ns	0.3677
Super (has a super scheme)	-0.0015	ns	0.3141
Dependants (number)	-0.0116	ns	0.1692
Attitudes to retirement			
Stopwork (plans to stop totally)	0.8638	***	0.2237
Reshealth (own health important factor)	-0.4143	*	0.2324
Resfamhealth (health of family member important factor)	-0.3420	ns	0.2398
Respositive (positive benefits of retirement important)	0.6900	***	0.2141
Resnegative (negative benefits of retirement important)	-0.6775	***	0.2306
Income (log)	0.4574	***	0.1095
Wealth (log)	0.0828	ns	0.0846
Intercept	-4.4075	***	1.0290

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.9-Estimated coefficients for logit regression for how will/did living standards change

(a) Working

Dependent variable: How will Living standards change?	No. of observations = 3,482		R^2 = 0.06
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0220	***	0.0066
Mental health	0.0251	***	0.0063
Male (base = female)	0.1012	ns	0.1156
Age			
Age normalised (= age minus 65)	-0.0211	ns	0.0191
Age 65 or over (base = less than 65)	-0.1619	ns	0.3122
Ethnicity (base = New Zealand European)			
Māori	0.1789	**	0.0851
Other	0.3703	ns	0.2267
Migrant status (years in New Zealand)	0.0074	ns	0.0056
Region (base = rural)			
Urbanmain	-0.4483	***	0.1242
Urbanother	-0.2771	**	0.1486
Education (base = no qualifications)			
Edusecond	0.1736	ns	0.1408
Edutertiary	-0.2236	*	0.1240
Marital status (base = married with non-working spouse)			
Separated	0.0353	ns	0.2059
Widow/er	0.0976	ns	0.2791
Never married	0.5018	*	0.2890
Married with working spouse	0.0481	ns	0.1424
Benefit status			
Onbenefit	0.4259	*	0.2415
Onsupernzs	0.3988	ns	0.2900
Onsuperother	0.1296	ns	0.2345
Super (has a super scheme)	0.0646	ns	0.1369
Dependants (number)	-0.0135	ns	0.0498
Attitudes to retirement			
Stopwork (plans to stop totally)	-0.0002	ns	0.1641
Reshealth (own health important factor)	-0.1263	ns	0.1205
Resfamhealth (health of family member important factor)	0.0988	ns	0.1162
Respositive (positive benefits of retirement important)	0.0263	ns	0.1109
Resnegative (negative benefits of retirement important)	-0.8470	***	0.1120
Income (log)	0.2306	ns	0.1538
Wealth (log)	0.0790	*	0.0471
Intercept	-3.7915	***	0.9599

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

(b) Retired

Dependent variable: How did living standards change?	No. of observations = 1,193	R^2 = 0.09	
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0229	***	0.0085
Mental health	0.0103	ns	0.0091
Male (base = female)	0.1507	ns	0.1908
Age			
Age normalised (= age minus 65)	-0.0338	ns	0.0436
Age 65 or over (base = less than 65)	0.6171	*	0.3627
Ethnicity (base = New Zealand European)			
Māori	0.0627	ns	0.1625
Other	-0.0840	ns	0.3650
Migrant status (years in New Zealand)	0.0085	ns	0.0073
Region (base = rural)			
Urbanmain	0.1201	ns	0.2380
Urbanother	0.2792	ns	0.2477
Education (base = no qualifications)			
Edusecond	0.1011	ns	0.2224
Edutertiary	-0.1194	ns	0.2039
Marital status (base = married with non-working spouse)			
Separated	0.4838	ns	0.3669
Widow/er	0.2505	ns	0.3262
Never married	-0.0399	ns	0.4530
Married with working spouse	-0.1385	ns	0.2250
Benefit status			
Onbenefit	-0.3312	ns	0.2839
Onsupernzs	-1.1190	***	0.2871
Onsuperother	-0.2556	ns	0.2792
Super (has a super scheme)	-0.1767	ns	0.2277
Dependants (number)	-0.1131	ns	0.1330
Attitudes to retirement			
Stopwork (plans to stop totally)	0.3961	**	0.1747
Reshealth (own health important factor)	-0.3358	*	0.1969
Resfamhealth (health of family member important factor)	-0.0062	ns	0.1914
Respositive (positive benefits of retirement important)	-0.1422	ns	0.1877
Resnegative (negative benefits of retirement important)	-0.6216	***	0.2172
Income (log)	0.1716	*	0.1020
Wealth (log)	0.1137	ns	0.0746
Intercept	-2.3357	**	0.9523

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.10-Estimated coefficients for logit regression for retirement years vs. working years (working group only)

Dependent variable: Retirement years vs. Working years	No. of observations = 3,583	R^2 = 0.13	
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0313	***	0.0079
Mental health	0.0172	**	0.0071
Male (base = female)	0.0976	ns	0.1486
Age			
Age normalised (= age minus 65)	0.0065	ns	0.0237
Age 65 or over (base = less than 65)	-1.1766	***	0.3986
Ethnicity (base = New Zealand European)			
Māori	-0.1735	*	0.1037
Other	-0.0790	ns	0.2610
Migrant status (years in New Zealand)	0.0008	ns	0.0062
Region (base = rural)			
Urbanmain	-0.1571	ns	0.1648
Urbanother	-0.0540	ns	0.1863
Education (base = no qualifications)			
Edusecond	0.3334	*	0.1729
Edutertiary	0.4444	***	0.1546
Marital status (base = married with non-working spouse)			
Separated	-0.0971	ns	0.2639
Widow/er	0.0323	ns	0.3349
Never married	-0.2339	ns	0.3418
Married with working spouse	0.1167	ns	0.1951
Benefit status			
Onbenefit	0.4661	*	0.2475
Onsupernzs	1.0225	***	0.3780
Onsuperother	0.1394	ns	0.2725
Super (has a super scheme)	0.1196	ns	0.1765
Dependants (number)	-0.0187	ns	0.0557
Attitudes to retirement			
Stopwork (plans to stop totally)	0.6812	***	0.2356
Reshealth (own health important factor)	-0.0299	ns	0.1597
Resfamhealth (health of family member important factor)	0.0097	ns	0.1517
Respositive (positive benefits of retirement important)	0.6734	***	0.1416
Resnegative (negative benefits of retirement important)	-1.3598	***	0.1387
Income (log)	0.0271	ns	0.1817
Wealth (log)	0.1526	***	0.0554
Intercept	-1.7528	ns	1.0777

