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# A Lifecycle Perspective of Stock Market Performance and Wellbeing

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## Abstract

We estimate the effect of stock market fluctuations on subjective wellbeing and health using Australian survey data over the period 2001-2012, which includes the Global Financial Crisis. By comparing survey respondents interviewed in the same quarter and location, we find that stock market increases lead to a significant but modest increase in life satisfaction and mental health. This effect is driven by young and middle-aged males, and is stronger for those with direct exposure to the stock market. For young cohorts, the stock market index acts as a leading indicator of employment prospects, whilst for older cohorts it acts directly on financial satisfaction. These results are in line with a stylised lifecycle investment model.

**Key Words:** Stock Market, Satisfaction, Wellbeing, Health

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## 1. Introduction

A central task of applied economists is to understand how individuals react to income and wealth changes that are caused by government policies, shocks to individual or family circumstances, and to movements in the macroeconomic environment. The question “Does money buy happiness” remains contentious despite decades of research on the topic (see, for example, Easterlin, 1974, 1995; Clark et al., 2008; Deaton, 2008; Stevenson and Wolfers, 2008; 2013; Easterlin et al., 2010; Kahneman and Deaton, 2010). Particular unresolved issues include whether anticipated future income streams matter, and whether there are groups for whom income and anticipated income matter less, issues that are particularly salient in the early stages of recessions when expectations are in flux.

Similarly, the key causal mechanisms linking income to health are still under debate, particularly during economic downturns (Deaton, 2006). While a large literature has demonstrated that higher household income is significantly associated with better child health outcomes (Case et al., 2002), a number of studies have shown that (plausibly exogenous) changes in income or wealth in adulthood are only weakly related to changes in health status (see, for example, the various results in Meer et al., 2003; Smith, 2004; Adda et al., 2009; Frijters et al., 2005; Lindahl, 2005; Gardner and Oswald, 2007; Michaud and van Soest, 2008; Kim and Ruhm, 2012; Apouey and Clark, 2014). Another important issue is whether there are any health benefits, in terms of improving certain health outcomes or reducing harmful health-related behaviours, in times of recessions as suggested in the studies by Ruhm (2000; 2005; 2007). For example, if alcohol and tobacco are normal goods, then we might expect a fall in consumption as real incomes decrease, or that there might be health-gains from the lowering of pollution or congestion as a result of reduced economic activity. Many studies have focused on whether health moves pro- or counter-cyclically, and there is a spread of evidence both ways. Some recent examples are Deaton (2008, 2012), Cotti and Tefft (2011), French and Davalos (2011), Kim and Ruhm (2012), Suhrcke and Stuckler (2012), McInerney et al. (2013), Cotti et al. (2014), Frijters et al. (2013), Macy et al. (2013), Tekin et al. (2013), Asgeirsdottir et al. (2014), and French and Gumus (2014).

One of the main challenges in this literature is moving from the study of association to that of causality. As with most areas of applied economics, finding exogenous variation in income and wealth is difficult. The difficulty with using macroeconomic movements to identify causal effects is that individuals may foresee changes, such as increases in local area unemployment or mortgage interest rates, and therefore adjust their economic decision-making in advance. Importantly however, the unexpected turbulence of the recent Global Financial

Crisis (GFC) has provided social scientists with a real-world experimental setting to further study the effect of financial shocks on health and subjective wellbeing. The GFC period is widely seen to be the worst financial crisis in the Western world since the Great Depression of the 1930s, and since stock market changes are generally assumed to be unanticipated, its movements are a prime candidate for the exogenous change in income and wealth looked for in applied research. Over the last five years a large number of studies have taken this opportunity to investigate a wide range of important economic questions (for example, see Hudomiet et al., 2011; McFall, 2011; Malmendier and Nagel, 2011; Murgea and Reisz, 2012). A prime example is Deaton (2011), who uses daily Gallup Survey data for the US and finds that subjective wellbeing closely tracks the stock market over the years 2008-2010. He suggests that this relationship is unlikely to capture a direct effect on wellbeing since most Americans do not have financial interests in the stock market. Rather, he argues that the stock market became the most watched economic indicator of what might happen in the future, in addition to an indicator of what is currently happening. Therefore the stock market acts as a leading indicator, and wellbeing movements pick up a ‘fear’ factor reflecting, for example, expectations of reduced employment prospects in times of stock market crisis (Deaton, 2011).

In terms of health outcomes, the titles of a number of recent papers convey similar findings. Cotti et al. (2014) examine whether “the Dow is killing me”, using data from the US Health and Retirement Study (HRS). Interpreting stock market fluctuations as exogenous variation in wealth, they find that a 10% increase in wealth leads to a significant but small improvement in four measures of physical and mental health, including mortality. Similarly, in “Recession Depression”, McInerney et al. (2013) use exogenous variation in interview dates in the HRS (before and after October 2008) to study the impact of wealth losses on mental health. They find that the financial crash increased feelings of depression, with the effect being largest for those with exposure to the stock market. This effect was found immediately after the crash. Interestingly, they found no evidence that the crash led to increases in clinically validated measures of mental illness, again suggesting that expectations matter for ‘normal’ fluctuations in mental health. Accordingly, Nandi et al. (2012) find that stock market volatility was not associated with suicide rates in the US.

In contrast, Lin et al. (2014) ask “Do stock prices drive people crazy?” using data on daily incidences of mental disorders in Taiwan from 1998 to 2009. They report evidence of increased hospitalisations in response to stock market crashes, with a 1000-point fall in the stock market index predicted to increase the number of daily mental health related hospitalisations by 4.71% (for the US, see also Schwartz et al., 2012; and Engelberg and

Parsons, 2013). Gili et al. (2012) using primary care centre data from Spain, a country strongly affected by the financial crisis, find a significant increase in the proportion of patients with mood disorders, anxiety, and alcohol-related disorders. Wunder (2014) analyses the effect of stock markets movements on subjective expectations of the future using German data to find that subjective expectations respond to short-term fluctuations (90 days horizon) in stock markets. In terms of identifying heterogeneity in the response of health to stock market movements, Ratcliffe and Taylor (2012) ask, “Who cares about stock market booms and busts?”, and answer the question using data on mental health from the British Household Panel Study over the period 1991-2008. They find that mental health is predicted by changes in the stock market, but that there is no evidence that the effect is confined to individuals who hold equity based assets. Rather they conclude, similar to Deaton (2012), that the share market acts as a general economic barometer.

