THE UNIVERSITY OF MELBOURNE

FACULTY OF BUSINESS & ECONOMICS

Melbourne Institute Working Paper Series

Working Paper No. 28/14

The Importance of Economic Expectations for Retirement Entry

Barbara Broadway and John P. Haisken-DeNew

MELBOURNE INSTITUTE®
of Applied Economic and Social Research

The Importance of Economic Expectations for Retirement Entry*

Barbara Broadway and John P. Haisken-DeNew
Melbourne Institute of Applied Economic and Social Research
The University of Melbourne

Melbourne Institute Working Paper No. 28/14

ISSN 1328-4991 (Print)

ISSN 1447-5863 (Online)

ISBN 978-0-7340-4368-9

December 2014

* The research reported on in this paper is part of the ARC-funded Discovery Project 'Subjective Expectations and Economic Behaviour' (Grant DP130103755). Access to the Consumer Attitudes, Sentiments & Expectations (CASiE) Survey was graciously provided by Guay Lim at the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The paper uses the general release file of the Household, Income and Labour Dynamics in Australia (HILDA) survey. HILDA is funded by the Australian Government Department of Social Services (DSS) and managed by the Melbourne Institute. The findings and views reported in this paper are those of the authors alone and should not be attributed to either DSS or the Melbourne Institute. The authors wish to thank Deborah Cobb-Clark and Nicolas Salamanca for helpful comments. Contact: <johnhd@unimelb.edu.au>.

Melbourne Institute of Applied Economic and Social Research
The University of Melbourne
Victoria 3010 Australia
***Telephone* (03) 8344 2100**
***Fax* (03) 8344 2111**
***Email* melb-inst@unimelb.edu.au**
***WWW Address* http://www.melbourneinstitute.com**

Abstract

We estimate hazard rates of retirement entry as a function of the option value of work. The individuals' expectations about the future economy are incorporated in the option value of work, through which they can impact on the timing of retirement entry. In a scenario where individuals expect a strong upturn, the annual hazard rate of retirement entry (average 8.4%) is reduced by 6.0% or half a percentage point compared to a scenario where they expect a downturn. Had individuals been able to anticipate the Global Financial Crisis, the mere expectation of this downturn would have increased retirement entries by 8.7%.

JEL classification: J26, D84, J32
Keywords: Retirement, expectations, pensions

1 Introduction

In 2006, Australia experienced the height of an extraordinary boom in the mining sector that resulted in excellent conditions at the labour market as well as the capital markets. The average rate of return on private pension funds in Australia was near 14% and would stay there the following year (APRA (2013)). An employed person near retirement age who had to decide whether to leave the workforce immediately or stay in employment, for example, for another two years, could increase his total retirement savings by more than a third when opting for the latter. Two years later in 2008, the Global Financial Crisis (GFC) began to unfold, and although its impact in Australia was less severe than in many other parts of the world, the situation in the capital markets changed fundamentally. The average rate of return on private pension funds was -8.1% in 2008 and further shrank to -11.5% in 2009. An average worker near retirement age facing the same decision as his colleague did two years earlier, would have lost about a quarter of his retirement savings by delaying retirement entry by two years. Such a difference in economic circumstances, if anticipated, should matter to both workers' decisions. This paper analyses how strongly such anticipated economic circumstances might impact on individuals retirement decisions.

The GFC hit the world unexpectedly, and thus neither worker could have incorprorated its impact into his decision making process. Previous analyses of *unexpected* changes in retirement wealth due to the development in the capital markets find them to have small effects on retirement behviour. Coile and Levine (2011) find that the GFC's impact on retirement wealth caused only a small delay in retirement entries, and this effect was more than outweighed by the impact of rising unemployment rates which pushed workers out of the labour market and into retirement. Their result is supported by Goda et al. (2012), Hurd et al. (2009) and Coile and Levine (2006). The first paper analyses stock market data from 2000 to 2008 and does not find a strong relationship between realised stock market returns and retirement *intentions*. The latter two papers analyse the stock market crash of the early 2000s and similarly find no evidence of a substantial impact on the timing of retirement. However, unexpected shocks on the stock market represent a sudden change in retirement wealth without any effects on expected *pension accruals*.

However, what about conditions in the capital markets that *are* expected? Distinguishing between expected and unexpected capital gains is theoretically important: if leisure is a normal good, an unexpected increase in retirement savings due to large capital gains should increase the probability of retirement entry *ex post*; at the same time, expected capital gains should make a worker more likely to delay their retirement entry *ex ante*, in order to receive the capital gain in the first place. That is, expected changes in retirement savings affect not only a worker's wealth level, but also his expected pension accruals when delaying retirement entry. Since Stock and Wise (1990) developed their option value model, numerous empirical studies from many different countries have confirmed their basic finding: when one decides about his retirement entry age, the expected change in retirement income, if retirement entry were to be delayed, is more important than the current wealth level (See Samwick (1998), Coile and Gruber (2001), and Gruber and Wise (2004) for a collection of studies from 12 different countries).

The forward-looking nature of the retirement entry decision implies that everyone forms an expectation about his future income. How strongly do expectations of our personal future income streams vary - over time and across individuals - with our expectations about the state of the economy? When calculating option values of work, it is usually assumed that individuals expect to be able to earn the same income from the labour market and the capital market in the future, as they do currently. In reality, the foregone expected income when one decides to retire and start dissaving, instead of accruing and collecting returns on one's retirement savings, can vary quite substantially at different points in time. The risk of job loss varies considerably across the business cycle, and it has been shown that job displacement has a long-lasting, strong impact on an individual's probability of being employed particularly near retirement age (Chan and Stevens (2001), Davis and von Wachter (2011)). At the same time, rates of return in the capital markets vary considerably, and are crucial for savings accruals. However, not only do the economic conditions change over time but also different individuals at the same point in time will also form different expectations about the state of the economy for the medium-term future, as some are more optimistic than others and act on these expectations. Puri and Robinson (2007) show how an individuals' level of optimism is indeed related to savings behaviour, investment choices, and expected retirement entry.

The simplifying assumption of fixed future income in standard option value models ignores optimism and pessimism just as it ignores the business cycle. However, how important are those differences in expectations? Does it really matter much whether a recession or a boom period is coming up, or whether an individual is optimistic or pessimistic? This paper explores the importance of accounting for expectations about the future state of the economy when modelling the timing of retirement. We study the case of Australia, where a mandatory savings scheme, which is dominated by defined contributions plans, implies that the vast majority of workers have retirement savings subject to changes in the capital markets. Australia is ideally suited to study the impact of those changes, because its public pension scheme has very small distortionary effects compared to most other industrialised countries.[1] It is thus possible to study the effects of capital markets on privately funded pension schemes in near isolation from the publicly funded pension scheme, which ensures that the results can be transferred to other countries' institutional framework to the extent that those countries rely on private savings for retirement.

We build on existing studies that apply a reduced-form version of the option value model as it is applied in Gruber and Wise (2004), in order to model the responsiveness of older Australian workers to changes in their option value of work. We then assume that any worker can be either optimistic, neutral or pessimistic in his expectations about the state of the economy in the next few years. Those expectations about the medium-term economic future translate into expectations about future rates of return on private pension funds, and thereby impact on the workers option value of remaining at work. By simulating retirement entry rates given an individual's option value based on their positive or negative expectations about the future, we can map out the possible impact of economic expectations on the retirement decision.

Had people been able to forecast the impending growth slowdown of the GFC, it would have led to a 9% increase in exit rates from employment to retirement. This is the first paper of its kind, identifying the statistically and economically significant effect of economic expectations on the retirement entry decision using nationally representative household

[1] This is mostly due to the fact that the public pension is low and its receipt not subject to a work test.

panel data. Given that the 20 years of unprecedented continual growth have now come to an end in the aftermath of the GFC, the importance of changing expectations on the margin is likely to increase for retirement decisions.

2 Institutional background

Australia's retirement system is two-tiered. The tax-funded, means-tested Age Pension is designed to ensure a basic living standard and prevent poverty in old-age and is available for all Australian residents at age 65.[2] The age of eligibility was previously 60 years for women, but has been increased in half-year intervals since 1995, first affecting the birth cohort of 1935. For the cohorts born on or after 01 January 1949, the age of eligibility is the same for men and women. Beginning in 2017, the age of eligibility will be increased further in half-yearly steps until it reaches age 67 for pensioners born on or after 1 January 1957. The maximum payment rate per fortnight is A$842.80 for singles and A$1270.60[3] for couples, and is increased in line with average wage growth over time.[4] The payment does not depend on past labour market history or current labour market activity, but is determined by an individual's or couple's income. The full pension is paid to singles (couples) with earnings of up to $156 ($276) per fortnight; if the income exceeds that threshold, the pension is reduced by $0.50 ($0.25) per dollar of earnings.[5]

The second pillar of the Australian retirement system is its mandatory savings scheme 'Superannuation Guarantee' (SG); all employees aged 18 or older who earn at least $450 per month are covered by the SG. Employers pay at least 9% of employees' wages in an approved superannuation fund chosen by the employee[6]. Employers as well as employees

[2]To qualify for an Age Pension, some other criteria must be met, such as residence in Australia for a total of ten years.

[3]All monetary amounts are henceforth expressed in Australian dollars.

[4]For comparison, the national minimum wage for fulltime employees (38 hours per week) is $1281.80 per fortnight.