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.11-Summary of significant variables in a regression for physical health by sex and work status

	Male variable			Female variable			Total variable		
Working	+	Logincome	***	+	Edusecond	***	+	Edutertiary	***
	+	Age65	***	+	Edutertiary	**	+	Logincome	***
	+	Edutertiary	**	+	Logwealth	*	+	Age65	***
	+	Never	**				+	Edusecond	**
	+	Resfamhealth	*				+	Logwealth	**
							+	Resfamhealth	*
	-	Reshealth	***	-	Onbenefit	***	-	Onbenefit	***
	-	Agenorm	**	-	Stopwork	**	-	Reshealth	***
	-	Resnegative	**	-	Onsupernzs	*	-	Stopwork	***
	-	Stopwork	**				-	Onsupernzs	***
	-	Onsupernzs	**				-	Agenorm	**
	-	Onbenefit	*				-	Resnegative	**
	-	Māori	*				-	Māori	**
Total	+	Working	***	+	Logwealth	***	+	Working	***
	+	Resfamhealth	***	+	Working	**	+	Logwealth	***
	+	Edutertiary	***	+	Edusecond	**	+	Edutertiary	***
	+	Logincome	***	+	Mental	*	+	Resfamhealth	***
	+	Age65	***				+	Mental	**
	+	Logwealth	**				+	Edusecond	**
	+	Onsuperother	**						
	-	Reshealth	***	-	Onbenefit	***	-	Onbenefit	***
	-	Onbenefit	***	-	Reshealth	***	-	Reshealth	***
	-	Resnegative	***	-	Māori	**	-	Māori	***
	-	Agenorm	***	-	Agenorm	*	-	Agenorm	***
	-	Stopwork	*	-	Stopwork	*	-	Resnegative	***
	-	Onsupernzs	*				-	Stopwork	**
							-	Onsupernzs	*

Appendix Table C.12-Summary of significant variables in a regression for mental health by sex and work status

	Male variable			Female variable			Total variable		
Working	+	Yearsinnz	***	+	Onsuperother	***	+	Yearsinnz	**
	+	Othereth	***	+	Reshealth	**	+	Logincome	**
	+	Logincome	**	+	Logwealth	**	+	Stopwork	**
	+	Stopwork	*	+	Logincome	*	+	Reshealth	**
	+	Edusecond	*	+	Onsupernzs	*	+	Onsuperother	**
							+	Othereth	*
	-	Onbenefit	***	-	Onbenefit	***	-	Onbenefit	***
	-	Resnegative	***	-	Resnegative	***	-	Resnegative	***
	-	Urbanother	**	-	Māori	**	-	Respositive	***
	-	Urbanmain	*	-	Respositive	*	-	Māori	**
	-	Respositive	*	-	Widow	*	-	Widow	**
Total	+	Yearsinnz	***	+	Physical	*	+	Yearsinnz	***
	+	Othereth	***	+	Logwealth	*	+	Physical	**
	+	Stopwork	***	+	Agenorm	*	+	Logincome	**
	+	Edusecond	**				+	Othereth	**
	+	Logincome	**				+	Stopwork	**
	+	Working	**				+	Edusecond	**
	+	Edutertiary	**				+	Working	*
	+	Age65	*				+	Agenorm	*
							+	Edutertiary	*
	-	Onbenefit	***	-	Resnegative	***	-	Resnegative	***
	-	Resnegative	***	-	Māori	***	-	Onbenefit	***
	-	Urbanother	**	-	Onbenefit	***	-	Māori	***
	-	Urbanmain	*	-	Widow	*	-	Widow	**
	-	Onsupernzs	*				-	Separated	*

Appendix Table C.13-Summary of significant variables in a regression for overall health by sex and work status

	Male variable			Female variable			Total variable		
Working	+	Logincome	***	+	Logwealth	***	+	Logincome	***
	+	Age65	***	+	Logincome	**	+	Age65	***
	+	Yearsinnz	**	+	Edusecond	*	+	Edutertiary	**
	+	Othereth	**				+	Logwealth	**
	+	Edutertiary	**				+	Edusecond	**
	+	Resfamhealth	**				+	Yearsinnz	*
							+	Resfamhealth	*
	-	Onbenefit	***	-	Onbenefit	***	-	Onbenefit	***
	-	Resnegative	***	-	Resnegative	***	-	Resnegative	***
	-	Urbanother	***	-	Māori	**	-	Māori	***
	-	Onsupernzs	**	-	Respositive	**	-	Respositive	***
	-	Reshealth	*				-	Urbanother	*
	-	Respositive	*						
	-	Māori	*						
Total	+	Working	***	+	Logwealth	***	+	Working	***
	+	Logincome	***	+	Edusecond	**	+	Logwealth	***
	+	Edutertiary	***	+	Working	**	+	Edutertiary	***
	+	Age65	***				+	Edusecond	***
	+	Othereth	***				+	Resfamhealth	***
	+	Resfamhealth	***				+	Yearsinnz	**
	+	Yearsinnz	**				+	Logincome	**
	+	Edusecond	**				+	Age65	*
	+	Onsuperother	*				+	Othereth	*
							+	Onsuperother	*
	-	Onbenefit	***	-	Onbenefit	***	-	Onbenefit	***
	-	Reshealth	***	-	Resnegative	***	-	Resnegative	***
	-	Resnegative	***	-	Māori	***	-	Reshealth	***
	-	Urbanother	***	-	Dependants0	*	-	Māori	***
	-	Onsupernzs	**	-	Reshealth	*	-	Male	*
	-	Māori	*				-	Onsupernzs	*
							-	Urbanother	*
							-	Separated2	*