The literature demonstrating immediate responses in subjective wellbeing following declines in the stock market suggests that anticipation over future consumption directly influences instantaneous utility (Engelberg and Parson, 2013; Foster et al., 2012; Frijters and Meng, 2012). Engelberg and Parsons (2013) point to Caplin and Leahy’s (2001) model of asset pricing with ‘anxious’ investors, and suggest that anticipatory utility helps explain investors’ reluctance to hold stocks including the equity premium puzzle. They also suggest that the more quickly ‘gyrations’ in prices affect investor utility, the higher the likelihood that the effect is working through expectations over future consumption, rather than through current consumption. Frijters et al. (2012), as well as Frijters and Meng (2012), use direct information on anticipated future incomes and health, which they find influences life satisfaction to a larger extent than actual income and health do. They interpret this result as evidence for a large anticipatory component in life satisfaction.

In this paper we contribute to this literature by investigating the extent to which subjective wellbeing and measures of health react to changes in a leading stock market index using Australian survey data over the period 2001-2012. Relative to the US and UK, Australia was less affected by the GFC, experiencing only one-quarter of negative growth (4<sup>th</sup> quarter 2008), and a relatively small increase in the unemployment rate (4.2% in 2008 to a peak of 5.6% in 2009).<sup>1</sup> In contrast, US unemployment increased from 4.8% in April 2008 to a peak of 10.6% by the start of 2010, and 60% of households saw a decline in wealth between 2007 and

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<sup>1</sup> As described by the Reserve Bank of Australia (ABS, 2010), “The Australian economy has recorded markedly better growth outcomes than most other developed countries, many of which experienced severe recession and rises in unemployment. The Australian financial system has been markedly more resilient. Notably, Australian banks have continued to be profitable and have not required any capital injections from Government”.

2009 (Bricker et al., 2011; Deaton, 2012). However, after five-years of sustained stock market increases that saw the Australia All Ordinaries Index rise from around 2,800 in March 2003 to 6,873 in November 2007, the index fell by 54% to 3,112 by the beginning of March 2009. This crisis had significant effects on Australian households because they hold the majority of their non-housing wealth in superannuation funds (around 60%), followed by equities and trusts (around 20%) (ABS, 2010; Finley, 2013). Quiggin (2009) calculated that household assets fell by around 14 per cent as a result of falling share prices and property values, and that superannuation accounts declined by around 20 per cent.

We match stock market changes observed between 2001-2012 to individual level data from the Household, Income and Labour Dynamics in Australian Survey (HILDA) to study how this form of exogenous variation impacted on subjective wellbeing and health. We investigate several aspects of this relationship. First, we investigate whether younger or older people are more affected, anticipating that younger individuals are more likely to worry about their jobs and older people relatively more about their assets. Accordingly, we do not only focus on life satisfaction, but also on satisfaction with employment opportunities and financial situation. A distinguishing feature of our analysis from the other papers is that we develop a simple lifecycle framework to motivate and explain differences across age profiles as well as differences across genders. Second, we test whether individuals who are directly exposed to the stock market are most affected by the stock market. Third, we investigate if health is affected by stock market changes using reports on satisfaction with health, the mental health component of the commonly used SF-36 scale, and an indicator of having a chronic health condition. Our expectation is that stock market changes will immediately impact on mental health, but will not affect the probability of reporting a chronic health condition. Fourth, we explore what are the most appropriate measures and temporal window for measuring stock market fluctuations. Finally, we determine the extent to which Australians' wellbeing is affected by Australian or US stock markets.

The paper is set out as follows. In Section 2 we outline a simple lifecycle investment model to motivate our empirical analysis. The data is described in Section 3, while Section 4 outlines our main empirical model and then discusses the results. Section 5 concludes.

## **2. A Lifecycle Model of Asset Formation and Life Satisfaction**

Following the extensive literature on the lifecycle hypothesis, we present a highly stylised lifecycle model of changes in assets over time, and the main source of those changes by broad age group – see Figure 1. Within this view, early life sees negative changes in assets as

resources are spent on the accumulation of human capital (school, training, university). After completing education, an individual begins earning money, which can be seen as obtaining rents from the accumulated human capital. During late middle age (say 45 to 60 years), the relative significance of a job reduces as financial assets, including property, stocks, and pension savings, become more important. This is the period in which individuals are actively planning for their future retirement. At the point of retirement (around 60 in Australia), there are little rents from human capital and the changes in assets primarily involve further accumulation and rents from financial capital, as well as a pension from private and public sources. The closer to death, the more the individual starts to dis-save.

Examining the data from the Household, Income and Labour Dynamics in Australia Survey (HILDA), discussed in Section 3, we test the basic life-cycle hypothesis that young individuals' main source of income is the returns from human capital via employment, while financial assets become dominant in later life. Figure 2 presents age profiles in real household net wealth and hours per week usually worked; the graphs are generated using kernel-weighted local polynomial regression with an Epanechnikov kernel function and a rule-of-thumb bandwidth. In line with the main predictions of the life-cycle hypothesis (Figure 1), these graphs show that hours worked peaks at around age 40 for men (but not for women) and that wealth peaks at around age 60.

In terms of the importance of the stock market for the subjective wellbeing of an individual, it is useful to define the expected value of the assets ( $A_{it}$ ) of an individual  $i$  at time  $t$  as a simple function of human capital ( $HC$ ), financial capital ( $FC$ ), and pensions ( $PE$ ):

$$E[A_{it}] = HC_{it}p_{hc,t} + FC_{it}p_{fc,t} + PE_{it} \quad (1)$$

where  $p_{hc,t}$  is the per-unit rent on human capital at time  $t$  and  $p_{fc,t}$  is the per-unit rent on financial capital at time  $t$ . The stylised viewpoint we hypothesise is that the importance of  $HC_{it}$  peaks in between the ages of 25 and 45; that the importance of  $FC_{it}$  peaks in mid-life (say age 45 to 60); and that the importance of  $PE_{it}$  peaks in later-life (age 60+). The main link with the stock-market is that we expect stock market changes to be taken as informative on the lifetime value of human capital ( $p_{hc,t}$ ) and the direct returns on financial capital ( $p_{fc,t}$ ), while being relatively unimportant for existing pensions.