[5]Additional asset tests apply. The maximum allowable amount of assets for receiving a full pension is $196,750 for singles and $279,000 for couples, excluding the principal home. For couples or singles who do not own a home, the allowable maximum assets are increased by $142,500. Once those thresholds are exceeded, the fortnightly pension is reduced by $1.50 per $1,000 of excess assets. The assets test and income test are applied separately; the smaller of both resulting pension amounts is paid.

[6]Generally, employees have the right to choose the fund that the employer's contributions are paid into, as well as the investment strategy applied by the fund. However, the majority of workers opts for the fund's default investment strategy (Gerrans et al. (2010))

can make additional voluntary contributions. Superannuation contributions are taxed at a flat-rate of 15%, and thus implicitly tax-subsidised for middle and high-income earners. For low-income earners, government co-payments for voluntary contributions are available. In 2012, total assets held in superannuation funds were about $1,400 billion or 92% of Australia's GDP; Australia ranks fifth in the OECD in terms of its 'pension asset-to-GDP' ratio and thus well above the OECD average (OECD (2013)). The majority of assets is held in defined contribution plans ($906 billion) or hybrids of defined contribution plans and defined benefit plans ($597 billion); pure defined benefit plans are rare and make up less than 5% of total assets held. Benefit payments during the financial year 2013 totalled $50 billion (APRA (2013)). The high prevalence of defined contribution plans in combination with the size of the superannuation scheme, in terms of the near universal coverage as well as the total amount of assets held and benefits paid out, implies that the performance of superannuation funds has a potentially large impact on older Australians' retirement entry decisions.

3 Estimation Strategy

We estimate hazard rates of retirement entry for discrete data. A dummy variable denotes the event in question, i.e. the retirement entry. The dummy variable is set to one at time t if the person i is not yet observed to be retired in t, but is observed to be retired in $t+1$. The decision to retire is assumed to be irreversible, and indviduals are censored after a retirement entry was observed. The model is estimated as a simple logit model with retirement entry as the dependent variable, and a financial incentive measure OV_{it} as the main explanatory variable. We control for 'retirement wealth' V_{it}, a quadratic in age, as well as a vector of sociodemographic control variables $\mathbf{X_{it}}$. Control variables include the individual's health, education, home-ownership status, state dummies and a linear time trend as in (1):

$$Prob(Y_{it} = 1) = \Lambda(\beta_0 + \beta_1 OV_{it} + \beta_2 V_{it}(t) + \beta_3 Age_{it} + \beta_4 Age_{it}^2 + \beta_5 \mathbf{X_{it}}.) \qquad (1)$$

3.1 Constructing the financial incentive measure

The financial incentive measure, the option value of work OV_t, is derived from the net present value of the future utility stream from income and leisure (discounted to the current period t) which results from retirement at date r: the 'retirement wealth' $V_t(r)$.[7]

$$V_t(r) = \sum_{s=t}^{r-1}[\beta^{s-t}E_t[Y_s^{\gamma}]\pi_{ts}] + \sum_{s=r}^{S}[\beta^{s-t}E_t[kB_s(r)^{\gamma}]\pi_{ts}] \tag{2}$$

The term Y_s denotes labour market income in period s in the periods when the individual is still participating in the labour market, i.e. from the current period t until the period immediately before retirement entry, $r-1$. The term $B_s(r)$ represents benefits in period s for those periods when the individual has already retired, i.e. from the period r until the period of death S. The stream of future retirement income depends on the time of retirement r. How expectations about the future economic development impact on the expected future income during retirement, is described in in detail in the following section.

Following Blundell et al. (2004), as would be standard in the literature, the parameter β is a discount factor set to 0.03; γ is set at 0.75 to account for risk aversion, while k represents the preference for leisure and is set to 1.5 to reflect that income gained while not working is more valuable than income gained while working. π_{ts} is the probability of survival until period s in period t. The option value of work OV_t is the difference between the discounted present value of the expected utility stream when entering retirement at time r^* (the retirement entry date which maximizes the utility stream) and when entering retirement immediately at time t, as in:

$$OV_t = V_t(r^*) - V_t(t) \quad \text{with} \quad r^* = argmax(V_t(r)). \tag{3}$$

3.2 Medium-term expectations and future income streams

We assume that individuals who are still participating in the labour market receive earnings if they are employed, and draw unemployment benefits if they are not employed. Expected income before retirement entry, Y_s, is the weighted average of the earnings in period s and the legal unemployment benefits in period s, weighted with the probability of being employed or unemployed in that same period. We assume that an individual's

[7] In what follows, we drop the index i for simplicity.

unemployment probability $u(s)$ in period s equals the average age-specific unemployment rate in the years 2001-2011 at the individual's age in s.

The income after retirement is determined by the retirement savings the individual has accumulated by the time of retirement. Individuals do not dissave and keep making contributions to their superannuation accounts while they are still in the labour force. The superannuation account thus continues to grow by the amount of additional contributions that are made, and by the returns that are earned on investing that money. The day the individual retires, superannuation accounts are converted into savings accounts that earn a secure interest payment i_{ret}, which is set to 5.1%.[8] The retiree now begins to withdraw money from this savings account to provide income during retirement. We assume that withdrawals are designed to smooth consumption: at the day of retirement entry, the individual expects to live for a certain number of additional years, and withdraws an amount equal to an annuity that they could withdraw for the remainder of their expected life span, when fully dissaving their superannuation account. The following year, they will update their expected life span, and adjust their withdrawal accordingly.[9] Once the individual's superannuation wealth falls below a certain level, he will become eligible for a government age pension to supplement their income.

$$E_t[B_s(r)] = E_t[\frac{i_{ret}}{1-(1+(i_{ret})^{E_t[LS_s]})}E_t[S_s(r)]] + A_s(E_t[S_s(r)]) \tag{4}$$

LS_s is the further expected life span in period s given the individual has survived until period s; this expectation is formed in t.[10] $S_s(r)$ denotes the individual's superannuation wealth in period s, given he retired in period r. A_s denotes the age pension one is eligible for in s. The age pension is means tested and thus depends on the superannuation wealth in the same period.

Superannuation contributions are made and thereby superannuation wealth is accrued as long as the individual is still working. Before the superannuation is claimed upon retirement entry, he earns returns from the capital markets $i_{lfp}(t)$ (rather than a fixed interest

[8] 5.1% is the average target cash rate set by the Reserve Bank of Australia between 2001 and 2011.

[9] Alternatively, the superannuation account could be converted into a life-long pension with its in-built insurance against longevity.

[10] In the empirical analysis, LS_s will be derived from official life-table data by age, year and gender.

rate i_{ret}, as they do during retirement). The returns earned in the last years before retirement entry thus alter the disposable income during retirement. Consequently, expected rates of return in the future change the option value of work today, and thus potentially alter the timing of retirement entry.

This is where medium-term expectations about the overall state of the economy enter the retirement decision, as $i_{lfp}(t)$ varies over time. Individuals who decide in t whether to retire or not, need to form expectations about a sequence of i_{lfp}(s), s=t,...T. In the absence of directly *observed* expectations of such future rates of return we need to make assumptions what such sequences might look like, for different individuals and at different points in time. This is not straightforward - there is no immediate reason for individuals' expectations to be a precise or unbiased forecast of the true future rates of return, and in fact their expectations might be not even sensible. Any assumption about those beliefs is thus necessarily somewhat arbitrary. However, in order to arrive at a *plausible* assumption about the expected sequence of future rates of return, we derive different scenarios from i) financial information on superannuation funds provided by the Australian Prudential Regulation Authority (APRA) and ii) the Consumer Attitudes, Sentiments & Expectations in Australia survey (CASiE). The next section describes the procedure we use to derive such scenarios of expected rates of return for pessimists and optimists, and at different points in time.

4 Expectation Scenarios

The model assumes that individuals observe the current rates of return on superannuation in period t, and based on their observation, they form an expectation of the rate of return during the following twelve months: i_{lfp}(s=t). We assume that in subsequent periods individuals expect the rate of return on superannuation to converge to its long-term equilibrium. i_{lfp}(s=t) is high for optimistic individuals and low for pessimistic individuals.

In order to find a plausible 'starting value' i_{lfp}(s=t) for the sequence of expected future rates of return, we divide the entire distribution of *observed* rates of return on superan-

nuation funds (RRS), in three classes: (1) the lowest observed rates of return are what the pessimists assume to determine the medium-term state of the economy, and what they base their behaviour on; (2) optimists behave as if the highest observed rates of return determined the economic reality in the upcoming years; (3) a person with neutral expectations will base his or her behaviour on the middle range of observed rates of return.

The exact size of these classes corresponds to the population shares with optimistic, pessimistic or neutral expectations. If $x\%$ of the population have a pessimistic view on the economy, the $x\%$ lowest rates of return in that year form the class of rates of return that we assume pessimists expect for the future. Further $y\%$ of the population have neutral expectation; thus the next-highest $y\%$ of observed rates of return form the middle class, which we assume a person with neutral expectations will base the calculation of his or her option value on. Finally, $100 - x - y\%$ of the population have optimistic views, and the highest $100 - x - y\%$ of realised rates of returns are the class of rates of returns that are relevant for optimistic individuals. The median rate of return within each of those three classes is the value for $i_{lfp}(s)$ for that expectation type, which is assigned to all individuals i in the corresponding expectation type in year s:

$$i_{lfp}(s=1) = \begin{cases} p_{x/2}(RRS) & \text{if } i \text{ is pessimistic} \\ p_{x\,+\,y/2}(RRS) & \text{if } i \text{ is neutral} \\ p_{x\,+\,y\,+\,(100\,-\,x\,-\,y)/2}(RRS) & \text{if } i \text{ is optimistic} \end{cases} \tag{5}$$

The information on rates of returns on superannuation is taken form APRA data, and the population shares with different expectations stem from CASiE data. APRA is a statutory authority that oversees the financial services industry, including most superannuation funds. They publish financial performance indicators including rates of return at the fund-level on an annual basis. This fund-level data allows us to see the entire distribution of rates of return on superannuation RRS, rather than just an average rate. CASiE is a cross-sectional telephone-survey conducted on a monthly basis. Among questions on the individual's own financial situation and intentions to make major purchases, CASiE also asks respondents about their expectations about the economy as a whole. Interviewees are asked to make a forecast for the state of the economy on a 5-point scale, with lower values representing more optimistic views. We define an individual to be op-

timistic if they answer '2' or '1', to have neutral expectations if they answer '3', and to be pessimistic if they answer '4' or '5'. Table 1 shows the distribution of individuals with optimistic, pessimistic and medium expectations, which amounts to about one third each for each year.

