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Abstract

This paper analyzes the relationship between individuals' locus of control and their decisions to exercise regularly, eat well, drink moderately, and avoid tobacco. Our primary goal is to assess the relative importance of the alternative pathways that potentially link locus of control to healthy habits. We find that individuals with an internal locus of control are more likely to eat well and exercise regularly. This link cannot be explained by the extent to which they are future-orientated and value their health, however. There are important gender differences in explaining the link between perceptions of control and healthy habits. Men with an internal locus of control expect to have higher health returns to their investments in diet and exercise. In contrast, women with an internal locus of control maintain healthy habits because they derive greater satisfaction from those activities than women with external control tendencies.

JEL classification: I14, J3, C18

Keywords: Non-cognitive skills, locus of control, health behavior, healthy diet, exercise

1 Introduction

The greatest current potential for improving the health of the American people is to be found in what they do and don't do for themselves (Fuchs, 1974, p. 54-55).

The health risks that individuals face are greatly influenced by the health behaviors they adopt. Risky sexual behavior and illicit drug use increase the risk of HIV and sexually transmitted diseases, for example, while smoking, physical inactivity, and unhealthy diets result in elevated risks of high blood pressure, diabetes, obesity, high cholesterol, and heart disease. As many as half of all deaths in the United States result from externally modifiable health factors (see McGinnis and Foege, 1993; Mokdad et al., 2004, 2005), while consumption behavior (e.g. food, alcohol, tobacco, and illicit drugs) and physical inactivity dramatically increase both morbidity and mortality risks in high-income countries around the world (World Health Organisation, 2009). It is not surprising that economic research is increasingly centered on understanding the decisions that individuals make regarding their own and others health.

Our objective is to contribute to this expanding literature by examining the link between individuals' locus of control and their health behavior – in particular, their decisions to exercise regularly, eat well, drink moderately, and avoid tobacco. Locus of control is a psychological concept reflecting an individual's overall expectations about the internal versus external control of reinforcement (Rotter, 1966). Those who believe that what happens in life stems mainly from their own actions have an "internal" locus (sense) of control, while those who believe that life's outcomes are mainly due to external factors (e.g. other people, fate, or luck) have an "external" locus (sense) of control (see Gatz and Karel, 1993). A small, but rapidly growing, literature demonstrates that individuals' perceptions of control are intricately linked to the human capital investments they make. Feinstein (2000) and Flouri (2006), for example, find that internal locus of control at age 10 is strongly related to educational attainment at age 26. Coleman and Deleire (2003) argue that locus of control affects educational attainment primarily by influencing the expected wage returns to education. Individuals' expected returns to job search also appear to be linked to their locus of control leading those who are more internal to search more intensively (Caliendo et al., 2010; McGee and McGee, 2011; McGee, 2010). Much of the link between locus of control and labor market outcomes, e.g. wages, may occur

indirectly through the decision to acquire productive skills (Heckman et al., 2006; Piatek and Pinger, 2010). Finally, self-efficacy is negatively associated with alcohol consumption and positively associated with exercise (Chiteji, 2010).[1]

We are particularly interested in the following questions: What is the relationship between perceptions of control, diet and exercise? Do those with an internal locus of control adopt healthier life styles? What are the pathways through which locus of control influences health behavior? What are the policy options for promoting better health outcomes? We address these questions by following Grossman (2000, 1972) in modeling diet and exercise as important health investments. This conceptual framework is used for (i) identifying the mechanisms through which locus of control may influence health behavior and (ii) isolating empirically testable predictions. We take advantage of panel data from the Household, Income and Labor Dynamics in Australia (HILDA) Survey to investigate the relationship between individuals' diet and exercise decisions and their locus of control. HILDA data are ideal for our purposes because they provide detailed measures of locus of control, eating patterns, and exercise behavior for a large, nationally-representative sample. The data also allow us to control for many factors, including other non-cognitive skills, that may be related to both locus of control and health behaviors.[2]