In terms of the various aspects of life-satisfaction, we therefore propose that financial satisfaction (FS) will be dependent on  $FC_{it}p_{fc,t} + PE_{it}$ , while satisfaction with employment (SE) will be dependent on  $HC_{it}p_{hc,t}$ :

$$FS_{it} = (FC_{it}p_{fc,t} + PE_{it})\alpha_1 + X_{it}\beta_1 + e_{FS,it} \quad (2)$$

$$SE_{it} = (HC_{it}p_{hc,t})\alpha_2 + X_{it}\beta_2 + e_{SE,it} \quad (3)$$

We view overall life satisfaction (LS) to combine these elements (and others) and to be dependent on all forms of capital:

$$LS_{it} = FC_{it}p_{fc,t}\gamma_1 + PE_{it}\gamma_2 + HC_{it}p_{hc,t}\gamma_3 + X_{it}\beta + e_{it} \quad (4)$$

In a reduced-form approach, we estimate equations that link stock market prices in period  $t$  ( $p_{sm,t}$ ) with individual  $i$ 's satisfaction in different domains  $j$  (financial, employment and overall):

$$S_{ijt} = p_{sm,t}f_j(\text{age}_i, z_{it}) + X_{it}\gamma_j + u_{ijt} \quad (5)$$

This approach allows for the relationship between stock market prices and satisfaction to differ by age and a set of characteristics  $z_{it}$  that includes exposure to the stock market, gender, and education level. We hypothesise that  $f_{\text{employment}}(\text{age}_i, z_{it})$  peaks for low educated young individuals with uncertain employment prospects, while  $f_{\text{financial}}(\text{age}_i, z_{it})$  peaks for middle-aged individuals with direct stock-market exposure. Given that males are more likely to participate in the labour market (see Figure 2), and are often the main generator of household wealth, we expect males to be more cognisant of the household's financial position, and more responsive to stock market changes. We verify this expectation using data from HILDA on who makes decisions in the household regarding "savings, investment and borrowing". Amongst cohabitating couples, based on both male and female responses, there are significantly more households in which the male makes the financial decisions than households in which the female is the decision maker.<sup>2</sup>

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<sup>2</sup> The gender difference in financial decision-making has also been discussed in an article that reports the latest statistics from the Commonwealth Bank's Wealthbeing Indicator. The statistics suggest that Australian men are much more likely to be focused on wealth creation than Australian females; males Wealthbeing score equals 29.2 compared to 4.7 for females (Money, May 2014).



Given the recent literature showing a negative effect of the GFC on mental health in the US and Europe, we also use health satisfaction (HS) and mental health (MH) as additional outcomes. Our expectation is that mental health, particularly symptoms such as anxiety, worry, and sleeplessness, may respond to a fall in the stock market for younger cohorts – through an expected drop in employment conditions – and for older cohorts – through an expected drop in their wealth. In contrast, we do not expect that physical health conditions such as diabetes, heart disease, and cancer, to be affected in the short-term. We use an indicator of a chronic health condition (CH) to test this expectation.

### **3. Data**

#### *3.1 HILDA Sample*

We use data from 12 waves of the Household, Income and Labour Dynamics in Australia Survey (HILDA), covering the period 2001-2012. HILDA is an annual nationally representative longitudinal survey that collects a wide-range of social and economic information at the individual and household level. Data is collected through a household questionnaire, person questionnaire, and a self-completion questionnaire.

An important issue, given our focus on the effects of stock market movements, is that the HILDA interviews do not take place evenly throughout the year. The vast majority of interviews (97%) have been undertaken in August (13.5%), September (50.9%), October (23.4%), November (7.5%) and December (1.7%). As we will describe in the next section, our main modelling strategy incorporates area-quarter fixed effects, and so the effects of the stock market on wellbeing are identified by comparing individuals interviewed in the same location and quarter. Therefore, we use only those observations from the third and fourth quarters. On a practical basis, we do not have enough observations in January (1.23%), February (1.37%), March (0.02%) and July (0.16%) to aid identification, and the data contains no individuals who were interviewed in April, May and June. It is also the case that those who are interviewed outside of the core quarters, are those households who have been difficult to interview.

We focus on individuals aged 25-75 years. Pooling the 12 waves of data provides 132,465 observations on 21,620 individuals. About 27% of individuals are observed in all 12 waves, and the average time in the panel is 6.12 waves. After dropping cases where we have missing satisfaction data for any of the four measures, and deleting the minority of individuals interviewed in January, February, March and July, we're left with 121,093 observations. After deleting a small number of cases where there is missing information on location or some key

individual characteristics such as marital status or education, we have a final working sample of 120,945 observations.

### *3.2. Measures of Wellbeing and Stock Market Prices*

In each wave, following extensive questions of individual demographic and socio-economic characteristics, respondents are asked about their satisfaction with various aspects of their life. Responses are given on an 11-point ordinal scale running from 0 (totally dissatisfied) to 10 (totally satisfied). In addition to asking about satisfaction with regard to “your financial situation”, “your employment opportunities” and “your health”, individuals are asked, “All things considered, how satisfied are you with your life?”.<sup>3</sup> Given the focus of many studies on mental health, we also use the mental health score derived from questions in the SF-36 scale, and we study physical health using an indicator of whether respondents report having a chronic health condition. The SF-36 questions are asked in the self-completion questionnaire each wave. Due to some non-response of this questionnaire, our sample is smaller (by around 8%) than for the satisfaction measures that are asked in the person questionnaire.

The HILDA has collected detailed wealth data, but only in 2002, 2006 and 2010, meaning that we cannot practically include interactions with wealth in the regression models. However, as part of the annual income questionnaire, individuals are asked if they obtained any income from dividends (around 53% report a positive amount in any wave of HILDA). We use this as a proxy for stock market exposure, and expect those who receive dividends to be more affected by stock market changes. We also test the robustness of the results using more direct information about whether any individual in a household owns shares, managed funds or property trusts (investments), using data from the first wealth module in which a household is observed. Just over 40% of respondents report being in a household that owns investments. These proxy variables suggest that the proportion of individuals with some exposure increases continually from age 25 to around age 65, and then declines thereafter. This is consistent with the stylised representation for Financial Capital (*FC*) in Figure 1.

The measure of stock market prices that we use is the All Ordinaries Index, which is the oldest index of shares in Australia, established in 1980. As a result of restructuring in 2000, this index encompasses the 500 largest listed companies by market capitalisation, accounting for over 98% of Australia’s total share market value. We use this index because it is the most widely reported aggregate indicator of stock market prices in the Australian media.