The reported population shares are then combined with APRA data that informs us on the distribution RRS. This is illustrated in Figure 1 for the year 2004. In 2004, 33.14 % of the population held a pessimistic view on the future state of the economy, and 35.09% held an optimistic view. We assume that both groups base their expectations about the future on past experience, but that the pessimists' perception of what to expect for the future is dominated by the worst results achieved in the given year. That means, each pessimist will base his behaviour on one of the lowest 33.14% of rates of return on superannuation funds, i.e. the area left from the first vertical line. The optimists' perception is dominated by the best results achieved in the given year, and they will base their behaviour on one of the highest 35.09% of rates of return, i.e. the area right of the second vertical line. The middle section is the range of rates of return which individuals with neutral expectations deem representative of the future. We use the median rate of return within each class to represent the whole class. In 2004, pessimists are assumed to have expected the rate of return on superannuation to be 8.7% in the following year, individuals with neutral expectations are assumed to have expected it would be 12.0%, and optimists are assumed to have expected a rate of return of 14.2%. The same procedure is applied in the following years, leading to the values for $i_{lfp}(s = t)$ by expectation type and time as they are shown in Table 2.

From this starting point, individuals assume convergence of $i_{lfp}(s)$ towards its long-term equilibrium:

$$i_{lfp}(s) = c_1 \cdot i_{lfpbase} + c_2 \cdot i_{lfp}(s-1). \tag{6}$$

We estimate the rate of convergence by regressing the rate of return in a given year on the rate return in the previous year, using information on average rates of return from 1996 to 2012. This yields $i_{lfp}(s) = 0.044 \cdot i_{lfpbase} + 0.232 \cdot i_{lfp(s-1)}$, implying a long-term equilibrium of 0.058. The optimist in year 2004 in the above example thus assumes $i_{lfp}(s)$,

s=t,...,T will be 14.2%, 7.7%, 6.2% and 5.9% before it converges to its equilibrium of 5.8%.

Those rates affect the expected retirement savings in an individual's superannuation account, which will affect the expected retirement income once the individual retires; the expected rates of return thus are a factor that determines each individual's option value of further work. In order to map out how strongly their retirement entry behaviour might be impacted by their optimism or pessimism, we will first estimate the model in equation (1) to get an estimate of workers' resposniveness to changes in their option value of work. We then simulate different option values for each worker, assuming the worker had optimistic or pessimistic expectations. Based on the behavioural model and the different option values for different economic expectations, we can then predict hazard rates of retirement entry for each individual, assuming the individuals had been optimistic or pessimistic.

5 Data and Descriptives

We estimate equation (1) using data from the Household, Income and Labour Dynamics in Australia study HILDA, an annual household survey conducted since 2001. HILDA contains all necessary information on individuals' labour force status, earnings and current superannuation wealth that are necessary for the analysis of their retirement entry behaviour. We restrict the analysis to men aged 55 to 75 between 2004 and 2010,[11] who have been employed at some point in their life, for whom all neccessary information on income and superannuation savings is available,[12] and discard observations after retirement entry has occured. A person is assumed to be retired if he is not working and not looking for work, and reports the main reason for this to be retirement. This leaves us with 4,258 observations from 1,123 individuals to estimate men's responsiveness to their option value of work in a standard framework; that is, assuming expectations about the future state of the economy are constant over time and across individuals.

[11] While average rates of return are available from APRA beginning in 1996, fund-level data is available only for year 2004 and later. Earlier waves of HILDA thus could not be used for this analysis.

[12] Information on superannuation is collected in 2002, 2006 and 2010. For the waves in between those years, we extrapolate the superannuation wealth from reported contribution and the average rate of return of all superannuation funds in the given year. If we extrapolate the superannuation wealth to a year when it is included in HILDA again, the extrapolated and reported values correspond reasonably closely. More detail is given in Appendix A.

Table 3 shows hazard rates into retirement together with the option value of work and the retirement wealth by age, each for constant expectations across indivdiuals and over time at the long-term equilibrium rate of return of 5.8%. An average option value of 31,109 means that the average individual in our sample expects that, by staying in the labour force until he reaches his maximum utility stream, he will be able to gain an additional 31,109 'utility units' compared to his utility from retiring immediately. A 'utility unit' is closely related to the discounted present value of $1 additional income at some point in the future, adjusted for utility from leisure and risk aversion. The average option value declines sharply with age, and at the same time, the population share with an option value of zero increases: the older an individual is, the less utility they can gain from an additional year of work, and the more likely they are to not gain anything at all.[13] Parallel to a decrease in the option value by age, we observe an increase in the probability of retirement entry.

However, these option values are calculated under the assumptions that everyone at every point in time assumes to receive 5.8% returns on his superannuation savings until his death. How does this change when we incorporate the expected sequences of rates of return as described in Section 4? In order to identify whether the financial incentives and the corresponding probability of retirement entry vary across individuals with different expectations on the economy, we need to identify 'optimists' and 'pessimists' in our sample. HILDA does not contain direct information on one's pessimism or optimism, but contains socio-demographic information that can be used to predict their level of optimism. This is described in Appendix B. It is important to note that there is no problem arising from endogneity of one's expectations, as we do not base our analysis on the individual's observed *personal* expectation, but on expectations of people who are *similar* to him, based on observed characteristics. Table 4 shows socio-demographic characteristics as well as the average probability of retirement entry, the option value of work OV_t and the retirement wealth V_t for individuals with optimistic, medium or pessimistic views. Financial incentives are now calculated under the assumptions described in Table 2 and the path of convergence as described in Section 4.

[13] At age 74, the option value reaches zero by construction, since we consider 75 to be the last possible age of retirement entry.

The descriptive statistics for the three groups of individuals paint a mixed picture. As expected, the hazard rate of retirement entry for pessimists is, on average, higher than the hazard rate for those with medium expectations, while their option value of work is lower. However, optimists have again a higher option value of work, but this is not accompanied by a further decrease in the hazard rate. While, as expected, the option value of work appears to monotonically increase with one's optimism, that does not appear to directly translate into a decrease in retirement entry rates. However, differences in the distribution of other characteristics shed some light on this.

First, the option value of work varies across groups not only because of their expectations. When we look at the option values of work that members of an expectation group would have had, had they formed different expectations (their 'counterfactual' option values), we see a monotonically increasing relationship between the option value of work and one's optimisim, but this hypothetical increase within each group is much smaller than the actual observed differences across groups. Optimists differ from pessimists not only in their option value of work - they are also older and enjoy a higher retirement wealth. If leisure is a normal good and disutility of labour increases with age, hazard rates of retirement entry would be higher for pessimists than they are, were they of the same age and wealth as the optimists.

On the other hand, pessimists are almost twice as likely to be in poor health as the optimists; twice as likely to not have finished high school, and twice as likely to be renting a domicile rather than owning their home. All these factors might also contribute to differences in pessimists' and optimists' hazard rates of retirement entry, regardless of any possible effects of pessimism and optimism on option values of work, and subsequently on retirement entry decisions. In the next section, we present how retirement entry rates differ with the option value if those differences in other observable characteristics are explicitly controlled for.

6 Estimation Results

Estimating equation (1) yields the effect of the option value of work on the hazard rate of retirement entry. Table 5 shows the coefficients and marginal effects of the option value for different model specifications. In the column 1, $\mathbf{X_{it}}$ is restricted to three dummy variables representing the individuals self-reported health; in column 3 the full set of covariates is included. The coefficient on OV_t is negative and highly significant; the higher the option value of work, the lower the probability that an individual retires within the next year. This result is in line with the international evidence from numerous different countries (Samwick (1998), Gruber and Wise (2004)), as well as a recent study by Warren and Oguzoglu (2010) for Australia.

The average marginal effect across all individuals is -0.012, which means that the hazard rate of retirement entry will drop on average by 1.2 percentage points, if the option value of work is increased by 10,000 utility units (=about half a standard deviation, see Table 3). The marginal effect is thus not only highly significant, but also economically substantial. Columns 2 and 3 present the coefficients and average marginal effects for two extended versions of the model that also control for education and home ownership, and for state dummies and a linear time trend. The additional controls have virtually no effect on neither the coefficient of the option value, nor its marginal effect.

6.1 The impact of expectations

The estimate of the parameters of equation (1) show clearly that greater expected financial gains from further work impact on the timing of retirement entry. But by how much will the option value, and in turn, the probability of retirement entry change, if an individual adopts a more pessimistic or more optimistic viewpoint on the medium-term future? For the simulation of the impact of pessimistic or optimistic interpretations of the current state of the economy, we calculate a 'pessimistic' and an 'optimistic' option value for each indivdiual in the sample, based on the rates of return on the retirement fund market as defined in Section 4. Those counterfactual option values were reported in Table 4. We then predict hazard rates of retirement entry for both option values of work,

using the coefficients from the model presented in the last column of Table 5. The first panel of Table 6 shows the results.