Developing a deeper understanding of the relationship between individuals' perceptions of control and their investment in maintaining a healthy lifestyle is critical for a number of reasons. First, the dramatic increase in obesity over the past thirty years constitutes a major public health problem in countries the world over (World Health Organisation, 2009). Obesity is associated with elevated mortality, increased morbidity, higher medical costs, and lower productivity (Ruhm, 2010). Understanding individuals' eating patterns and exercise habits is central to understanding obesity since weight gain occurs when calories consumed exceed calories expended. Second, standard economic models based on utility maximization appear to be limited in explaining the rapid and continuing rise in obesity (Ruhm, 2010). Thus, there is a need to accommodate the role of non-cognitive skills (including locus of control), risk preferences, biological and genetic influences, and bounded rationality in driving decisions about diet, exercise, and a range

[1] Judge et al. (2002) compare the closely related psychological concepts of locus of control, self efficacy, neuroticism, and self-esteem, and conclude that they may be markers of the same higher order concept.

[2] Conscientiousness, for example, has been shown to be correlated with the demand for preventive care and the avoidance of risky health behaviors. See Bogg and Roberts (2004) for a meta analysis and Lodi-Smith et al. (2010) for recent evidence on conscientiousness and health behaviors.

of other health behaviors. Third, although there has been convergence in men's and women's investments in many forms of human capital – in particular, educational attainment and labor market skills – there remains a persistent gender gap in many health behaviors including eating habits (Baker and Wardle, 2003; Wardle et al., 2004). The source of these gender differences is not well understood raising questions about the extent to which gender differences in perceptions of control contribute to the gender gap in men's and women's decisions regarding their health. Finally, policies designed to stem the obesity epidemic frequently focus on providing information about the costs and benefits of specific food choices or exercise regimes. The provision of information, however, often appears to have perverse effects or to be less effective than alternative policies that rely on insights from behavioral economics (Downs et al., 2009; Just, 2006). In short, while consumer information is almost certainly a necessary prerequisite for changing consumption patterns, it does not appear to be sufficient. Consumers must also be willing and able to act on the information they receive. Evidence suggests that individuals' objective knowledge of health risks and responsiveness to that information are both related to their locus of control (Crisp and Barber, 1995).

We find that individuals with an internal locus of control are more likely to eat well and exercise regularly. This link cannot be explained by the extent to which they are future-orientated and value their health, however. There are important gender differences in explaining the link between perceptions of control and healthy habits. Men with an internal locus of control expect to have higher health returns to their investments in diet and exercise. In contrast, women with an internal locus of control maintain healthy habits because they derive greater satisfaction from those activities than women with external control tendencies.

The outline of the paper is as follows. In Section 2 we briefly review the literature in psychology and economics which informs our understanding of individuals' decisions to exercise regularly, eat a healthy diet, and avoid alcohol and tobacco. In Section 3, we outline the conceptual framework we use to derive a series of testable hypotheses explaining why those with an internal locus of control might invest more in their health. The details of our data are discussed in Section 4. In Section 5, we systematically present the estimation framework used to test each hypothesis as well as our results. Finally, our conclusions and suggestions for future research are discussed in Section 6.

2 The Evidence on Healthy Lifestyles

Unlike economists, health psychologists have devoted considerable effort to analyzing the impact that perceptions of control have on health behaviors. The theoretical foundations underpinning this work stem from: i) the Health Belief Model; ii) Social Cognitive Theory; and iii) the Theory of Planned Behavior. All three postulate that health decisions are based on personal cognition or beliefs. In particular, the first two incorporate self-efficacy (belief in one's own ability) (Rosenstock et al., 1988; Bandura, 1986), while the latter rests on individuals' perceived behavioral control (Ajzen, 1991). These models have been used to both predict health behavior and to design health interventions.

Psychologists have historically been divided on whether individual differences in perceived control are trait-like (are stable facets of individuals' personalities) or state-like (are dependent on the situations in which individuals find themselves) (Wallston et al., 1987).[3] It is perhaps not surprising that early work relating Rotter's (1966) uni-dimensional, generalized locus of control scale to health behavior quickly led to the development of multi-dimensional, domain-specific locus of control measures.[4] One of the most prominent of these is the Multi-dimensional Health Locus of Control (MHLC) scale developed by Wallston et al. (1978) which measures the extent to which individuals believe their health is (i) the result of their own actions; (ii) under the control of powerful others; or (iii) due to fate or chance.