Appendix Table C.14-Estimated coefficients for logit regression for working, based on physical and mental health, and income

(a) Male

Dependent variable: Working	No. of observations = 2,376		R^2 = 0.45	
Explanatory variable	Coefficient	Significance	Standard error	Marginal effect
Health				
Physical health	0.0529	***	0.0109	0.02
Mental health	0.0272	***	0.0106	0.01
Age				
Age normalised (= age minus 65)	-0.1242	***	0.0425	-0.01
Age 65 or over (base = less than 65)	-0.1639	ns	0.6308	-0.35
Ethnicity (base = New Zealand European)				
Māori	-0.1520	ns	0.1718	-0.01
Other	-0.0907	ns	0.3275	-0.01
Migrant status (years in New Zealand)	0.0228	***	0.0085	0.01
Region (base = rural)				
Urbanmain	0.3638	ns	0.2473	0.03
Urbanother	0.0113	ns	0.2533	0.00
Education (base = no qualifications)				
Edusecond	0.0581	ns	0.2635	0.01
Edutertiary	0.4034	*	0.2187	0.04
Marital status (base = married with non-working spouse)				
Separated	1.1184	***	0.3420	0.14
Widow/er	1.3757	***	0.5017	0.16
Never married	0.3667	ns	0.4057	0.06
Married with working spouse	1.5787	***	0.2486	0.18
Benefit status				
Onbenefit	-0.5050	ns	0.3242	-0.05
Onsupernzs	-1.3315	**	0.5378	-0.16
Onsuperother	-1.1917	***	0.2950	-0.16
Super (has a super scheme)	0.1712	ns	0.2547	0.02
Dependants (number)	0.4318	***	0.1504	0.05
Attitudes to retirement				
Stopwork (plans to stop totally)	-1.9872	***	0.2417	-0.29
Reshealth (own health important factor)	-0.1044	ns	0.2346	-0.01
Resfamhealth (health of family member important factor)	0.4187	*	0.2248	0.04
Respositive (positive benefits of retirement important)	-0.4069	*	0.2123	-0.04
Resnegative (negative benefits of retirement important)	0.3672	*	0.2162	0.03
Income of other household members (log)	-0.0171	ns	0.0539	0.00
Wealth (log)	0.0327	ns	0.0959	0.00
Intercept	-4.7054	***	0.9924	

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

(b) Female

Dependent variable: Working	No. of observations = 2,472		R^2 = 0.47	
Explanatory variable	Coefficient	Significance	Standard error	Marginal effect
Health				
Physical health	0.0262	***	0.0102	0.02
Mental health	0.0090	ns	0.0111	0.01
Age				
Age normalised (= age minus 65)	-0.1531	***	0.0355	-0.02
Age 65 or over (base = less than 65)	-0.5597	ns	0.3676	-0.35
Ethnicity (base = New Zealand European)				
Māori	-0.0008	ns	0.1512	0.00
Other	0.5650	ns	0.4303	0.08
Migrant status (years in New Zealand)	0.0174	*	0.0104	0.01
Region (base = rural)				
Urbanmain	-0.1730	ns	0.2114	-0.03
Urbanother	0.1254	ns	0.2357	0.02
Education (base = no qualifications)				
Edusecond	0.6192	***	0.2299	0.10
Edutertiary	0.6754	***	0.2116	0.11
Marital status (base = married with non-working spouse)				
Separated	2.4150	***	0.3317	0.42
Widow/er	1.6610	***	0.3408	0.34
Never married	2.4199	***	0.4704	0.42
Married with working spouse	1.8863	***	0.2238	0.37
Benefit status				
Onbenefit	-1.1444	**	0.2756	-0.22
Onsupernzs	-0.9312	**	0.3038	-0.16
Onsuperother	-0.2943	ns	0.3535	-0.05
Super (has a super scheme)	0.1553	ns	0.2215	0.02
Dependants (number)	0.5173	**	0.2219	0.08
Attitudes to retirement				
Stopwork (plans to stop totally)	-1.6675	***	0.1861	-0.31
Reshealth (own health important factor)	0.1325	ns	0.2004	0.02
Resfamhealth (health of family member important factor)	0.3033	ns	0.2015	0.05
Respositive (positive benefits of retirement important)	-0.2428	ns	0.2091	-0.04
Resnegative (negative benefits of retirement important)	0.4510	**	0.2172	0.07
Income of other household members (log)	0.0291	ns	0.0626	0.00
Wealth (log)	0.0951	ns	0.0806	0.00
Intercept	-3.6604	***	1.1734	

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.15-Estimated coefficients for logit regression for working, based on self-reported health, and income