The predicted retirement entry rate if everyone were to adopt an optimistic view on the medium-term economic future decreases to 8.4%, compared to 8.5% if everyone were to adopt a pessimistic view. The difference in the hazard rates of entering retirement of 0.1 percentage points is statistically significant at the 1%-level. The behavioural impact is thus very small. However, it is important to keep in mind that this is a behavioural response based on nothing but the individual's *view* of the world. The past and current economic environment, as far as they affect current and past income and savings streams, are controlled in the model through the individual's wealth level. The effect of optimism and pessimism stems purely from the fact that optimists and pessimists deem different parts of the actually observed reality to be representative of the future. The behavioural response is not a response to *experienced* changes in the economic environment, but purely an effect of the *expectations* about changes in the economic environment, regardles of whether those expected changes turn out to be realised later on.

Moreover, optimists as well as pessimists take their expectations from the observed rates of return within the last twelve months. One group focuses on the best outcomes that were observed last year, while the other group focuses on the worst outcomes observed last year - but both groups base their future expectations on what has happened last year, leaving no room for major changes of the overall economy, such as large upswings or downturns. Table 2 shows that the variation of rates of return within one year is much smaller than is the variation of rates of return over time. If we want to simulate possible responses to expectations of an economic upturn or downturn, using a rate of return from a 'bad year' and a 'good year' as starting point $i_{lfp}(s = 1)$ is more appropriate. We calculate option values for a 'very pessimistic' scenario, where the option value is based on a rate of return on superannuation funds of $i_{lfp}(s = t)$ = -22.0% in the next year, and then converges towards the long-term equlibrium according to the same path as defined in Section 4; the alternative scenario is 'very optimistic', where the rate of return for the next year is assumed to be $i_{lfp}(s = t) = 18.3\%$.[14]

[14]The value -22.0% was the 5^{th}-percentile of rates of return in 2008, the year when the GFC hit its peak; the convergence path is -22.%, -0.6%, 4.3%, 5.4% and 5.7% before the equilibrium is reached. Likewise,

The second panel of Table 6 shows predicted retirement entry rates if the expected economic circumstances are 'very pessimistic' or 'very optimistic'. Although both shocks are short, they appear to be sufficient to induce a sizable behavioural response, increasing the average retirement entry rate by 6% from 8.2% to 8.7%. The table also reports the 10-, 25-, 75-, and 90-percentile as well as the median of the predicted propensity of entering retirement in any given year. It appears that the effect of optimism versus pessimism is greater in absolute terms at the upper end of the distribution, but in relative terms, the impact of optimism and pessimism is fairly stable across the distribution. At the 90-%ile of hazard rates of retirement entry, being 'very optimistic' instead of 'very pessimistic' decreases the hazard rate by 6%, at the 10-percentile the same effect is 7%. This is clearly an effect of economic significance. The timing of retirement is a major life decision; it is commonly seen as almost irreversible and depends on an entire lifetime of accumulating earnings and savings. If the medium-term economic outlook, even if it might never be *realised*, can change the propensity to retire by six to seven per cent, this has to be considered a major effect.

We then investigate a third scenario: what behavioural response would have resulted, if individuals had expected the mining boom and the following GFC? The term i_{lfp} now does not, after one initial shock, converge according to the rate assumed so far, but takes on the average rates of return on superannuation savings that were observed over the period of the mining boom and the GFC, respectively. For the 'mining boom' scenario, i_{lfp} takes on the values of the average rate of return between 2003 and 2007 , and the long-term rate of return of 5.8% immediately thereafter; for the 'GFC-scenario', the average rates of return between 2008 and 2012 are used instead, equally followed by the long-term equilibrium thereafter.[15] The third panel of Table 6 shows the response of retirement entry behaviour, had individuals expected the swing from the mining boom to the GFC. On average, such a change in expectations would incur a change in the hazard rate of retirement entry of 9% or 0.7 percentage points.

18.3% was the 95^{th}-percentile of rates of returns in 2006, the year with the highest returns recorded in our observation period. The convergence path is: 18.3%, 8.7%, 6.4%, and 5.9%.

[15]The rates of return on superannuation funds during the mining boom period and the GFC-period were as follows: 2003: -2.1%; 2004: 12.2%; 2005: 12.2%; 2006: 13.3%; 2007: 14.5%, 2008:-8.1%; 2009: -11.5%; 2010: 8.9%; 2011:7.8%; 2012: 0.6%.

Finally, the lowest panel shows the predicted hazard rate of retirement entry for the 'extreme and inert' scenario: the assumed rate of return is initially -22% and 18.3% as in the 'very pessimistic' and 'very optimistic' scenario. However, this scenario assumes that individuals see these rates as very inert; instead of expecting the rate of return to converge to its long-term equilibrium quickly, individuals expect that it will stay as high or as low for a period of five years. The hazard rate is 28% higher when individuals expect such a lasting, major crisis than when they expect a lasting, major boom. Now the effect is stronger at the lower tail of the distribution: at the 10-percentile, optimists are 48% more likely to retire than optimists are; at the 90-percentile the effect is 22%. However, the scenario is extreme, and unlikely to occur in such strength in reality, which in turn means it is not a likely expectation for a majority of reasonable individuals. It is thus to be seen as an upper bound of the impact of economic expectations on retirement behaviour.

6.2 Heterogeneity in the response to expectations

In the previous section, we have shown that the impact of expecting a boom or a deep recession on retirement entry is considerable, and appears to vary across the distribution. The latter fact immediately raises the question which groups are the ones to respond strongly or not at all. There are generally two possible reasons why one individual's behaviour might be more affected by an expected up-coming boom or recession than another individual's behaviour: first, they may differ in how strongly their economic expectations change their option value of work. We would expect that an individual's option value varies the stronger with his expectations, the more superannuation savings he has, given that the rate of return on superannuation savings is the main mediating factor between economic expectations and the option value. That is, we expect stronger behavioural changes for those with high savings when economic expectations change from good to bad, which are likely to be those with high wages and higher education. Second, two individuals whose option values are affected identically by their economic expectations, might still differ in their *responsiveness* to their option value of work. We would expect that an individuals' responsiveness to financial incentives would change with health and age. Health and age are the two main driving factors of the retirement decision, and the

importance of financial incentives should decrease when the 'pressure' to retire increases because of one's age or health.

6.2.1 Heterogeneity in the impact of expectations on the option value

To explore the first source of variation in the impact of economic expectations on retirement entry rates, we split the population in groups according to their wages, superannuation savings and education. Where Table 6 showed changes in the hazard rate of retirement entry for different expectations over the full estimation sample, Table 7 shows the results of the same simulations by sub-groups. As expected, among individuals with no superannuation savings, whether they are pessimistic or optimistic hardly matters for their hazard rates of retirement entry. Had individuals without superannuation savings anticipated the mining boom or the GFC, this anticipation would not have impacted on their behaviour at all.

Even in the very pessimistic or very optimistic scenarios, individuals with no superannuation savings have no reason to change their behaviour: neither do bad economic conditions threaten to reduce their savings, nor can good economic conditions improve them. Instead, we find that the average response as reported in Table 7 is caused predominantly by individuals with high superannuation savings: even in the very "mild" scenario of individual pessimism or optimism within the range of rates of returns observed in one given year, individuals with high superannuation savings are 2.2% less likely to retire when they are optimistic than when they are pessimistic, and when a strong downturn is expected, individuals' retirement entry rate decreases by 12.4% if they have high superannuation savings.

Expecting a situation such as the world experienced during the GFC, increases retirement entry rates by 17.4% compared to an expected boom as Australia experienced it in the early 2000s. The most extreme scenario even shows an increase in the hazard rate of retirement entry of 61.9% for the sub-group with high superannuation savings; however, as stated before, this scenario is an extreme upper bound.

The same patterm is found when looking at low versus high wage earners and indi-

viduals with and without a tertiary qualification. Economic expectations matter most for those at the upper end of the wage distribution, because these individuals have more savings that can potentially be affected by overall economic conditions, be it positively or negatively.

6.2.2 Heterogeneity in individual's responsiveness to the option value

The second possible reason why the importance of economic expectations varies across the population, is that some individuals will respond more strongly to a change in their expected income streams than others. We would expect one's responsiveness to financial incentives to be the stronger, the less strongly *other factors* point towards either staying in or leaving the labour force. In the models presented in Table 5, age and health were unsurprisingly found to be the strongest predictors of retirement entry.[16] Does that mean that young and healthy individuals also respond more strongly to changes in their expectations of future income streams? To analyse this, we have re-estimated the model from Table 5, column (3), and added interaction terms between age and the option value, as well as interaction terms between the health indicators and the option value. The results from the interacted model suggest that those individuals who are a few years away from the normal retirement age and in good health respond strongly to their expectations of future income streams, whereas old or unhealthy individuals are likely to retire regardless of their financial expectations.[17]

We would thus expect to see that the 6.0%-change in the average hazard rate of retirement entry when short downturn is expected rather than a short upturn (see Section 6.1), is predominantly driven by a response of healthy workers at an age of a few years before the normal retirement age. To explore further what role optimism or pessimism

[16]To illustrate the strength of the effect, Tables 15 and 16 in Appendix C show average predicted hazard rates of retirement entry across ages and health status groups. The average predicted annual hazard rate of retirement entry is 8.3%, but if every individual in the sample were in excellent health, this hazard rate would drop to 6.9%. If everyone were in fair or poor health instead, it would increase to 14.1% instead. In other words, being in poor health instead of excellent health more than doubles an individual's propensity to retire. A very strong effect is also found for age: at age 55, the average hazard rate of retirement entry is just 3%, but at age 60 it is 8%, and at age 66 it is 15%. Unsurprisingly, relatively young and healthy individuals are unlikely to retire, while older or sick individuals have a high propensity to exit the labour force.