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<sup>3</sup> Respondents are also asked about their satisfaction with “The home in which they live”, “How safe they feel”, “Feeling part of your community”, “The neighbourhood in which you live”, and “The amount of free time you have”. We do not use these measures in this paper.

Our main stock market price measure is the average value of the index over four-weeks prior to the interview, but we also test the robustness of our results using one-week and three-month averages. Timing may matter because it is our expectation that very short-run changes in the stock market, such as by hour or even by week, are too frequent and noisy to affect the general population, while changes over the long run are not separable from general socioeconomic conditions. For the empirical analyses, following Ratcliffe and Taylor (2012), we have adjusted the index for inflation, although our main results are not sensitive to this decision. We also use the monthly average of the Dow Jones Industrial Average to test if Australians react to changes in the US stock market.

Figure 3 shows the monthly average value of the All Ordinaries Index over our data period 2001-2012. The value of the index increased sharply between 2002 and 2007, reaching a peak in November 2007 (at 6,873). However, by January 2008 it had fallen by around 24%, and by 54% by March 2009. This was followed by a bounce-back over the next six months with the index in the 4800's in November 2009. The following three-years saw a great deal of volatility in the index, and by the end of 2012 it was around the pre-GFC 2006 value. As noted, the HILDA respondents we use are interviewed in the 3rd and 4th quarters of each year, and the blue-shading in Figure 3 shows the timing and mass of HILDA observations in relation to the Index (the green shading shows the timing of the unused HILDA observations). It is clear that there is a large amount of variation in the stock market to use for identification over this period, to which we will return in Section 4.

## 4. Main Model and Results

### 4.1. Model

We estimate the impact of the Australian All Ordinaries Index ( $p_{sm,t}$ ) on wellbeing ( $S_{ijt}$ ) using linear regression models with area-quarter fixed effects. To estimate this fixed-effects (FE) model we demean the variables using the within-transformation. The demeaned model can be represented by:

$$S_{ijt} - \bar{S}_{jt} = (p_{sm,t} - \overline{p_{sm,t}})\delta_j + (X_{it} - X_t)\beta_j + e_{ijt}^* \quad (6)$$

where  $S_{ijt}$  is the  $j$ th measure of wellbeing (satisfaction or health) of individual  $i$  in area-quarter  $t$ , and  $\bar{S}_{jt}$  is the average  $j$ th wellbeing of all respondents in area-quarter  $t$ . As discussed in Section 3, our data is from 24 quarters (two quarters in each of the 12 waves), and we use 13

geographical areas across Australia: Sydney, balance of NSW, Melbourne, balance of Victoria, Brisbane, balance of Queensland, Adelaide, balance of SA, Perth, balance of WA, Tasmania, Northern Territory, and ACT. The term  $X_{it}$  is a vector of variables including gender, age, ethnicity, marital status, children, and education. We purposely do not control for any individual economic variables that could reasonably have been affected by stock market changes over one quarter, such as own employment or estimated savings.  $X_{it}$  also contains day-of-the-week and month-of-the-year dummy variables, as it has been shown that stock markets and wellbeing are influenced by the day of the week (Dubois and Louvet, 1996; Taylor, 2006) and by seasonality (Tefft, 2012).

We estimate equation (6) separately for different combinations of age and other key characteristics, such as gender and stock-market exposure, in line with the hypotheses in Section 2, i.e. the coefficients  $\delta_j$  for different age and demographic groups reflect particular values of  $f_j(\text{age}_i, z_{it})$ . The linear regression model is our main specification because the estimated coefficients are easily interpreted. The ordered-probit model is used to test the sensitivity of the results to the assumption that the 11-point wellbeing measures (0-10 point scale) are cardinal variables.

The demeaned representation of our regression model makes clear that identification of  $\delta_j$  (Equation 6) is driven by comparing the life satisfaction of individuals interviewed in the same location and quarter, but who recently observe different average stock market index values. This approach is valid if differences in the All Ordinaries Index across respondents interviewed in the same quarter are unrelated to individual circumstances. In particular, we assume that there is no systematic re-scheduling of HILDA interviews in response to changes in the stock market. Importantly, this empirical approach means that the estimated stock market effects are not confounded by medium- and long-term macroeconomic events that occur Australia-wide and that occur in certain areas only. For example, upward and downward movements in the economy, which may positively and negatively influence wellbeing, are captured by the area-quarter fixed-effects. Similarly, political and social events, such as a change of government, will be captured. A further implication of the empirical approach is that  $\delta_j$  does not reflect long-term stock market effects, and should strictly be interpreted as the short-term wellbeing effect of stock market changes, akin to the argument by Deaton (2012) and others that stock market fluctuations can cause short-run anxiety about the future.

Figure 4 shows the variation in the stock market index that we use for identification. It shows, within all of the available area-quarters, the largest absolute difference between 30-day

averaged values of the inflation-adjusted All Ordinaries Index, as well as whether the index is trending positively or negatively during the quarter. It is clear that within-quarter movements of around 300 index points are common over the 2001-2012 period. These large within-quarter movements occur in quarters with positive and negative trends; though, overall the index is trending upwards in most quarters (17 of 24 quarters). A clear outlier during our sample is the substantial variation during the 4th quarter of 2008. During this quarter, the 30-day averaged value of the Index fell by around 1,100 points. In the next section we test the sensitivity of our results to the omission of this quarter from the analysis.

#### *4.2. Results for Overall Life Satisfaction*

Our main results from life satisfaction models are presented in Table 1, which shows the coefficient estimates for stock market changes from 11 separate models. These estimates are each multiplied by 100 so that the coefficients are the predicted effect of a 100-point change in the index. Results are presented for the pooled sample, and separately by gender. Model 1 shows that increases in the one-month mean of the All Ordinaries Index significantly increases life satisfaction; though the magnitude of the effect is modest, with a one-hundred point increase leading to a 0.016 (on a 0-10 scale) rise in satisfaction. We observe a number of monthly increases in the index of around 300 points, which the model predicts to increase life satisfaction by 0.048 ( $= 0.016 * 3$ ). For a 1,000 point increase life satisfaction is predicted to increase by 0.16 ( $= 0.016 * 10$ ), which would be about one-quarter greater in magnitude than the estimated gender gap in life satisfaction (-0.141 for males) or one-third of the married/cohabiting premium (+0.562). Notably, the life satisfaction effect is more evident for males, for whom we find a significant positive estimate (0.021), in contrast to the insignificant estimate for females (0.009).<sup>4</sup>

Models (2) and (3) test whether individuals' life satisfaction responds differently to other stock market information during the past month. In particular, we test the effects of the one-month maximum and the one-month minimum, which naturally are highly correlated with the one-month average. The estimated coefficients suggest that life satisfaction is similarly affected by the past-month maximum index value as it is by the past-month mean index value: the pooled estimate equals 0.019 and the male estimate equals 0.023. Interestingly, estimates for the past-month minimum are weaker: the pooled estimate equals 0.008 and the male estimate equals 0.016.