(a) Male

Dependent variable: Working	No. of observations = 2,373	R^2 = 0.46	
Explanatory variable	Coefficient	Significance	Standard error
Health (base = excellent)			
Very good	-0.0214	ns	0.3160
Good	-0.6843	**	0.3069
Fair	-1.6748	***	0.3769
Poor	-2.4858	***	0.5626
Age			
Age normalised (= age minus 65)	-0.1254	***	0.0430
Age 65 or over (base = less than 65)	-0.1275	ns	0.5908
Ethnicity (base = New Zealand European)			
Māori	-0.1706	ns	0.1743
Other	-0.0996	ns	0.3478
Migrant status (years in New Zealand)	0.0207	**	0.0084
Region (base = rural)			
Urbanmain	0.3780	ns	0.2580
Urbanother	0.0330	ns	0.2645
Education (base = no qualifications)			
Edusecond	0.1188	ns	0.2688
Edutertiary	0.5215	**	0.2242
Marital status (base = married with non-working spouse)			
Separated	1.0716	***	0.3495
Widow/er	1.2900	**	0.4993
Never married	0.3655	ns	0.4090
Married with working spouse	1.6033	***	0.2546
Benefit status			
Onbenefit	-0.5076	ns	0.3266
Onsupernzs	-1.3431	***	0.4917
Onsuperother	-1.1944	***	0.2964
Super (has a super scheme)	0.1407	ns	0.2614
Dependants (number)	0.4366	***	0.1577
Attitudes to retirement			
Stopwork (plans to stop totally)	-2.0228	***	0.2337
Reshealth (own health important factor)	-0.1293	ns	0.2343
Resfamhealth (health of family member important factor)	0.4306	*	0.2283
Respositive (positive benefits of retirement important)	-0.4885	**	0.2130
Resnegative (negative benefits of retirement important)	0.3693	*	0.2220
Income of other household members (log)	-0.0211	ns	0.0539
Wealth (log)	0.0420	ns	0.1008
Intercept	-0.0787	ns	0.7405

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

(b) Female

Dependent variable: Working	No. of observations = 2,467	R^2 = 0.47	
Explanatory variable	Coefficient	Significance	Standard rrror
Health (base = excellent)			
Very good	-0.1657	ns	0.2673
Good	-0.3681	ns	0.3054
Fair	-1.0219	**	0.4048
Poor	-1.2976	**	0.6561
Age			
Age normalised (= age minus 65)	-0.1562	***	0.0358
Age 65 or over (base = less than 65)	-0.5304	ns	0.3731
Ethnicity (base = New Zealand European)			
Māori	-0.0075	ns	0.1523
Other	0.6032	ns	0.4264
Migrant status (years in New Zealand)	0.0154	ns	0.0105
Region (base = rural)			
Urbanmain	-0.1661	ns	0.2121
Urbanother	0.1367	ns	0.2381
Education (base = no qualifications)			
Edusecond	0.5917	***	0.2280
Edutertiary	0.6383	***	0.2162
Marital status (base = married with non-working spouse)			
Separated	2.4270	***	0.3301
Widow/er	1.6717	***	0.3452
Never married	2.4571	***	0.4898
Married with working spouse	1.8666	***	0.2258
Benefit status			
Onbenefit	-1.1578	***	0.2731
Onsupernzs	-0.9512	***	0.3130
Onsuperother	-0.3558	ns	0.3556
Super (has a super scheme)	0.1481	ns	0.2215
Dependants (number)	0.5117	**	0.2164
Attitudes to retirement			
Stopwork (plans to stop totally)	-1.6761	***	0.1864
Reshealth (own health important factor)	0.1329	ns	0.2003
Resfamhealth (health of family member important factor)	0.2852	ns	0.2053
Respositive (positive benefits of retirement important)	-0.2408	ns	0.2105
Resnegative (negative benefits of retirement important)	0.4782	**	0.2118
Income of other household members (log)	0.0259	ns	0.0621
Wealth (log)	0.0941	ns	0.0818
Intercept	-1.4554	ns	0.9345

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.16-Estimated coefficients for logit regression for working, based on physical and mental health, and wage.

(a) Male

Dependent variable: Working	No. of observations = 2,373		R^2 = 0.46
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0560	***	0.0110
Mental health	0.0319	***	0.0106
Age			
Age normalised (= age minus 65)	-0.1227	***	0.0420
Age 65 or over (base = less than 65)	-0.2268	ns	0.6380
Ethnicity (base = New Zealand European)			
Māori	-0.2411	ns	0.1758
Other	-0.2085	ns	0.3416
Migrant status (years in New Zealand)	0.0233	***	0.0085
Region (base = rural)			
Urbanmain	0.2993	ns	0.2533
Urbanother	-0.1366	ns	0.2579
Education (base = no qualifications)			
Edusecond	0.1282	ns	0.2656
Edutertiary	0.6097	***	0.2280
Marital status (base = married with non-working spouse)			
Separated	0.9528	***	0.3364
Widow/er	1.1924	**	0.5088
Never married	0.1903	ns	0.3965
Married with working spouse	1.3673	***	0.2450
Benefit status			
Onbenefit	-0.5057	ns	0.3212
Onsupernzs	-1.2442	**	0.5468
Onsuperother	-1.0562	***	0.2927
Super (has a super scheme)	0.1811	ns	0.2606
Dependants (number)	0.4833	***	0.1559
Attitudes to retirement			
Stopwork (plans to stop totally)	-1.8842	***	0.2447
Reshealth (own health important factor)	-0.0759	ns	0.2388
Resfamhealth (health of family member important factor)	0.4339	*	0.2294
Respositive (positive benefits of retirement important)	-0.4277	**	0.2137
Resnegative (negative benefits of retirement important)	0.3392	ns	0.2211
Wage (log)	-1.2708	***	0.3026
Wealth (log)	0.0649	ns	0.0959
Intercept	-3.3644	***	1.0491