[17]Table 17 in Appendix C shows detailed results.

plays, given one's other characteristics, we predict hazard rates of retirement entry for 'very optimistic' and 'very pessimistic' individuals as in the second panel of Table 6, but based on the interacted model from Table 17 and for two different types of individuals: for an individual in excellent health at age 60, and for an individual in poor health at age 55. Both are expected to have an overall similar retirement entry rate, but different responsiveness to financial incentives.

Table 8 shows that for a healthy 60-year old hazard rates of retirement entry are around 8% higher when a downturn is expected, than when an upturn is expected. This is true at all percentiles of the entire distribution of predicted hazard rates. For the 55-year old in poor health, hazard rates for retirement entry are similar to those for the healthy 60-year old: the combined effect of being younger and of being less healthy adds up to about zero, and the propensity to retire is very similar for both groups. However, the response to future income expectations is less than half as strong at 3.7%: men are more responsive in their retirement decision to future income expectations in their early 60s than they are at earlier or later ages, and they are also more responsive when they are in good health. As a result, the less healthy younger individual responds substantially less to future income than his 60-year-old healthy counterpart, and expectations about the medium-term economic development matter less.

To summarize, expectations about the future state of the economy have an economically and statistically significant impact on the timing of retirement, when strong changes in the overall economic situation such as economic upturns and downturns are considered. 'Milder' forms of optimism and pessimism that are based only on variations of rates of return observed within one year have a statistically significant but economically small effect on the decision to enter retirement. The effect of economic expectations unsurprisingly fades in comparison to the effect of age and health itself; however, the behavioural response to optimism and pessimism is not homogenous, and particularly healthy individuals close to the normal retirement age are 7.8% more likely to retire when they expect a strong downturn than when they expect an upturn.

7 Conclusion

Using a nationally representative household panel study for Australia (2004-2009), we identify the role and importance of generally held expectations about economic conditions in the next 5 years in determining the probability of exit from the labour market into retirement. We carry out a retirement option value analysis, such that economic expectations factor into the individual's *perceived* option value. During the time period under observation, Australia, along with the rest of the world, experienced substantial economic turbulence of the Global Financial Crisis. During the time, the top and bottom 5% of the distribution of returns on superannuation funds ranged from 18% (in 2006) to -22% (in 2008), respectively.

Had people been able to forecast the impending growth slowdown of the GFC, it would have led to a 8.7% increase in exit rates from employment to retirement. Seen in absolute terms, this implies increasing the exit rate from 8.1 percentage points to 8.8 percentage points (+0.7 percentage points). While an individual's health status and age are main determinants of entry into retirement, these perceived economic expectations have an additional effect in themselves. Those persons exiting the labour market would no longer be paying tax on labour earnings and superannuation withdrawals are at that point tax-free. Thus, a government would be expected to forgo substantial tax revenues from this additional increase in the exiting population. These forgone tax revenues would of course exacerbate the falling revenues from the overall tax base during the downturn, i.e. the goods and services value-added tax (GST), corporate tax, tax on earnings, capital gains. At the same time, the government would experience increased expenditures on welfare, unemployment insurance and other transfers.

The effects of economic expectations are not uniform over other individual characteristics, such that individuals with high superannuation savings experience the greatest impact of their economic expectations on their financial incentives to retire, and that those individuals who are a few years away from the normal retirement age and in good health have the strongest response to any given change in their financial incentives. In contrast, the retirement decision of elderly or unhealthy individuals is likely to be irrespective of their financial expectations, while the financial incentives for individuals with no or little

savings do not depend on their economic outlook nearly as much. As a result, the effect of economic expectations on retirement entry behaviour is concentrated among individuals at the upper end of the earnings distribution. This indicates further that those exiting into retirement earlier are likely to be those with high earnings (as opposed to merely average earnings), making the loss in income tax revenue even stronger.

This is the first paper to combine reported forward looking economic expectations with nationally representative data on retirement and labour market participation. The expectations are not from the individuals themselves, but generally held by people like them, strengthening their exogenous nature and the generalisability of the results. These expectations play an economically and statistically significant role and must be accounted for in retirement decision models. Given the dynamically changing growth patterns post GFC, economic expectations are likely to play a more important role, not only in influencing retirement decisions, but also in general economic decision making.

References

APRA (2013). Annual superannuation bulletin: June 2013. revised 5 february 2014. Australian Prudential Regulation Authority.

Blundell, R., C. Meghir, and S. Smith (2004, October). Pension Incentives and the Pattern of Retirement in the United Kingdom. In *Social Security Programs and Retirement around the World: Micro-Estimation*, NBER Chapters, pp. 643–690. National Bureau of Economic Research, Inc.

Chan, S. and A. H. Stevens (2001). Job loss and employment patterns of older workers. *Journal of Labor Economics 19*(2), pp. 484–521.

Coile, C. and J. Gruber (2001). Social security incentives for retirement. In *Themes in the Economics of Aging*, pp. 311–354. University of Chicago Press.

Coile, C. C. and P. B. Levine (2006). Bulls, bears, and retirement behavior. *Industrial and Labor Relations Review 59*(3), pp. 408–429.

Coile, C. C. and P. B. Levine (2011). The market crash and mass layoffs: How the current economic crisis may affect retirement. *The BE Journal of Economic Analysis & Policy 11*(1).

Davis, S. J. and T. M. von Wachter (2011). Recessions and the cost of job loss. Technical report, National Bureau of Economic Research.

Gerrans, P., M. Clark-Murphy, and C. Speelman (2010). Asset allocation and age effects in retirement savings choices. *Accounting & Finance 50*(2).

Goda, G. S., J. B. Shoven, and S. N. Slavov (2012). Does Stock Market Performance Influence Retirement Intentions? *Journal of Human Resources 47*(4), 1055–1081.

Gruber, J. and D. A. Wise (2004, September). *Social Security Programs and Retirement around the World: Micro-Estimation*. NBER Books. National Bureau of Economic Research, Inc.

Hurd, M. D., M. Reti, and S. Rohwedder (2009). The effect of large capital gains or losses on retirement. In *Developments in the Economics of Aging*, pp. 127–163. University of Chicago Press.

OECD (2013). Pensions markets in focus. Organisation for Economic Cooperation and Development Publishing.

Puri, M. and D. T. Robinson (2007). Optimism and economic choice. *Journal of Financial Economics 86*(1), 71–99.

Samwick, A. A. (1998, November). New evidence on pensions, social security, and the timing of retirement. *Journal of Public Economics 70*(2), 207–236.

Stock, J. H. and D. A. Wise (1990, September). Pensions, the option value of work, and retirement. *Econometrica 58*(5), 1151–80.

Warren, D. and U. Oguzoglu (2010). Retirement in australia: a closer look at the financial incentives. *Australian Economic Review 43*(4), 357–375.

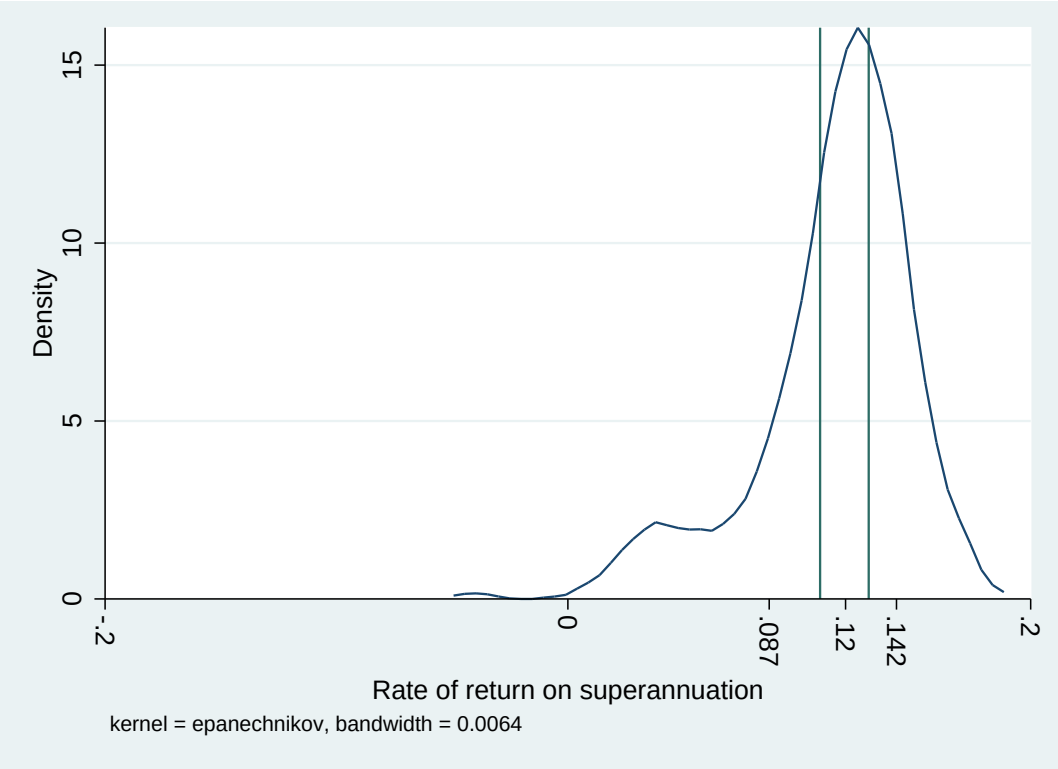

Figure 1: Distribution of rates of return on superannuation funds (RRS) in 2004

	Expectation Type			
Year	Optimistic	Medium	Pessimistic	Total
2004 %	35.09	31.77	33.14	100.00
2005 %	31.47	27.94	40.60	100.00
2006 %	30.31	27.77	41.93	100.00
2007 %	39.51	28.93	31.57	100.00
2008 %	32.43	30.76	36.81	100.00
2009 %	39.34	33.28	27.38	100.00
2010 %	38.20	33.89	27.90	100.00