On balance, however, the results of this extensive research effort have been disappointing with health-related locus of control measures often only weakly and inconsistently associated with related health behaviors. In particular, Steptoe and Wardle (2001) review the psychological literature and conclude that: (i) regular physical exercise is sometimes – though not always – positively associated with having an internal locus of control and negatively associated with chance and powerful others locus of control; and (ii) individuals' healthy food choices are also not consistently related to their health locus of control.[5] As the authors note, it is difficult to know whether these results reflect the genuine state of affairs or represent a statistical artifact. In particular, small, non-representative sam-

[3] Perceived behavioral control, for example, is related to the perceived difficulty of a specific behavior, while locus of control is a general skill that is thought to be stable across situations (Ajzen, 1991).

[4] See Norman et al. (1998), Marshall (1991), and Steptoe and Wardle (2001) for reviews of the psychology literature linking locus of control to health behavior.

[5] AbuSabha and Achterberg (1997) and Gale et al. (2008) reach similar conclusions.

ples have limited both statistical power and external validity, while the frequent use of cross-sectional data has restricted attention to statistical associations rather than causal inference. A limited number of randomized-control trials have proven more useful by suggesting that interventions targeting self-efficacy can be effective in changing behavior (see Luszczynska et al., 2007).

There remains a lot we do not yet understand about the link between perceived control and health behaviors. The evidence linking locus of control to health outcomes is more consistent, however. There appears to be a strong correlation between external control tendencies and (i) poor self-assessed health (Gale et al., 2008; Mackenbach et al., 2002); (ii) the incidence of depression in students or young adults (Gale et al., 2008; Burger, 1984); and (iii) anxiety in children (Nunn, 1988). Internal control beliefs are also associated with a lower risk of myocardial infarction (Sturmer et al., 2006; Rosengren et al., 2004) and mortality (Bosma et al., 1999).

It is also clear that there are important differences in the health behaviors that men and women adopt. In a recent review, Courtenay (2000a) concludes that across more than 30 health behaviors ranging from seat belt use, smoking, medical visits, and nutrition, women consistently make healthier choices than do men. In particular, men and boys (i) eat fewer fruits and vegetables; (ii) eat fewer high-fiber foods; (iii) eat fewer low-fat foods; and (iv) consume more soft drinks than do women and girls (see Courtenay, 2000a; Wardle et al., 2004, and the references therein). Psychologists have proposed a number of explanations for these gender differences in health behavior including gender roles which link 'maleness' to risk-taking and 'femaleness' to protective behaviors (Courtenay, 2000b) and gender differences in the ideal body image, health knowledge, tastes, and enthusiasm for healthy eating generally (see Furnham and Greaves, 1994; Wardle et al., 2004). Moreover, women are more likely than men to (i) be dissatisfied with their body images; (ii) suffer from depression and low self-esteem as a result; and (iii) be dieting in order to lose weight (Furnham and Greaves, 1994). Importantly, Furnham and Greaves (1994) find that individuals' perceived control towards achieving their ideal body shape is an important predictor of their diet and exercise behavior as well as their body satisfaction.

Unlike psychologists, economists have been slow to link perceptions of control to investments in health. To our knowledge, there is only one other economic analysis of perceived control on health behavior. Chiteji (2010) motivates her empirical analysis

by extending a standard Grossman (2000, 1972) model of health investments to allow non-cognitive skills (specifically, future orientation and self-efficacy) to affect individuals' discount rates. Her reduced-form analysis indicates that self-efficacy is associated with lower alcohol consumption and more physical exercise. She does not, however, formally test the implications of her theoretical model and so provides no guidance on the specific mechanism underlying the link between perceived control and health behavior.

It is more common for economists to focus their attention on the price determinants of food consumption and, to a lesser extent, physical exercise. The overall price effect includes not only the market price of consuming certain products, but also the time costs involved in activities such as meal preparation and exercising. Both are important in understanding why healthy behavior appears in general to be counter-cyclical (see Cawley and Ruhm, 2011, and the references therein). Radically falling money and time costs of preparing meals since the technological advances of the 1960s are often thought to be an underlying cause of increased obesity rates (Cutler et al., 2003). In contrast, Ruhm (2010) notes that body weight has continued to increase even though the rapid decline in food prices ended in the 1980s. He instead argues that biological influences need to be incorporated into models of food consumption.