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

(b) Female

Dependent variable: Working	No. of observations = 2,469	R^2 = 0.48	
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0247	**	0.0104
Mental health	0.0149	ns	0.0112
Age			
Age normalised (= age minus 65)	-0.1491	***	0.0355
Age 65 or over (base = less than 65)	-0.4755	ns	0.3633
Ethnicity (base = New Zealand European)			
Māori	-0.1381	ns	0.1558
Other	0.2704	ns	0.4255
Migrant status (years in New Zealand)	0.0155	ns	0.0099
Region (base = rural)			
Urbanmain	-0.2319	ns	0.2144
Urbanother	-0.0144	ns	0.2433
Education (base = no qualifications)			
Edusecond	0.7615	***	0.2373
Edutertiary	0.9059	***	0.2294
Marital status (base = married with non-working spouse)			
Separated	2.0235	***	0.2946
Widow/er	1.3767	***	0.3078
Never married	1.9857	***	0.4589
Married with working spouse	1.6682	***	0.2280
Benefit status			
Onbenefit	-1.1898	***	0.2821
Onsupernzs	-0.9982	***	0.2982
Onsuperother	-0.1163	ns	0.3588
Super (has a super scheme)	0.1797	ns	0.2208
Dependants (number)	0.5392	**	0.2177
Attitudes to retirement			
Stopwork (plans to stop totally)	-1.6666	***	0.1863
Reshealth (own health important factor)	0.0764	ns	0.1995
Resfamhealth (health of family member important factor)	0.2964	ns	0.2018
Respositive (positive benefits of retirement important)	-0.2486	ns	0.2089
Resnegative (negative benefits of retirement important)	0.3528	ns	0.2224
Wage (log)	-1.6270	***	0.3791
Wealth (log)	0.1263	ns	0.0785
Intercept	-1.2149	ns	1.2189

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.17-Estimated coefficients for logit regression for working, based on self-reported health, and wage

(a) Male

Dependent variable: Working	No. of observations = 2,372		R^2 = 0.46
Explanatory variable	Coefficient	Significance	Standard error
Health (base = excellent)			
Very good	0.0135	ns	0.3225
Good	-0.7452	**	0.3122
Fair	-1.6960	***	0.3831
Poor	-2.6073	***	0.5622
Age			
Age normalised (= age minus 65)	-0.1245	***	0.0425
Age 65 or over (base = less than 65)	-0.1698	ns	0.5834
Ethnicity (base = New Zealand European)			
Māori	-0.2603	ns	0.1768
Other	-0.2047	ns	0.3590
Migrant status (years in New Zealand)	0.0212	**	0.0083
Region (base = rural)			
Urbanmain	0.3141	ns	0.2633
Urbanother	-0.1045	ns	0.2676
Education (base = no qualifications)			
Edusecond	0.1909	ns	0.2703
Edutertiary	0.7366	***	0.2334
Marital status (base = married with non-working spouse)			
Separated	0.9187	***	0.3451
Widow/er	1.1344	**	0.4992
Never married	0.2333	ns	0.4016
Married with working spouse	1.3997	***	0.2534
Benefit status			
Onbenefit	-0.5426	*	0.3207
Onsupernzs	-1.2760	***	0.4878
Onsuperother	-1.0750	***	0.2939
Super (has a super scheme)	0.1549	ns	0.2680
Dependants (number)	0.4857	***	0.1641
Attitudes to retirement			
Stopwork (plans to stop totally)	-1.9246	***	0.2379
Reshealth (own health important factor)	-0.1099	ns	0.2370
Resfamhealth (health of family member important factor)	0.4417	*	0.2310
Respositive (positive benefits of retirement important)	-0.5099	**	0.2132
Resnegative (negative benefits of retirement important)	0.3313	ns	0.2251
Wage (log)	-1.2070	***	0.3098
Wealth (log)	0.0752	ns	0.1002
Intercept	1.5604	*	0.8271

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

(b) Female

Dependent variable: Working	No. of observations = 2,464	R^2 = 0.48	
Explanatory variable	Coefficient	Significance	Standard error
Health (base = excellent)			
Very good	-0.2202	ns	0.2715
Good	-0.4010	ns	0.3126
Fair	-1.0505	**	0.4160
Poor	-1.4914	**	0.6875
Age			
Age normalised (= age minus 65)	-0.1505	***	0.0358
Age 65 or over (base = less than 65)	-0.4478	ns	0.3693
Ethnicity (base = New Zealand European)			
Māori	-0.1507	ns	0.1565
Other	0.3184	ns	0.4202
Migrant status (years in New Zealand)	0.0138	ns	0.0101
Region (base = rural)			
Urbanmain	-0.2182	ns	0.2134
Urbanother	0.0055	ns	0.2444
Education (base = no qualifications)			
Edusecond	0.7423	***	0.2356
Edutertiary	0.8693	***	0.2319
Marital status (base = married with non-working spouse)			
Separated	2.0378	***	0.2948
Widow/er	1.3765	***	0.3134
Never married	2.0308	***	0.4789
Married with working spouse	1.6475	***	0.2293
Benefit status			
Onbenefit	-1.2053	***	0.2794
Onsupernzs	-1.0153	***	0.3076
Onsuperother	-0.1849	ns	0.3601
Super (has a super scheme)	0.1764	ns	0.2167
Dependants (number)	0.5333	**	0.2115
Attitudes to retirement			
Stopwork (plans to stop totally)	-1.6709	***	0.1863
Reshealth (own health important factor)	0.0875	ns	0.1986
Resfamhealth (health of family member important factor)	0.2753	ns	0.2060
Respositive (positive benefits of retirement important)	-0.2415	ns	0.2088
Resnegative (negative benefits of retirement important)	0.3655	*	0.2164
Wage (log)	-1.6192	***	0.3705
Wealth (log)	0.1248	ns	0.0794
Intercept	1.2307	ns	1.0837

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.18-Estimated coefficients for logit regression of full-time vs. part-time