Table 1: Observed economic expectations in CASiE - population shares in per cent

Year	Expectation Type			
	Optimistic	Medium	Pessimistic	Total
2004	0.142	0.120	0.087	0.118
2005	0.141	0.121	0.095	0.118
2006	0.156	0.139	0.113	0.134
2007	0.159	0.135	0.100	0.135
2008	-0.046	-0.085	-0.125	-0.084
2009	-0.059	-0.116	-0.146	-0.096
2010	0.100	0.080	0.039	0.079

Table 2: Rates of return by predicted expectation type and year

Age (Years)	Hazard Rate (0 - 1)	Option Value (Mean)	Option Value (Std. Dev.)	Option Value=0 Population share
55 years	0.030	45378	23604	0.000
56 years	0.042	41311	22858	0.000
57 years	0.019	38254	21406	0.004
58 years	0.060	35534	20591	0.002
59 years	0.078	32860	21344	0.003
60 years	0.068	30899	18920	0.003
61 years	0.083	27921	17464	0.006
62 years	0.059	25112	12735	0.011
63 years	0.127	22257	9856	0.004
64 years	0.250	19663	9689	0.011
65 years	0.185	17055	7599	0.022
66 years	0.156	14691	8273	0.011
67 years	0.158	13768	6740	0.013
68 years	0.143	11263	5997	0.063
69 years	0.208	9621	3746	0.063
70 years	0.200	7165	3477	0.067
71 years	0.135	5243	2425	0.054
72 years	0.086	3821	1620	0.057
73 years	0.188	1949	574	0.031
74 years	0.375	0	0	1.000
Total	0.082	31019	21343	0.013

Table 3: Retirement entry and financial incentive by age

cons	Expectation Type			
	Optimistic	Medium	Pessimistic	Total
Hazard rate	0.085	0.069	0.088	0.082
Option value (if own expectation)	34863.87	32014.25	26381.76	31202.36
Option value (if optimistic)	34863.87	32382.99	26851.77	31463.18
Option value (if neutral)	34395.69	32014.25	26638.86	31108.96
Option value (if pessimistic)	33821.36	31601.97	26381.76	30686.81
Retirement wealth (if own expectation)	42045.86	34467.25	22588.71	33360.43
Retirement wealth (if optimistic)	42045.86	35146.30	23462.05	33843.39
Retirement wealth (if neutral)	41283.39	34467.25	23065.83	33228.14
Retirement wealth (if pessimistic)	40401.48	33727.09	22588.71	32522.55
Age (years)	60.62	59.70	59.44	59.97
Health				
Excellent or Very Good	48.40	42.78	38.02	43.35
Good	38.46	40.29	39.74	39.40
Fair or Poor	13.15	16.93	22.24	17.25
Education				
Postgraduate	16.43	14.44	7.47	12.85
Bachelor/ Bachelor (Honours)	12.60	13.25	7.20	10.94
Cert III/IV, (Advanced) diplomas	41.63	39.83	33.77	38.47
Year 12, Cert I/II	10.41	7.86	12.94	10.57
Y11 or less	18.93	24.62	38.62	27.17
Home Ownership				
Rented	8.09	11.62	17.09	12.12
Owned	88.98	86.50	80.97	85.58
Other/ Don't know	2.92	1.88	1.94	2.30
State of Residence				
NSW	37.37	30.77	21.80	30.27
VIC	16.13	25.81	34.53	25.04
QLD	14.00	21.62	22.91	19.12
SA	7.55	10.00	13.70	10.31
WA	19.35	7.26	4.71	11.06
TAS	3.65	2.31	1.59	2.58
NT	0.37	0.26	0.07	0.23
ACT	1.58	1.97	0.69	1.39

Table 4: Hazard rates, financial incentives and sociodemographic characteristics by economic expectations

	(1)	(2)	(3)
Coefficients	-0.175	-0.173	-0.163
(Std. Err.)	(0.053)	(0.054)	(0.053)
Average Marginal Effect	-0.013	-0.013	-0.012
(Std. Err.)	(0.004)	(0.004)	(0.004)
Control variables			
Retirement wealth	y	y	y
Age (linear)	y	y	y
Age (squared)	y	y	y
Health (3 categories)	y	y	y
Education (6 categories)	n	y	y
Home ownership (3 categories)	n	y	y
State of residence (8 states)	n	n	y
Year (linear)	n	n	y

Table 5: The option value and its effect on the hazrad rate of retirement entry: Coefficients and marginal effect

	Probability of Retirement Entry in percentage points			
Expectations:	optimistic	pessimistic	Diff.	Std.Err.(Diff)
Mean	8.368	8.460	0.092	0.030
10-percentile	2.004	2.029	0.025	0.012
25-percentile	3.348	3.386	0.038	0.017
50-percentile	6.274	6.346	0.071	0.033
75-percentile	11.550	11.668	0.119	0.056
90-percentile	17.841	18.030	0.189	0.111
Expectations:	very optimistic	very pessimistic	Diff.	Std.Err.(Diff)
Mean	8.177	8.670	0.493	0.162
10-percentile	1.947	2.086	0.139	0.053
25-percentile	3.263	3.477	0.213	0.074
50-percentile	6.126	6.512	0.386	0.131
75-percentile	11.279	11.977	0.698	0.246
90-percentile	17.426	18.480	1.055	0.418
Expectations:	mining boom	GFC	Diff.	Std.Err.(Diff)
Mean	8.044	8.746	0.702	0.227
10-percentile	1.880	2.124	0.244	0.086
25-percentile	3.168	3.531	0.363	0.122
50-percentile	5.976	6.593	0.616	0.200
75-percentile	11.081	12.082	1.002	0.341
90-percentile	17.246	18.592	1.346	0.514
Expectations:	extremely and inertly optimistic	extremely and inertly pessimistic	Diff.	Std.Err.(Diff)
Mean	7.260	9.285	2.025	0.625
10-percentile	1.578	2.342	0.763	0.255
25-percentile	2.726	3.859	1.133	0.367
50-percentile	5.225	7.121	1.896	0.593
75-percentile	9.917	12.872	2.955	0.915
90-percentile	15.901	19.403	3.503	1.168

Table 6: Predicted hazard rates of retirement entry for different scenarios of economic expectations

Standard errors are bootstrapped with 200 repetitions. The bootstrap procedure includes the estimation of workers' responsiveness to their option value, but does not account for the random nature of one's assigned expectation type.

	Probability of Retirement Entry in percentage points			
Expectations:	Optimistic	Pessimistic	Diff.	Std.Err.(Diff)
No superannuation	12.555	12.555	0.000	0.000
Low superannuation	8.079	8.106	0.027	0.009
High superannuation	7.847	8.020	0.173	0.058
Low wage	10.458	10.522	0.063	0.024
High wage	6.299	6.419	0.120	0.038
No tertiary qualification	8.925	8.994	0.069	0.023
Tertiary qualification	7.361	7.494	0.133	0.045
Expectations:	Very optimistic	Very pessimistic	Diff.	Std.Err.(Diff)
No superannuation	12.554	12.557	0.003	0.002
Low superannuation	8.030	8.177	0.147	0.049
High superannuation	7.481	8.406	0.926	0.307
Low wage	10.330	10.648	0.317	0.117
High wage	6.045	6.712	0.667	0.210
No tertiary qualification	8.784	9.154	0.370	0.125
Tertiary qualification	7.080	7.794	0.714	0.239
Expectations:	Mining Boom	GFC	Diff.	Std.Err.(Diff)
No superannuation	12.550	12.558	0.008	0.004
Low superannuation	7.954	8.217	0.263	0.086
High superannuation	7.267	8.534	1.267	0.412
Low wage	10.240	10.699	0.459	0.169
High wage	5.870	6.814	0.944	0.288
No tertiary qualification	8.660	9.223	0.563	0.188
Tertiary qualification	6.930	7.884	0.954	0.309
Expectations:	Extremely and inertly optimistic	Extremely and inertly pessimistic	Diff.	Std.Err.(Diff)
No superannuation	12.544	12.568	0.024	0.012
Low superannuation	7.683	8.480	0.797	0.260
High superannuation	5.831	9.444	3.613	1.111
Low wage	9.604	10.986	1.382	0.484
High wage	4.939	7.601	2.662	0.774
No tertiary qualification	8.031	9.692	1.661	0.536
Tertiary qualification	5.866	8.548	2.682	0.818

Table 7: Predicted hazard rates of retirement entry for different scenarios of economic expectations - by sub-groups

Standard errors are bootstrapped with 200 repetitions. The bootstrap procedure includes the estimation of workers' responsiveness to their option value, but does not account for the random nature of one's assigned expectation type. Superannuation is defined as 'low' or 'high' if total superannuation savings are below or above the median of positive superannuation savings in the estimation sample. Wages are defined as 'low' or 'high' if an individual's annual labour earnings are below or above the median annual labour earnings in the estimation sample.