Our review highlights the value in revisiting the link between perceived control and health behaviors from an economic rather than a psychological perspective. The use of large-scale, nationally-representative data to investigate the links between generalized locus of control and the decision to eat well and exercise regularly complements the existing psychological literature in this area.[6] Moreover, there is also a great deal to be gained from extending standard economic models of health behaviors to accommodate the multiple pathways through which individuals' locus of control influences their health behaviors. This is an important step in developing an understanding not only of whether locus of control matters for investments in health, but why it matters.

[6]See Wallston et al. (1978) who point to the value of both trait (i.e. generalized) and state (i.e. domain-specific) approaches to understanding perceived control. Much of the psychology literature, however, has focused on domain-specific measures.

3 Conceptual Framework

We begin with a simple conceptual framework in which health behaviors represent a form of human capital investment. Individuals adopt specific health behaviors in order to increase their stock of health capital which in turn provides both direct consumption benefits and greater earnings potential.

Specifically, following Grossman (1972, 2000), let an individual's discounted, multi-period utility be given by:

$$U = U_1(C_1, L_1, H_1) + \rho U_2(C_2, L_2, H_2), \tag{1}$$

where U is a concave function in its arguments; H_t is the stock of health in time period $t \in \{1, 2\}$; ρ is the discount factor; C_t is an aggregated consumption good; and L_t is leisure. Health stocks are measured in terms of the number of days that individuals are in good health.

Healthy days are assumed to provide consumption benefits and therefore have a direct effect on individuals' utility. An individual's health stock also has implications for his earnings since it determines the amount of time he has available for labor market work. Health investments (and hence health stocks) are endogenous. Individuals make investments in their health – i.e. adopt specific health behaviors – in order to increase their utility and their earnings potential. Specifically, an individual's health stock in period 2 (H_2) is given by:

$$H_2 = I_1 + (1 - \delta)H_1, \tag{2}$$

where I_1 is an individual's gross health investment in period 1; δ is the depreciation rate of individuals' period 1 health stock; and $0 < \delta < 1$.

Individuals choose their health investment in order to maximize (1) subject to the following inter-temporal budget constraint:

$$y + wH_1 + \frac{w}{1+r}H_2 = pC_1 + wL_1 + kI_1 + \frac{1}{1+r}\Big[pC_2 + wL_2\Big]. \tag{3}$$

where y is unearned income; w is the market wage; k is the price of health investments; p is the price of the aggregated consumption good; and r is the discount rate.

This framework points to a number of mechanisms which potentially link individuals' decisions to invest in their own health to their perceived control. To illustrate ideas, let θ be a parameter reflecting an individual's perceived control with higher values denoting a more internal locus of control.[7] How might θ affect individuals' decisions to engage in a healthy lifestyle?

First, locus of control may constitute a preference parameter.[8] In the simple framework outlined above, individuals only derive consumption benefits from being in good health. They do not derive direct utility from the behaviors they undertake to maintain their health. This simplification seems quite reasonable when we have in mind investments in preventative medical care, e.g. dental visits or immunizations, but is overly restrictive when we consider certain lifestyle choices, e.g. good diets and exercise, which themselves may have direct utility benefits.[9] Relaxing this restriction implies that utility is a function of health behaviors whether or not they have an effect on health stock, i.e.

$$U = U_1(C_1, L_1, H_1, I_1) + \rho U_2(C_2, L_2, H_2(I_1)). \tag{4}$$

Thus, equation (4) implies that it is also possible that internals may derive more utility from their health investments than do externals implying that $\frac{\partial^2 U}{\partial I_1 \partial \theta} > 0$.

Second, locus of control may influence the health production function. This possibility is consistent with psychologists' observation that having an internal locus of control is typically correlated with better health outcomes, i.e. more health capital (see for example Gale et al., 2008; Mackenbach et al., 2002; Sturmer et al., 2006; Rosengren et al., 2004). To illustrate, consider the following extension of equation (2):

$$H_2 = \theta I_1 + (1 - \delta(\theta))H_1(\theta), \tag{5}$$

in which those with an internal locus of control have more health capital in period 2 because: (i) there is a positive relationship between health capital and internal perceptions of control, i.e. they are healthier in period 1; or (ii) they are more efficient in transforming

[7] For simplicity, we assume that θ represents an exogenous personality trait. Empirical evidence documenting the stability of locus of control can be found in Cobb-Clark and Schurer (2011). The consequence of this assumption for our estimation strategy is discussed in Section 4.