(a) Male

Dependent variable: Working	No. of observations = 1,852		R^2 = 0.21
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0157	ns	0.0146
Mental health	0.0062	ns	0.0137
Age			
Age normalised (= age minus 65)	-0.0917	***	0.0354
Age 65 or over (base = less than 65)	0.1349	ns	0.4821
Ethnicity (base = New Zealand European)			
Māori	0.2426	ns	0.1595
Other	0.5632	ns	0.4203
Migrant status (years in New Zealand)	0.0111	ns	0.0093
Region (base = rural)			
Urbanmain	0.3205	ns	0.2282
Urbanother	-0.2407	ns	0.2449
Education (base = no qualifications)			
Edusecond	-0.3451	ns	0.2795
Edutertiary	-0.4091	*	0.2135
Marital status (base = married with non-working spouse)			
Separated	0.4682	ns	0.3435
Widow/er	0.9494	**	0.4653
Never married	-0.3060	ns	0.4214
Married with working spouse	0.9987	***	0.2311
Benefit status			
Onbenefit	-2.0687	***	0.3740
Onsupernzs	-1.1696	***	0.4456
Onsuperother	-1.3912	***	0.2802
Super (has a super scheme)	0.3088	ns	0.2286
Dependants (number)	0.2451	***	0.0938
Attitudes to retirement			
Stopwork (plans to stop totally)	0.3804	ns	0.3195
Reshealth (own health important factor)	0.0572	ns	0.2203
Resfamhealth (health of family member important factor)	0.1911	ns	0.2284
Respositive (positive benefits of retirement important)	0.0863	ns	0.1889
Resnegative (negative benefits of retirement important)	0.4874	ns	0.2469
Income of other household members (log)	-0.1833	***	0.0512
Wealth (log)	0.0825	ns	0.0992
Intercept	-1.2549	ns	1.1456

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

(b) Female

Dependent variable: Working	No. of observations = 1,691	R^2 = 0.11	
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0035	ns	0.0091
Mental health	-0.0012	ns	0.0091
Age			
Age normalised (= age minus 65)	-0.0784	***	0.0282
Age 65 or over (base = less than 65)	0.2956	ns	0.5525
Ethnicity (base = New Zealand European)			
Māori	0.3702	***	0.1271
Other	0.5882	*	0.3741
Migrant status (years in New Zealand)	0.0051	ns	0.0093
Region (base = rural)			
Urbanmain	0.3064	*	0.1835
Urbanother	-0.0879	ns	0.2129
Education (base = no qualifications)			
Edusecond	-0.0702	ns	0.2005
Edutertiary	-0.2493	ns	0.1812
Marital status (base = married with non-working spouse)			
Separated	0.8777	***	0.3062
Widow/er	0.7084	**	0.3370
Never married	0.5477	ns	0.3953
Married with working spouse	-0.3059	ns	0.2337
Benefit status			
Onbenefit	-1.5705	***	0.3001
Onsupernzs	-1.0286	**	0.5071
Onsuperother	-0.8582	**	0.3942
Super (has a super scheme)	0.5258	***	0.1712
Dependants (number)	0.2682	**	0.1266
Attitudes to retirement			
Stopwork (plans to stop totally)	-0.1768	ns	0.2215
Reshealth (own health important factor)	-0.1851	ns	0.1800
Resfamhealth (health of family member important factor)	0.0426	ns	0.1781
Respositive (positive benefits of retirement important)	-0.2201	ns	0.1729
Resnegative (negative benefits of retirement important)	0.1745	ns	0.1623
Income of other household members (log)	-0.0497	ns	0.0482
Wealth (log)	0.0932	ns	0.0677
Intercept	-0.8120	ns	0.9894

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.19-Estimated coefficients for logit regression for working full time at older age

(a) Age 62

Dependent variable: Working Full-time at age 62	No. of observations = 2,496		R^2 = 0.08
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0060	ns	0.0078
Mental health	0.0128	ns	0.0080
Male (base = female)	0.7579	***	0.1378
Age			
Age normalised (= age minus 65)	0.0001	ns	0.0312
Ethnicity (base = New Zealand European)			
Māori	0.2265	**	0.1085
Other	0.3056	ns	0.2871
Migrant status (years in New Zealand)	0.0063	ns	0.0078
Region (base = rural)			
Urbanmain	0.4198	***	0.1544
Urbanother	0.4298	**	0.1848
Education (base = no qualifications)			
Edusecond	-0.0033	ns	0.1814
Edutertiary	-0.0567	ns	0.1624
Marital status (base = married with non-working spouse)			
Separated	0.7980	***	0.2832
Widow/er	1.4136	***	0.4338
Never married	0.7010	*	0.4028
Married with working spouse	0.3564	*	0.2038
Benefit status			
Onbenefit	-0.6773	**	0.2754
Onsupernzs	-0.6465	ns	0.5692
Onsuperother	-0.6378	*	0.3707
Super (has a super scheme)	0.1933	ns	0.1634
Dependants (number)	0.1607	**	0.0734
Attitudes to retirement			
Stopwork (plans to stop totally)	-0.6201	***	0.1860
Reshealth (own health important factor)	-0.4999	***	0.1532
Resfamhealth (health of family member important factor)	0.4547	***	0.1454
Respositive (positive benefits of retirement important)	-0.2420	*	0.1430
Resnegative (negative benefits of retirement important)	0.2464	*	0.1443
Income of other household members (log)	-0.0888	*	0.0460
Wealth (log)	0.0167	ns	0.0623
Intercept	-1.3555	*	0.8247

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

(b) Age 65

Dependent variable: Working Full-time at 65	No. of observations = 3,111	R^2 = 0.10	
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0004	ns	0.0073
Mental health	0.0105	ns	0.0068
Male (base = female)	0.6791	***	0.1257
Age			
Age normalised (= age minus 65)	0.0196	ns	0.0198
Ethnicity (base = New Zealand European)			
Māori	0.0580	ns	0.0927
Other	0.4382	*	0.2547
Migrant status (years in New Zealand)	0.0081	ns	0.0065
Region (base = rural)			
Urbanmain	0.2785	**	0.1324
Urbanother	0.2472	ns	0.1567
Education (base = no qualifications)			
Edusecond	-0.1212	ns	0.1535
Edutertiary	-0.2065	ns	0.1319
Marital status (base = married with non-working spouse)			
Separated	0.8881	***	0.2370
Widow/er	1.6498	***	0.3797
Never married	0.5041	ns	0.3394
Married with working spouse	0.3629	**	0.1616
Benefit status			
Onbenefit	-1.1789	***	0.2693
Onsupernzs	-1.3506	***	0.4492
Onsuperother	-0.8633	***	0.2989
Super (has a super scheme)	0.0736	ns	0.1416
Dependants (number)	0.0635	ns	0.0553
Attitudes to retirement			
Stopwork (plans to stop totally)	-1.0251	***	0.1815
Reshealth (own health important factor)	-0.2359	*	0.1309
Resfamhealth (health of family member important factor)	0.2800	**	0.1254
Respositive (positive benefits of retirement important)	-0.3299	***	0.1236
Resnegative (negative benefits of retirement important)	0.4961	***	0.1245
Income of other household members (log)	-0.0020	ns	0.0390
Wealth (log)	-0.0634	ns	0.0514
Intercept	-1.1594	*	0.6949