Expectations:	Age 60; Health: Excellent Very optimistic	Very pessimistic	Diff.	Std.Err.(Diff)
Mean	5.968	6.437	0.469	0.229
10-percentile	3.045	3.256	0.210	0.106
25-percentile	4.237	4.499	0.262	0.132
50-percentile	5.734	6.059	0.324	0.152
75-percentile	7.398	7.874	0.475	0.227
90-percentile	9.134	9.988	0.854	0.484
Expectations:	Age 55; Health: Fair/Poor Very optimistic	Very pessimistic	Diff.	Std.Err.(Diff)
Mean	5.991	6.211	0.220	0.338
10-percentile	3.439	3.546	0.107	0.146
25-percentile	4.460	4.593	0.133	0.179
50-percentile	5.728	5.893	0.165	0.237
75-percentile	7.190	7.417	0.227	0.364
90-percentile	8.776	9.174	0.398	0.704

Table 8: Predicted hazard rates of retirement entry for different scenarios of economic expectations - by age and health

A Imputation of superannuation wealth

HILDA contains detailed information on households' wealth, including superannuation wealth, in waves 2002, 2006 and 2010. In the waves in between, we imputed individuals' savings in superannuation accounts by extrapolating the most recent observed values. Alongside the total savings in one's account in a given wave, HILDA asks respondents about the total employer contributions they receive, as well as about regular, own voluntary contributions; both as a percentage of their salary. Together with information on individuals' salaries and average rates of return on superannuation funds are taken from APRA data, we can extrapolate total superannuation wealth under the assumption that the contribution rates stay constant and the individual receives an average rate of return. Table 9 shows imputed superannuation wealth for the sample of men that was used for the analysis, if positive superannuation wealth was observed in at least one of the waves.

	Superannuation Wealth				
	Mean	Std. Dev.	25-percentile	Median	75-percentile
			Observed Values		
2002	188900	252915	25000	100000	250000
			Imputed Values		
2003	189591	243867	26856	96527	266499
2004	187710	242458	27000	97403	260688
2005	212504	266083	33428	113863	302938
2006	243145	304923	37438	128340	339897
			Observed Values		
2006	271598	425130	25250	132500	322500
			Imputed Values		
2007	309930	467428	33990	158620	376265
2008	362704	525528	46702	191496	448730
2009	329881	470022	46496	178831	412076
2010	297142	418616	45369	162637	379837
			Observed Values		
2010	305146	466962	25000	140000	380000

Table 9: Observed and Imputed Superannuation Wealth

In 2006 and 2010, we can compare the values that were extrapolated from the last wave with wealth information to the newly observed values in order to test how accurate the extrapolation method is. The men included in our sample reported a mean superannuation wealth of \$189,000 in 2002. The median wealth is substantially lower at \$100,000. Four

years later, we predict superannuation wealth for the same group to have increased to an average of $243,000 and a median of $128,000. Comparing the extrapolated values to the observed values in 2006 shows that superannuation wealth has, on average, increased stronger than the extrapolation suggests, by 11%. The predicted median wealth is very close to the observed wealth, as is the 75-percentile. However, the extrapolation method fails to pick up that the lower end of the distribution hardly experiences any increase in reported superannuation wealth from 2002 to 2006 at all. Overall, the predicted distribution of superannuation wealth resembles the observed distribution reasonably closely. The same observation can be made four years later, when comparing superannuation wealth extrapolated from the information that was available in 2006, to observed superannuation wealth in 2010. The average extrapolated superannuation wealth is less than 2% smaller the the observed superannuation wealth, and the median and the 75-percentile are predicted reasonably well. Again, the extrapolation method does not pick up that the lower end of reported superannuation wealth is near stagnant between 2002 and 2010. Overall, imputed superannuation wealth seems to resemble closely the observed superannuation wealth, except for the lower tail of the distribution. However, the option value of work for those with very low private savings will be driven mostly by their salary and Age pension entitlement; whereas the rate of return on private savings will impact the option value of work mostly for those at the upper end of the superannuation wealth distribution. The error that extrapolation of superannuation wealth potentially imposes on the behavioural simulation in this paper, should thus be limited.

B Estimating the probability of being optimistic or pessimistic

Since HILDA data does not contain direct information on individuals' optimism or pessimism (see Section 5), we predict their attitude based on their socio-economic characteristics, and the relationship between those characteristics and one's optimism or pessimism as we observe it in CASiE. Besides individual and general economic expectations, CASiE provides a number of personal characteristics, namely the state of residence, age and gender, occupation and education, household size, income and home ownership. Based on those characteristics, we estimate ordered probit models (separately for each year, for men only) to model the expectations on the state of the economy in the future. The same characteristics that can be identified in CASiE can also be identified in HILDA. Combining the coefficients from the ordered probit models estimated from CASiE, and the individual characteristics observed in HILDA, we can predict the latent variable describing an individual's continuous optimism or pessimism for each individual in the HILDA population. We sort individuals according to that latent variable, and assign the expectation type 'optimist' to those with the highest and the expectation type 'pessimist' to those with the lowest predicted latent optimism. The expectation types are assigned in such a way that the observed population shares for optimists and pessimists from CASiE are maintained.[18]

Table 10 shows the expectation types assigned to each individual in the HILDA sample. Compared to the population shares observed in CASiE, our sample of men aged 55 to 75 contains more pessimists and more optimists, but fewer individuals with neutral expectations. However, the differences between the observed population shares in CASiE and the assigned expectation types in HILDA are small and not systematic.

we assign expectation types to individuals on HILDA based on their personal characteristics, and an ordered probit model of 'economic optimism' estimated on CASiE data. The estimation was conducted separately by year, for men only. Table 11 shows the coefficients and standard errors, as well as some model information.

[18]Note that in order to match the population the CASiE estimates and population shares are based on, the predicted latent optimism is estimated for, and the expectation types are assigned to, the entire HILDA population rather than our sample of men aged 55 to 75.

	Expectation Type			
Year	Optimistic	Medium	Pessimistic	Total
2004 %	29.00	28.65	42.35	100.00
2005 %	33.57	26.09	40.35	100.00
2006 %	37.34	21.79	40.87	100.00
2007 %	45.20	26.99	27.81	100.00
2008 %	29.19	27.68	43.12	100.00
2009 %	48.06	30.97	20.97	100.00
2010 %	45.64	29.99	24.37	100.00

Table 10: Predicted economic expectations in HILDA - population shares in per cent

	Coeff. (Std.Err.)					
	Y2004		Y2005		Y2006	
exp_type						
State; Ref.: NSW	.	.	.	.	.	.
VIC	0.070	(0.044)	0.144	(0.043)	0.121	(0.044)
QLD	0.058	(0.047)	0.076	(0.046)	0.016	(0.047)
SA	0.118	(0.052)	0.171	(0.051)	0.071	(0.052)
WA	-0.097	(0.050)	0.020	(0.049)	-0.205	(0.050)
TAS	0.024	(0.081)	0.231	(0.082)	-0.088	(0.081)
ACT	0.090	(0.125)	0.180	(0.122)	0.099	(0.124)
HH income; Ref: <=20k	.	.	.	.	.	.
>20k-30k	-0.021	(0.066)	0.031	(0.066)	-0.027	(0.065)
>30k-40k	0.022	(0.067)	-0.094	(0.067)	-0.076	(0.069)
>40k-50k	-0.047	(0.071)	-0.062	(0.070)	-0.084	(0.073)
>50k-60k	-0.040	(0.072)	-0.119	(0.070)	-0.211	(0.073)
>60k-80k	-0.097	(0.069)	-0.131	(0.067)	-0.130	(0.069)
>80k-100k	-0.105	(0.075)	-0.184	(0.074)	-0.199	(0.075)
>100k	-0.174	(0.070)	-0.256	(0.067)	-0.251	(0.069)
Age; Ref: 55-64 years	.	.	.	.	.	.
65 years and older	-0.163	(0.052)	-0.146	(0.050)	-0.109	(0.048)
Occupation; Ref: Managers	.	.	.	.	.	.
Professionals	0.110	(0.050)	0.082	(0.048)	0.057	(0.050)
Tradespersons	0.116	(0.065)	0.033	(0.063)	0.123	(0.067)
Clerks	0.007	(0.103)	0.128	(0.102)	0.129	(0.105)
Salespersons	0.084	(0.074)	-0.112	(0.075)	0.040	(0.074)
Machine Operators	0.103	(0.082)	0.139	(0.078)	0.101	(0.078)
Labourers	0.188	(0.067)	0.111	(0.068)	0.077	(0.072)
Out of the Labour Force	0.029	(0.059)	-0.000	(0.056)	0.005	(0.056)
Education; Ref <=Year 11	.	.	.	.	.	.
Full secondary	0.020	(0.046)	0.022	(0.046)	-0.007	(0.047)
Certificate, non-trade	0.164	(0.124)	0.081	(0.119)	-0.070	(0.101)
Certificate, trade	-0.082	(0.056)	-0.026	(0.055)	-0.056	(0.055)
(Under-)graduate degree	0.020	(0.045)	0.037	(0.044)	0.014	(0.045)
Psotgraduate Degree	-0.013	(0.066)	-0.004	(0.063)	0.017	(0.062)
Home ownership; Ref: Rented	.	.	.	.	.	.
Owned	0.054	(0.040)	-0.011	(0.040)	-0.018	(0.045)
Other	0.066	(0.102)	-0.050	(0.102)	-0.080	(0.108)
HH size; Ref: 1 person	.	.	.	.	.	.
2 persons	0.004	(0.045)	0.021	(0.044)	0.009	(0.044)
3 persons	-0.017	(0.054)	0.102	(0.054)	-0.009	(0.055)
4 persons	-0.053	(0.055)	0.063	(0.054)	0.073	(0.056)
5 persons	-0.120	(0.068)	0.008	(0.068)	-0.035	(0.072)
6 persons	0.110	(0.111)	0.072	(0.108)	-0.039	(0.125)
7 persons and more	-0.214	(0.165)	-0.061	(0.153)	0.136	(0.144)
Observations	5638		5870		5727	
Log lik.	-6104.216		-6312.349		-6114.188	
Chi-squared	72.363		83.542		90.254	
p-value	0.000		0.000		0.000	