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<sup>4</sup> Results from ordered probit models are consistent with the results shown in Table 1. For example, a change in the one-month mean of the All Ordinaries Index is estimated to have a statistically significant effect on male life satisfaction (1% level), but a statistically insignificant effect on female life satisfaction.

As already noted, a number of studies have found that wellbeing reactions to stock market changes occur almost immediately. Consequently, Models (4) and (5) change the length of time that the stock market index is averaged over. While our main models all use a monthly mean, these Models replace this measure with a one-week and three-month mean, respectively. The estimated effects of one-week mean changes in the stock market are much weaker than the estimated effects of one-month mean changes; although the point estimate for males (0.012) is statistically significant at the 10% level. One explanation is that variation at the weekly level consists overwhelmingly of small changes that people do not notice. The results are similarly weak when using three-month mean changes; the point estimate for the pooled sample (0.016) is statistically significant at the 10% level. One explanation for this finding is that a three month period aggregates voluminous information that will have been adapted to or forgotten. Given this set of results, we maintain the use of the monthly average as the most appropriate measure, but we are aware that this is not a theory driven choice.

While the All Ordinaries Index is widely reported in the Australian media, movements in the US stock market are also regularly reported. Model (6) includes the Dow Jones Industrial Index (DJIA) instead of the All Ordinaries index, and we find a significant (at the 10% level) positive association with life satisfaction, but again only for males. However, this effect (0.006 for males) is only around one-quarter the size of that found using the Australian index (0.021). If a model is estimated with both indices, only the Australian index has a statistically significant effect on wellbeing. These results suggest that the wellbeing of Australians is more closely aligned with the Australian stock market than the US stock market.

In Models (7)-(9) we include area-month fixed effects, rather than area-quarter fixed effects. This means that identification is now driven by differences between individuals interviewed within the same month and who reside in the same area, but who experience different values for the stock market index due to their exogenous assignment to interview date within a month. Results from the one-month mean and one-month maximum models (7 and 8) provide statistically significant estimates around one-third larger than for the area-quarter fixed-effects specification, but the estimates for females remain statistically insignificant. It is unlikely that there are unobserved within area-month changes that are correlated with stock market changes. Therefore, Models (7)-(9) provide extra assurance that the life satisfaction responses we have identified are due to changes in the stock market rather than other

macroeconomic changes.<sup>5</sup>

The final models in Table 1 include measures of volatility – the one-month variance and one-month range – in addition to the one-month mean. These terms are added because it's possible that individual wellbeing responds negatively to market volatility; given its relationship with market risk. The volatility terms are not significantly related to male life satisfaction, however, they are positively associated with female life satisfaction; the one-month range coefficient is statistically significant at the 10% level. It is unclear what may be driving this surprising positive relationship. Importantly, the estimated effects of the one-month mean are unaffected by including the one-month variance or the one-month range.

Table 2 tests the robustness of the results using subsamples defined by stock market exposure and by calendar years. For all models, the stock market measure we use is one-month mean of the All Ordinaries Index. Models 1-4 are based on subsamples defined by our two indicators for exposure to the stock market (see Section 3 for details). The results are in line with expectations, with the stock market only affecting life satisfaction for individuals who report having an investor in the household (mostly themselves or their spouses), and for individuals who report receiving dividend income. Again, this effect is only found for males. The effect of an increase in the All Ordinaries Index is about 50% larger (0.032) for those with an investor in the household than for the pooled sample of males (0.022). Models (5) and (6) further explore the 'investor in household' effect by disaggregating this sub-sample in to groups with total investment values above and below the median (\$18,300). The estimates indicate that increases in the value of the All Ordinaries Index have a larger wellbeing effect for low value investors than for high value investors.

Finally, we split the sample between 2001-06 and 2007-12. This is partly driven by Deaton's (2012) suggestion that the GFC established the stock market as the prime signal of future economic activity amongst the general population. As shown in Figure 3, the first period was characterised by an almost continuous increase in the average stock market index, in contrast to the more volatile later period. Importantly, we find no significant effect of stock market changes on life satisfaction using the 2001-06 data, but a highly significant (at the 1% level) effect for 2007-12 for both the pooled sample and for males separately. Interestingly, this latter effect is not driven by the large drop in the All Ordinaries Index during the fourth quarter of 2008. The estimated effects become even larger if we omit this one quarter from the

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<sup>5</sup> We use area-quarter fixed-effects in our main specifications rather than area-month fixed-effects because area-month sample sizes become small when we estimate models for some subgroups defined by age and gender. This reduction in sample size inflates the standard errors; although, the point estimates are little affected.

sample.<sup>6</sup>

#### 4.3. Results for Separate Domains of Wellbeing

In Table 3 we more directly test the predictions from the stylised Lifecycle Model in Section 2. Results are reported for six age-gender subgroups and for six wellbeing measures (overall life satisfaction, financial satisfaction, employment satisfaction, health satisfaction, mental health and chronic health). Starting with overall life satisfaction (Models 1-3), it appears that an increase in the stock market index is significantly linked to improved outcomes for both young males (0.030) and females (0.031), and in particular for middle-aged males (0.046). No effect is found for the older cohort. The same pattern is found for male financial satisfaction, though the estimates are 50% larger (0.051 and 0.061 for the young and middle-aged). In contrast, we find no significant effect of stock market changes on the financial satisfaction of females. Young males appear to be particularly affected in terms of their employment satisfaction (0.048), whereas this is not the case for older respondents or females of any age.<sup>7</sup> In results now shown, we find the effect of stock market changes on the employment satisfaction of low-educated young males to be especially large (0.074). This result may be driven by the positive association between low education and unstable employment.