[8] See Almlund et al. (2011) who model non-cognitive skills more generally as a preference parameter.

[9] Kenkel (1994) discusses investment versus consumption motives for demanding health inputs.

a given health investment into improved health, i.e. $\frac{\partial^2 H_2}{\partial I_1 \partial \theta} > 0$. *Ceteris paribus*, increased efficiency raises the future returns to health investments leading us to expect those with an internal locus of control to make bigger investments in their own health.

Third, individuals' locus of control may be related to their time preferences (ρ). In Chiteji's (2010) model, for example, individuals' non-cognitive skills (specifically, self-efficacy and future orientation) are linked to their health behavior through the discount rate they adopt. Chiteji (2010) does not test this model against alternative specifications. Nonetheless, it seems sensible to expect that those with an internal locus of control may be more future-oriented leading them to be more patient with respect to the future consumption benefits and investment returns associated with healthy habits.

Finally, locus of control may affect individuals' expectations about the return to the health investments they make. In our conceptual framework, as in Grossman (1972), there is a deterministic relationship between health investments and health capital. Thus, individuals are not required to form expectations about their future health status or the health implications of the behaviors they adopt. Introducing uncertainty over future health outcomes raises the potential for an individual's health behavior to depend on his subjective beliefs about the health benefits of that behavior. In particular, those with an internal locus of control may simply believe that there is a higher probability that eating well and exercising regularly will result in good health raising the returns to investments in health. This argument is consistent with psychologists' view that locus of control reflects the degree to which individuals believe they can influence life's outcomes. Increasingly, economists are incorporating locus of control into economic decision making through its influence on the perceived likelihood that specific outcomes will occur. Empirical evidence suggests that there is a link between perceptions of control and individuals' subjective beliefs about the returns to investments in education (Coleman and Deleire, 2003) and job search (Caliendo et al., 2010; McGee and McGee, 2011; McGee, 2010).

In Section 5, we will empirically investigate which of the four pathways outlined above is most consistent with the relationship we observe between individuals' locus of control and their decisions to invest in a healthy lifestyle.

4 Data

Our data come from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA Survey collects longitudinal information from a large nationally representative sample of Australian households through both face-to-face interviews and self-completion questionnaires for all household members aged 15 years and older (Wooden and Watson, 2007; Summerfield, 2010). A total of 13,969 individuals in 7,682 households were interviewed in wave 1.

4.1 Estimation sample

Our data are drawn from waves 3 - 10 which span the years 2003 to 2010. Locus of control data were collected in 2003, 2004, and 2007, while data on diet, exercise, and other healthy habits were collected in 2007 and 2009. We restrict our analysis to the 10,503 individuals aged 15 to 69 who provided complete locus of control, diet, and exercise information in at least one year.[10] We then drop 3,190 individuals from the sample because they provided incomplete information on our key socioeconomic and demographic control variables. This leaves us with an estimation sample of 3,412 men (5,831 person-years) and 3,901 women (6,581 person-years) the majority of whom are observed in both 2007 and 2009.

4.2 Key Variables

4.2.1 Parameterizing Locus of Control

In 2003, 2004, and 2007, HILDA respondents were asked all seven of the original items from the Psychological Coping Resources component of the Mastery Module developed by Pearlin and Schooler (1978). Mastery refers to beliefs about the extent to which life's outcomes are under one's own control. Strictly speaking, coping efficacy is not identical

[10] These 10,503 individuals represent 80 percent of all individuals aged 15 to 69 who were observed in the relevant years. For this age-group, we investigated whether locus of control is related to sample attrition by regressing the number of waves an individual is observed in the 2001-2010 panel on a standardized measure of his or her locus of control score averaged over 2003, 2004, and 2007. Regressions were conducted separately by gender for a pooled sample and for sub-samples defined by general health status. For both men and women, we find a positive relationship between locus of control and years spent in panel in the pooled sample indicating that those with an internal locus of control are somewhat less likely to leave sample. However, this effect is strongest for those with the median general health status and weakest for the very healthy and the very unhealthy. Thus, there is no evidence that sample attrition leads us to either over- or under-estimate the effect of locus of control on health status.

to Rotter's (1966) concept of locus of control. Much of the economics literature relies on an abbreviated version of Rotter's (1996) locus of control instrument. There is, however, substantial overlap in the questions used in the two scales which allows us to treat the two concepts as equivalent.