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.20-Estimated coefficients for logit regression for working involving chronic diseases

(a) Male

Disease	Odds ratio	Coefficient	Significance	Standard error	Marginal effect
Skin cancer	1.1807	0.1661	ns	0.2826	0.01
Other cancer	0.4182	-0.8717	***	0.3104	-0.10
Diabetes	1.0055	0.0054	ns	0.3865	0.00
Epilepsy	0.2198	-1.5150	**	0.6776	-0.23
Blood pressure	0.7204	-0.3279	ns	0.2084	-0.03
Heart	0.6816	-0.3823	*	0.2284	-0.04
Asthma	1.6842	0.5213	*	0.3067	0.04
Respiratory	0.7268	-0.3191	ns	0.3143	-0.03
Ulcer	0.4465	-0.8063	*	0.4375	-0.09
Liver	0.2426	-1.4162	*	0.8635	-0.20
Bowel	0.9326	-0.0698	ns	0.3373	-0.01
Hernia	0.9030	-0.1021	ns	0.2737	-0.01
Kidney	1.3099	0.2699	ns	0.4375	0.02
Skin conditions	0.7370	-0.3052	ns	0.3027	-0.03
Arthritis	1.1470	0.1371	ns	0.2208	0.01
Hepatitis	2.1395	0.7606	ns	1.0055	0.05
Sight	0.9795	-0.0207	ns	0.2837	-0.02
Hearing	1.0547	0.0532	ns	0.2181	0.04
Stroke	0.6974	-0.3604	ns	0.4499	-0.04

Note: This is the same model as used for Appendix Table C.14, with these variables added.

(b) Female

Disease	Odds ratio	Coefficient	Significance	Standard error	Marginal effect
Skin cancer	0.8378	-0.1770	ns	0.2901	-0.03
Other cancer	1.0200	0.0198	ns	0.3211	0.00
Diabetes	0.5898	-0.5279	*	0.2883	-0.09
Epilepsy	1.4704	0.5541	ns	0.7425	0.07
Blood pressure	0.7023	-0.3533	*	0.1933	-0.05
Heart	0.8536	-0.1583	ns	0.2739	-0.02
Asthma	0.8001	-0.2230	ns	0.2645	-0.04
Respiratory	0.8320	-0.1840	ns	0.2547	-0.03
Ulcer	0.8694	-0.1399	ns	0.3767	-0.02
Liver	0.0433	-3.1392	***	0.9367	-0.66
Bowel	1.0049	0.0049	ns	0.2819	0.00
Hernia	1.3197	0.2774	ns	0.3134	0.04
Kidney	1.2730	0.2414	ns	0.4265	0.03
Skin conditions	1.9009	06423	**	0.2863	0.08
Arthritis	0.9459	-0.0556	ns	0.2011	-0.01
Hepatitis	2.6595	0.9781	ns	0.9931	0.10
Sight	0.8704	-0.1388	ns	0.2915	-0.02
Hearing	0.8608	-0.1499	ns	0.2115	-0.02
Stroke	0.5736	-0.5558	ns	0.6824	-0.10

Note: This is the same model as used for Appendix Table C.14, with these variables added.

Appendix Table C.21-SoFIE comparison: HWR results of logit regression of working

(a) Male

Dependent variable: Working	No. of observations = 2,565	R^2 = 0.32	
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0532	***	0.0094
Mental health	0.0191	**	0.0096
Age			
Age normalised (= age minus 65)	-0.0613	ns	0.0375
Age 65 or over (base = less than 65)	-0.5912	ns	0.3666
Ethnicity (base = New Zealand European)			
Māori	0.0390	ns	0.1310
Other	0.0402	ns	0.2802
Migrant status (born in New Zealand)	-0.5829	***	0.2211
Education (base = no qualifications)			
Edusecond	0.1237	ns	0.2116
Edutertiary	0.2185	ns	0.1953
Marital status (base = married with non-working spouse)			
Not married	0.4419	*	0.2393
Married with working spouse	1.5711	***	0.2037
Onbenefit	-1.1632	***	0.2267
Smoking	0.2058	ns	0.2403
Has a chronic disease	-0.1415	ns	0.1984
Income of other household members (log)	-0.0531	ns	0.0484
Intercept	-2.3267	***	0.7645

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

(b) Female

Dependent variable: Working	No. of observations = 2,872	R^2 = 0.29	
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0240	***	0.0076
Mental health	0.0085	ns	0.0075
Age			
Age normalised (= age minus 65)	-0.1130	***	0.0263
Age 65 or over (base = less than 65)	-0.2112	ns	0.2567
Ethnicity (base = New Zealand European)			
Māori	0.1283	ns	0.1073
Other	0.3942	ns	0.2992
Migrant status (born in New Zealand)	-0.1067	ns	0.2106
Education (base = no qualifications)			
Edusecond	0.2398	ns	0.1747
Edutertiary	0.4734	***	0.1549
Marital status (base = married with non-working spouse)			
Not married	1.4721	***	0.2116
Married with working spouse	1.4287	***	0.1795
Onbenefit	-1.1313	***	0.1928
Smoking	-0.2947	ns	0.2130
Has a chronic disease	-0.2278	ns	0.1511
Income of other household members (log)	-0.0516	ns	0.0442
Intercept	-1.9148	***	0.6672