Table 11: Ordered probit estimation of the probability of being optimistic or pessimistic by year, 2004-2006

	Coeff. (Std.Err.)			
	Y2007		Y2008	
exp_type				
State; Ref.: NSW	.	.	.	.
VIC	0.092	(0.044)	0.082	(0.041)
QLD	0.060	(0.048)	-0.006	(0.046)
SA	0.010	(0.052)	0.116	(0.050)
WA	-0.184	(0.050)	0.051	(0.050)
TAS	-0.053	(0.083)	-0.134	(0.075)
ACT	0.020	(0.122)	0.075	(0.113)
HH income; Ref: <=20k	.	.	.	.
>20k-30k	-0.047	(0.065)	-0.068	(0.064)
>30k-40k	-0.058	(0.069)	-0.024	(0.069)
>40k-50k	-0.117	(0.072)	-0.115	(0.071)
>50k-60k	-0.114	(0.076)	-0.003	(0.072)
>60k-80k	-0.125	(0.070)	-0.092	(0.069)
>80k-100k	-0.163	(0.077)	-0.135	(0.072)
>100k	-0.199	(0.069)	-0.140	(0.065)
Age; Ref: 55-64 years	.	.	.	.
65 years and older	-0.199	(0.046)	-0.028	(0.044)
Occupation; Ref: Managers	.	.	.	.
Professionals	0.064	(0.052)	0.008	(0.047)
Tradespersons	0.041	(0.070)	0.044	(0.066)
Clerks	0.058	(0.106)	-0.058	(0.111)
Salespersons	-0.054	(0.077)	-0.103	(0.076)
Machine Operators	0.068	(0.082)	0.104	(0.082)
Labourers	0.113	(0.077)	0.107	(0.069)
Out of the Labour Force	0.082	(0.056)	-0.087	(0.051)
Education; Ref <=Year 11	.	.	.	.
Full secondary	-0.035	(0.049)	-0.032	(0.047)
Certificate, non-trade	0.144	(0.092)	-0.075	(0.092)
Certificate, trade	0.047	(0.055)	-0.118	(0.052)
(Under-)graduate degree	-0.003	(0.046)	-0.122	(0.044)
Psotgraduate Degree	0.032	(0.062)	-0.033	(0.059)
Home ownership; Ref: Rented	.	.	.	.
Owned	-0.077	(0.046)	-0.014	(0.042)
Other	-0.100	(0.108)	0.019	(0.120)
HH size; Ref: 1 person	.	.	.	.
2 persons	-0.014	(0.045)	-0.039	(0.043)
3 persons	0.022	(0.056)	0.001	(0.055)
4 persons	0.001	(0.057)	-0.047	(0.055)
5 persons	-0.086	(0.070)	-0.037	(0.070)
6 persons	0.163	(0.126)	-0.138	(0.110)
7 persons and more	0.268	(0.178)	-0.078	(0.168)
Observations	5676		6073	
Log lik.	-6009.481		-6596.055	
Chi-squared	90.128		62.654	
p-value	0.000		0.002	

Table 12: Ordered probit estimation of the probability of being optimistic or pessimistic by year, 2007-2008

	Coeff. (Std.Err.)			
	Y2009		Y2010	
exp_type				
State; Ref.: NSW	.	.	.	.
VIC	0.011	(0.044)	-0.014	(0.040)
QLD	-0.014	(0.050)	0.114	(0.045)
SA	0.020	(0.054)	-0.008	(0.050)
WA	-0.099	(0.054)	-0.021	(0.049)
TAS	-0.191	(0.083)	-0.058	(0.073)
ACT	0.047	(0.127)	0.047	(0.113)
HH income; Ref: <=20k	.	.	.	.
>20k-30k	0.058	(0.070)	-0.160	(0.066)
>30k-40k	-0.151	(0.077)	-0.188	(0.072)
>40k-50k	0.010	(0.076)	-0.070	(0.071)
>50k-60k	-0.101	(0.079)	-0.161	(0.073)
>60k-80k	-0.115	(0.075)	-0.250	(0.070)
>80k-100k	-0.157	(0.081)	-0.160	(0.074)
>100k	-0.155	(0.073)	-0.291	(0.068)
Age; Ref: 55-64 years	.	.	.	.
65 years and older	-0.146	(0.047)	-0.071	(0.042)
Occupation; Ref: Managers	.	.	.	.
Professionals	-0.023	(0.053)	0.071	(0.049)
Tradespersons	-0.068	(0.073)	0.049	(0.066)
Clerks	-0.112	(0.123)	-0.069	(0.120)
Salespersons	-0.217	(0.085)	0.099	(0.076)
Machine Operators	-0.117	(0.090)	0.084	(0.085)
Labourers	0.036	(0.081)	-0.064	(0.075)
Out of the Labour Force	-0.073	(0.057)	-0.017	(0.053)
Education; Ref <=Year 11	.	.	.	.
Full secondary	-0.110	(0.054)	-0.076	(0.048)
Certificate, non-trade	0.046	(0.096)	-0.052	(0.094)
Certificate, trade	-0.051	(0.056)	-0.016	(0.052)
(Under-)graduate degree	-0.105	(0.048)	-0.108	(0.043)
Psotgraduate Degree	-0.145	(0.064)	-0.178	(0.059)
Home ownership; Ref: Rented	.	.	.	.
Owned	-0.054	(0.047)	-0.017	(0.042)
Other	-0.125	(0.198)	-0.293	(0.210)
HH size; Ref: 1 person	.	.	.	.
2 persons	-0.000	(0.048)	0.030	(0.044)
3 persons	0.037	(0.059)	0.039	(0.055)
4 persons	-0.019	(0.060)	0.009	(0.056)
5 persons	-0.046	(0.077)	0.025	(0.070)
6 persons	0.176	(0.138)	0.043	(0.114)
7 persons and more	-0.071	(0.189)	0.319	(0.166)
Observations	5292		6276	
Log lik.	-5506.321		-6645.056	
Chi-squared	65.583		79.807	
p-value	0.001		0.000	

Table 13: Ordered probit estimation of the probability of being optimistic or pessimistic by year, 2009-2010

While some of the characteristics that determine one's predicted level of optimism have little change over time (such as occupation and education), others vary more strongly (for example age and household income), as do the models' coefficients. As a result, the same individual might be estimated to be optimistic in one year, and pessimistic in another. Table 14 shows how frequently individuals adopt a type of expectations that differs from their expectations last year.

Last Year:	Optimistic		Neutral		Pessimistic		
This Year:	Neutral	Pessimistic	Optimistic	Pessimistic	Optimistic	Neutral	Total
2005	0.066	0.047	0.101	0.092	0.057	0.103	0.466
2006	0.069	0.038	0.074	0.091	0.059	0.074	0.405
2007	0.061	0.033	0.096	0.045	0.076	0.126	0.437
2008	0.117	0.129	0.072	0.128	0.037	0.065	0.549
2009	0.060	0.021	0.124	0.037	0.140	0.132	0.515
2010	0.115	0.078	0.131	0.061	0.056	0.064	0.505

Table 14: Population share who changes expectation type compared to previous year

C The impact of age and health on retirement entry

Tables 15 and 16 show average predicted hazard rates of retirement entry at different ages and for different health situations.

	Probability of Retirement Entry	
Health Status	Absolute probability	Relative to Baseline
Observed Health	0.084	1.000
Excellent/Very Good	0.069	0.822
Good	0.074	0.890
Fair/Poor	0.141	1.682

Table 15: Prediction - by Health Status

	Probability of Retirement Entry	
Age	Absolute probability	Relative to Baseline
Observed Age	0.084	1.000
55	0.031	0.366
57	0.047	0.568
60	0.080	0.960
63	0.116	1.392
66	0.147	1.754
69	0.162	1.944
72	0.160	1.910
75	0.139	1.661

Table 16: Prediction - by Age

Table 17 shows the marginal effect of the option value of work on the hazard rate of retirement entry, based on model (3) in table 5 with additional interaction terms (the option value is interacted with age, age squared and the health situation). Marginal effects are reported as average effect across the population, as well as for different ages and health situations.

Marginal effects (Std. Err.)			
Overall effects in interacted model		-0.009 (0.005)	
Marginal Effects at age ...		Marginal Effects at health ...	
55	-0.005 (0.003)	Excellent	-0.009 (0.006)
57	-0.008 (0.003)	Good	-0.010 (0.006)
60	-0.011 (0.004)	Fair/Poor	-0.006 (0.011)
63	-0.013 (0.008)		
66	-0.012 (0.014)		
69	-0.007 (0.029)		
72	0.001 (0.056)		
75	0.012 (0.095)		

Table 17: Marginal effect of the option value by age and health