Consistent with the financial and employment satisfaction results, we see that only male health satisfaction is impacted by stock markets, with the point estimates larger for middle-aged (0.050) than young males (0.031). Similarly, there is evidence that stock market increases positively and significantly affect the mental health of young (0.403) and middle-aged (0.357) males. If we multiple the estimate for young males by a 1,000 point drop in the stock market index, the decline in mental health is about one-quarter of one standard deviation. As expected, we find no evidence that chronic health is significantly affected by the stock market in the short-term.

Overall, the differential responses for financial and employment satisfaction for males across the three age groups, and corresponding results for mental health, are broadly consistent with the stylised lifecycle model we presented in Section 2. In particular, it appears that stock

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<sup>6</sup> A possible explanation for this finding is that policy announcements during this quarter, which were in direct response to the GFC, were shifting financial and employment expectations in ways that countered the significant falls in the All Ordinaries Index. For example, the government announced the guarantee of bank deposits and a large economic stimulus package, and official interest rates were dropped from 7% in September to 4.25% in December.

<sup>7</sup> HILDA also asks respondents who are employed, what is the percentage chance that they will lose their job in the next 12 months. If we estimate the probability of respondents answering a positive value to this question (40% report that there is some chance) we find that for young men a 100-point increase in the stock market index is predicted to reduce the subjective probability of a positive value by 1.1 percent ( $t$ -stat=1.85). In contrast, a significant effect is not found for males aged 45-60 (0.5 percent,  $t$ -stat=0.76).



market movements act as a leading indicator of employment prospects for young males, while for the middle-age cohort stock market movements appear to be more likely to reflect expected changes in wealth.

## 5. Conclusion

In this paper we have contributed to a growing literature that focuses on better understanding the drivers of subjective wellbeing. In particular, we have used movements in stock market prices as a form of exogenous variation in the economic environment, and modelled their impact on the subjective wellbeing and health of a sample of Australians. Data are drawn from the Household, Income and Labour Dynamics in Australia Survey (HILDA), which covers the years 2001-2012; a period containing substantial stock market volatility. We attempt to gain accurate estimates by comparing individuals within the same quarter and residing in the same area, but who observe different stock market changes due to the assumed exogenous assignment of interview date. This approach rules out the possibility that changes in reported wellbeing and health are being driven by macroeconomic factors other than stock market prices. Following the US literature that shows wellbeing reacts quickly to stock market changes, and that individuals adapt quickly to financial shocks, we focus exclusively on the short-term impacts. Therefore we do not consider longer-term changes to investments, consumption or savings.

Our main findings are that stock market increases are positively and significantly related to life satisfaction; though the size of the effect is modest. As expected, we find that this relationship is larger for those who have greater exposure to financial markets. Importantly, this effect is only found for males. Over our sample period we observe a number of quarterly movements in the monthly averaged stock market index of between 200-300 index points, and a fall in the index of around 1,100 points observed around October 2008. The effect of such a large fall on male life satisfaction is predicted by our model to be around one-quarter greater in magnitude than the estimated gender gap in life satisfaction (-0.141 for males) or about one-third of the married/cohabiting premium (+0.562). In line with a simple lifecycle model of asset accumulation, the results suggest that for young men stock market index acts as a signal for employment prospects, whereas for middle-aged (pre-retirement) men the market affects financial satisfaction. We find no evidence that stock market impact on female subjective wellbeing or health.

Overall, this paper has added to the existing international literature by providing additional evidence using Australian data that individuals' assessments of their own health and

wellbeing are significantly affected by plausibly exogenous economic-related shocks.