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.22-SoFIE comparison: SOFIE results of logit regression of working

(a) Male

Dependent variable: Working	No. of observations = 1,790		R^2 = 0.41
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0426	***	0.0079
Mental health	0.0309	***	0.0098
Age			
Age normalised (= age minus 65)	-0.2027	***	0.0341
Age 65 or over (base = less than 65)	0.5806	*	0.3205
Ethnicity (base = New Zealand European)			
Māori	-0.5572	**	0.2356
Other	-0.7533	**	0.3347
Migrant status (born in New Zealand)	-0.4022	*	0.2078
Education (base = no qualifications)			
Edusecond	0.1182	ns	0.2429
Edutertiary	0.0926	ns	0.1815
Marital status (base = married with non-working spouse)			
Not married	1.4258	***	0.1943
Married with working spouse	0.4738	**	0.2377
Onbenefit	-1.8221	***	0.2059
Smoking	-0.4477	***	0.1600
Has a chronic disease	-0.0367	ns	0.1772
Income of other household members (log)	0.0035	ns	0.0253
Intercept	-2.8110	***	0.7358

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

(b) Female

Dependent variable: Working	No. of observations = 1,960		R^2 = 0.28
Explanatory variable	Coefficient	Significance	Standard error
Health			
Physical health	0.0440	***	0.0064
Mental health	0.0123	*	0.0074
Age			
Age normalised (= age minus 65)	-0.1228	***	0.0247
Age 65 or over (base = less than 65)	-0.1030	ns	0.2563
Ethnicity (base = New Zealand European)			
Māori	-0.1464	ns	0.2283
Other	-0.7383	**	0.3022
Migrant status (born in New Zealand)	0.0624	ns	0.1745
Education (base = no qualifications)			
Edusecond	0.3130	**	0.1833
Edutertiary	0.5506	***	0.1358
Marital status (base = married with non-working spouse)			
Not married	1.5210	***	0.1753
Married with working spouse	0.8678	***	0.2066
Onbenefit	-0.8804	***	0.1597
Smoking	-0.0292	ns	0.1300
Has a chronic disease	-0.1691	ns	0.1405
Income of other household members (log)	-0.0400	**	0.0201
Intercept	-.3.3531	***	0.5856

Note: *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level; ns= not significant.

Appendix Table C.23-Correlation matrix of chronic diseases

Disease	Skin cancer	Other cancer	Diabetes	Epilepsy	Blood pressure	Heart	Asthma
Skin cancer	1.0000						
Other cancer	0.0555	1.0000					
Diabetes	-0.0336	-0.0240	1.0000				
Epilepsy	-0.0008	0.0121	0.0340	1.0000			
Blood	0.0210	0.0203	0.1804	-0.0012	1.0000		
Heart	0.0040	0.0665	0.0747	0.0259	0.2089	1.0000	
Asthma	0.0099	0.0174	0.0469	0.0477	0.0547	0.0928	1.0000
Respiratory	0.0345	0.0557	0.0601	0.0712	0.0930	0.1261	0.2958
Ulcer	0.0143	0.0711	0.0438	0.0549	0.0510	0.0707	0.0603
Liver	-0.0054	0.0694	0.0328	0.1335	0.0549	0.0609	0.0436
Bowel	0.0418	0.1211	0.0338	0.0070	0.0781	0.0533	0.0286
Hernia	0.0029	0.0709	0.0960	0.0397	0.0739	0.0726	0.0420
Kidney	-0.0147	0.0597	0.1620	0.0439	0.0800	0.0839	0.0501
Skin	0.0109	-0.0112	0.0334	0.0363	0.0558	0.0416	0.0569
Arthritis	0.0293	0.0208	0.0795	-0.0114	0.1519	0.1135	0.1178
Hepatitis	0.0339	0.0264	0.0281	0.1067	0.0343	-0.0130	-0.0021
Sight	0.0142	0.0590	0.0526	-0.0152	0.0413	0.0678	0.0139
Hearing	0.0317	0.0199	0.0236	0.0213	0.0547	0.0868	0.0291
Stroke	-0.0201	0.0445	0.0524	0.0223	0.0812	0.1235	0.0314

Disease	Respiratory	Ulcer	Liver	Bowel	Hernia	Kidney	Skin
Respiratory	1.0000						
Ulcer	0.1227	1.0000					
Liver	0.0731	0.0987	1.0000				
Bowel	0.0803	0.1058	0.0364	1.0000			
Hernia	0.1073	0.0784	0.0501	0.1166	1.0000		
Kidney	0.0957	0.0514	0.1396	0.0894	0.1231	1.0000	
Skin	0.0837	0.0247	0.0310	0.0470	0.0391	0.0653	1.0000
Arthritis	0.1545	0.1238	0.0395	0.1277	0.0669	0.0261	0.0973
Hepatitis	0.0450	-0.0044	0.1428	0.0013	0.0529	0.0759	0.0388
Sight	0.0663	0.0378	0.0339	0.0691	0.0533	0.0745	0.1104
Hearing	0.0759	0.0212	0.0667	0.0635	0.0919	0.0147	0.0348
Stroke	0.0114	0.0124	0.0101	0.0186	0.0417	0.0683	0.0388

Disease	Arthritis	Hepatitis	Sight	Hearing	Stroke
Arthritis	1.0000				
Hepatitis	0.0195	1.0000			
Sight	0.0702	0.0182	1.0000		
Hearing	0.0811	0.0304	0.1406	1.0000	
Stroke	0.0350	0.0373	0.0707	0.0408	1.0000