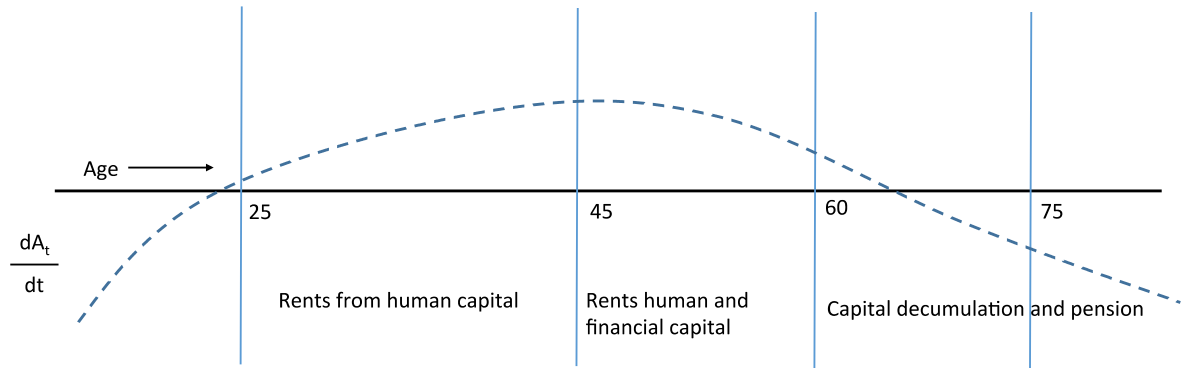
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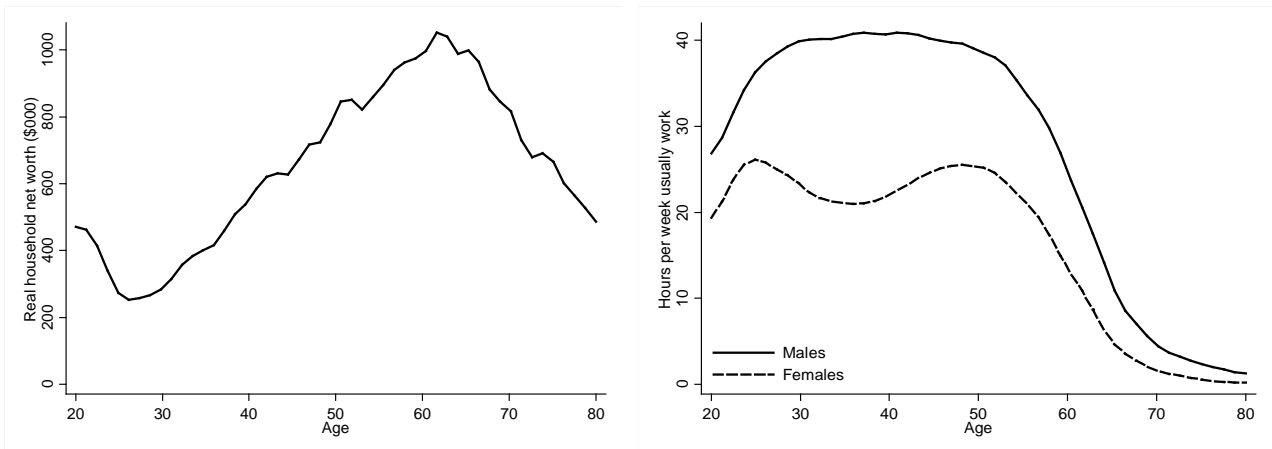
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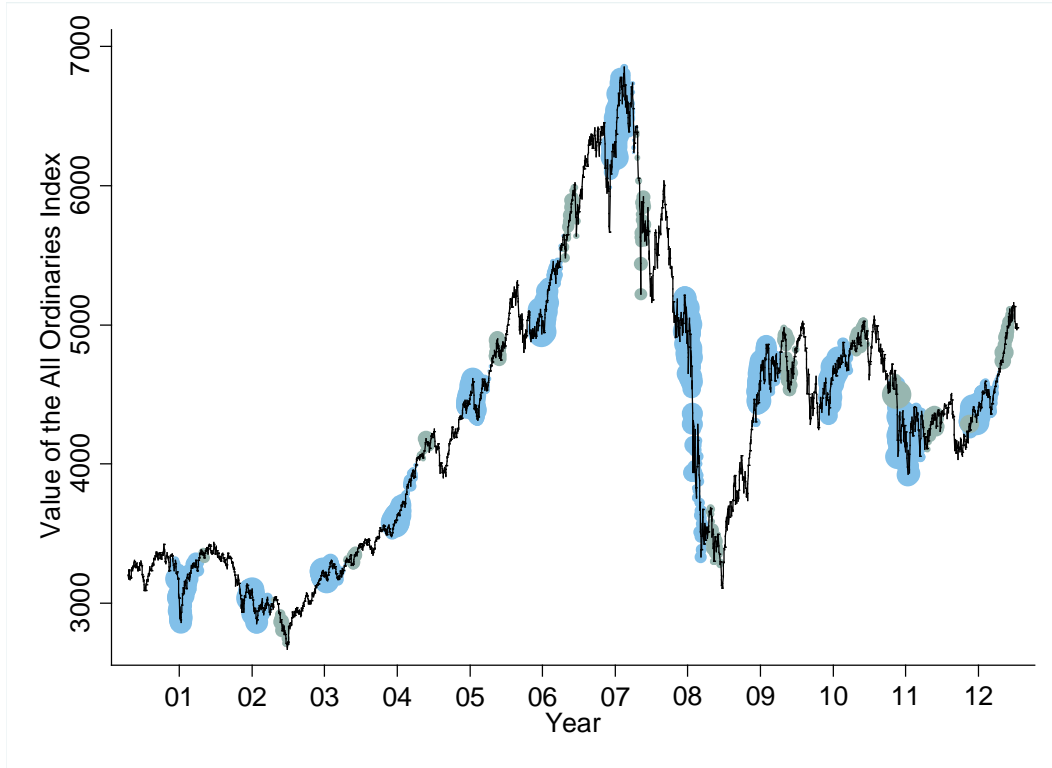
**Figure 1: Changes in Assets over the Lifecycle: A Standard View**



**Figure 2: Non-Parametric Regression Estimates of the Age Profiles in Wealth and Hours Worked**



**Figure 3: HILDA Sampling and the All Ordinaries Index**



**Figure 4: Quarterly Variation in the Monthly-Averaged Inflation-Adjusted All Ordinaries Index**

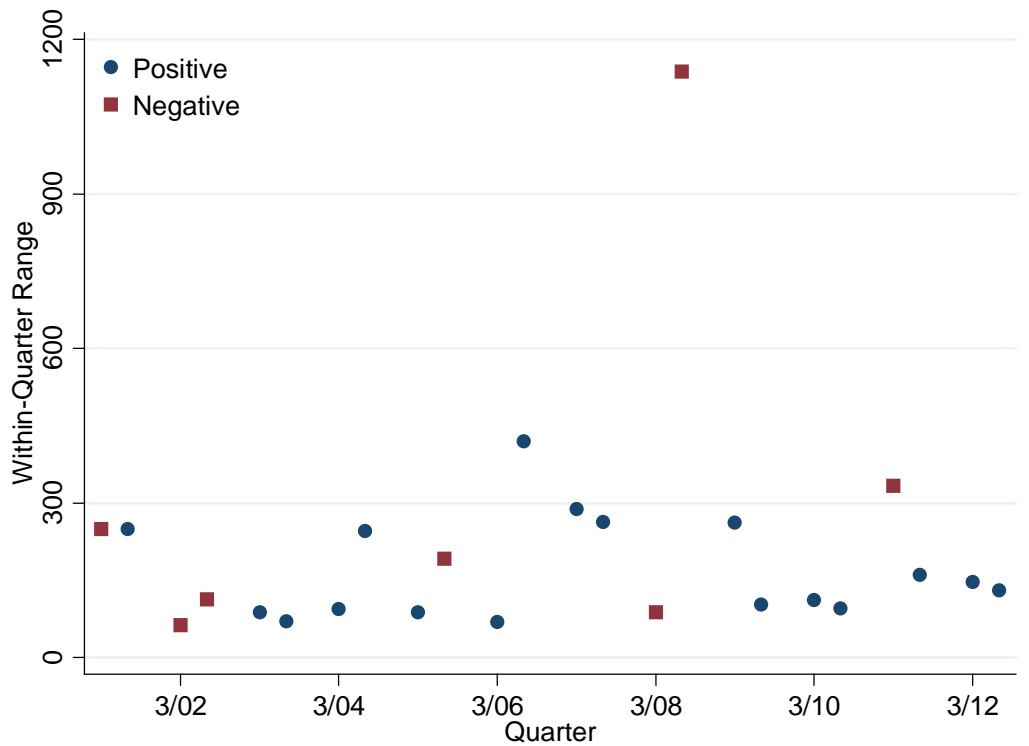


Table 1: Effects of Changes in Stock Market Outcomes on Life Satisfaction

	All		Male		Female	
	$\delta$	<i>t</i> -stat	$\delta$	<i>t</i> -stat	$\delta$	<i>t</i> -stat
<i>Alternative Measures of Stock Market Outcomes</i>						
(1) All Ords 1-month mean	0.016 <sup>***</sup>	2.58	0.021 <sup>**</sup>	2.49	0.009	1.12
(2) All Ords 1-month maximum	0.019 <sup>***</sup>	2.89	0.023 <sup>**</sup>	2.46	0.015	1.60
(3) All Ords 1-month minimum	0.008 <sup>*</sup>	1.77	0.016 <sup>**</sup>	2.37	0.001	0.15
(4) All Ords 1-week mean	0.004	0.80	0.012 <sup>*</sup>	1.69	-0.004	-0.53
(5) All Ords 3-month mean	0.016 <sup>*</sup>	1.77	0.019	1.46	0.012	0.98
(6) DJIA 1-month mean	0.004 <sup>*</sup>	1.82	0.006 <sup>*</sup>	1.82	0.002	0.69
<i>Specifications with Area-Month Fixed Effects</i>						
(7) All Ords 1-month mean	0.021 <sup>**</sup>	2.03	0.028 <sup>*</sup>	1.94	0.014	0.99
(8) All Ords 1-month maximum	0.025 <sup>**</sup>	2.07	0.038 <sup>**</sup>	2.16	0.015	0.86
(9) All Ords 1-month minimum	0.006	1.02	0.013	1.52	-0.000	-0.01
<i>Specifications with Added Variance Outcomes</i>						
(10) All Ords 1-month mean	0.017 <sup>***</sup>	2.72	0.020 <sup>**</sup>	2.23	0.013	1.53
All Ords 1-month variance	0.006	0.83	-0.006	0.53	0.016	1.62
(11) All Ords 1-month mean	0.018 <sup>***</sup>	2.82	0.021 <sup>**</sup>	2.37	0.014	1.56
All Ords 1-month range	0.008	1.16	-0.001	0.07	0.015 <sup>*</sup>	1.69

*Notes:* All figures relate to the estimated coefficient on the measure of stock market changes. |*t*-stat| indicates absolute *t*-statistics. Models (1)-(6) and (10)-(11) include 312 area-quarter fixed effects. Models (7)-(9) include 156 area-quarter fixed effects. Each model includes controls for age, age-squared, gender, marital status, immigrant status, non-English speaking country of origin, highest education, state-month unemployment rate, and month and day of interview. \*\*\* indicates significance at the 1% level, \*\* at the 5% level and \* at the 10% level.

Table 2: Subsample Analysis of the Effects of Changes in the Monthly Meaned All Ordinaries Index on Life Satisfaction

	All		Male		Female	
	$\delta$	<i>t</i> -stat	$\delta$	<i>t</i> -stat	$\delta$	<i>t</i> -stat
<i>Stock Market Exposure</i>						
(1) Investor in household	0.022 <sup>***</sup>	2.79	0.033 <sup>***</sup>	2.93	0.011	1.00
(2) Individual receives dividend income	0.020 <sup>**</sup>	2.40	0.021 <sup>*</sup>	1.86	0.016	1.32
(3) No investor in household	0.004	0.37	0.015	1.02	-0.009	-0.59
(4) No dividend income	0.013	1.44	0.019	1.47	0.004	0.37
(5) Low value investor	0.031 <sup>***</sup>	2.71	0.037 <sup>**</sup>	2.18	0.023	1.42
(6) High value investor	0.015	1.31	0.029 <sup>*</sup>	1.83	-0.001	-0.06
<i>Calendar Years</i>						
(11) Time Period 2001-2006	0.001	0.06	-0.007	0.34	0.009	0.39
(12) Time Period 2007-2012	0.020 <sup>***</sup>	2.97	0.028 <sup>***</sup>	2.94	0.011	1.20
(13) Time Period 2007-2012 less Q4/2008	0.036 <sup>***</sup>	3.57	0.042 <sup>***</sup>	2.82	0.030 <sup>**</sup>	2.20

*Notes:* All figures relate to the estimated coefficient on changes in the All Ordinaries Index 1-month mean. |*t*-stat| indicates absolute *t*-statistics. All models include area-quarter fixed effects, and controls for age, age-squared, gender, marital status, immigrant status, non-English speaking country of origin, highest education, state-month unemployment rate, and month and day of interview. \*\*\* indicates significance at the 1% level, \*\* at the 5% level and \* at the 10% level.

Table 3: Effects of Changes in the Monthly Meaned All Ordinaries Index on Satisfaction Domains by Age and Gender (2007-2012)

	Male		Female	
	$\delta$	<i>t</i> -stat	$\delta$	<i>t</i> -stat
<i>Life Satisfaction</i>				
(1) Age 25-44	0.030**	2.21	0.030**	2.23
(2) Age 45-60	0.046***	2.65	0.004	0.24
(3) Age 61-75	0.000	0.02	-0.012	0.51
<i>Financial Satisfaction</i>				
(4) Age 25-44	0.051**	2.52	-0.012	0.60
(5) Age 45-60	0.061***	2.58	0.028	1.12
(6) Age 61-75	-0.008	0.24	-0.022	0.64
<i>Employment Satisfaction</i>				
(7) Age 25-44	0.048***	2.58	0.034	1.58
(8) Age 45-60	0.021	0.82	0.009	0.30
(9) Age 61-75	-	-	-	-
<i>Health Satisfaction</i>				
(10) Age 25-44	0.030*	1.80	0.011	0.61
(11) Age 45-60	0.050**	2.27	-0.007	0.30
(12) Age 61-75	0.028	0.89	0.003	0.10
<i>Mental Health Score (0-100)</i>				
(13) Age 25-44	0.393**	2.05	-0.053	0.30
(14) Age 45-60	0.370*	1.85	-0.173	0.80
(15) Age 61-75	-0.236	0.91	-0.050	0.18
<i>Chronic Health Condition</i>				
(16) Age 25-44	-0.002	0.57	0.001	0.29
(17) Age 45-60	-0.002	0.41	-0.006	1.17
(18) Age 61-75	0.008	1.00	0.007	0.87

Notes: All figures relate to the estimated coefficient on changes in the All Ordinaries Index 1-month mean. |*t*-stat| indicates absolute *t*-statistics. All models include area-quarter fixed effects, and controls for age, age-squared, gender, marital status, immigrant status, non-English speaking country of origin, highest education, state-month unemployment rate, and month and day of interview. \*\*\* indicates significance at the 1% level, \*\* at the 5% level and \* at the 10% level.