Specifically, respondents were asked the extent to which they agree with the seven statements given in Figure 1. Possible responses ranged from 1 (strongly disagree) to 7 (strongly agree). A preliminary factor analysis reveals that items (f) and (g) load onto one factor, while the remaining five items load onto another factor. These two factors can be interpreted as internal and external control respectively. We reversed the scores for items (f) and (g) so that all seven locus-of-control items are increasing in internal control tendencies. We follow Piatek and Pinger (2010) in constructing an index of locus of control using the first predicted factor obtained from a factor analysis. This has the advantage that the weight assigned to each item in the overall index is determined by the data. The index is standardized to have mean 0 and standard deviation (SD) 1. Our locus-of-control index (LOC_{it}) is therefore increasing in internal control tendencies.[11] A test of internal consistency yields a Cronbach's α reliability statistic of 0.84 indicating the seven items are highly reliable (Cronbach, 1951).

[Insert Figure 1 here]

Using HILDA data, Cobb-Clark and Schurer (2011) provide evidence that locus of control – while not time invariant – cannot be meaningfully explained by a series of important life events. Most importantly, health shocks have little impact on measured locus of control. The small variation which occurs in individuals' locus of control over time appears to stem from measurement error. Nonetheless, we follow the majority of previous studies in also using lagged locus-of-control information in order to minimize concerns about reverse causality and endogeneity bias. We construct an average locus of control index for all individuals providing locus of control data in at least one wave. For the majority of individuals (70 percent), this average is constructed from three waves of locus of control data, while for 15 percent we have data from two waves, and for another

[11] Our results remain unchanged if we adopt equal weights. Note that our measure differs to that of Chiteji (2010) who relies on self-efficacy data from the PSID which capture the extent to which one believes that life will work out as one wishes it to.

15 percent we have only one wave of data available. This approach allows us to reduce the attenuation bias associated with any measurement error in our locus of control index. Finally, we include a range of detailed controls (see Section 4.2.3) in order to reduce the potential for omitted variable bias to influence our results.

4.2.2 Health Behavior

We capture health behavior using two different measures of individuals' lifestyle choices – namely adaptations of the Alameda 7 and Healthy Eating Indexes. These measures can be constructed in waves 7 (2007) and 9 (2009) allowing us to exploit the longitudinal nature of the HILDA data in our analysis.

The Healthy Eating Index was developed for the US Department of Agriculture to approximate overall diet quality. The index consists of five components taken from the USDA Food Guide Pyramid (number of servings for grains, vegetables, fruit, milk and meat) and five components from the 1995 Dietary Guidelines for Americans (total fat in the diet, percentage of calories from saturated fat, cholesterol intake, sodium intake, and variety of the diet). Our data allow us to calculate an approximate version of the Healthy Eating Index based on the following indicators: (1) eating fruit seven days a week; (2) eating vegetables seven days a week; (3) avoiding (i.e. eating $<$ once per month) fatty, high cholesterol foods such as fried potatoes, French fries, hot chips or wedges; and (4) avoiding milk fat by drinking skim or low fat milk. These four items are then added together to create an index that is bounded between 0 and 4. Similar indexes have been used to study the relationship between nutritional outcomes, poverty and food insecurity (e.g. Bhattacharya et al., 2004, 2006).

The Alameda 7 Index is also often used to capture healthy lifestyle choices. It summarizes seven specific habits that have been found to be highly predictive of future health status and longevity. These habits are: (1) having never smoked; (2) drinking less than five drinks at one sitting; (3) sleeping 7-8 hours a night; (4) exercising; (5) maintaining desirable weight for height; (6) avoiding snacks; and (7) eating breakfast regularly. Early research demonstrated that the Alameda 7 Index is negatively related to both health status and mortality (Belloc and Breslow, 1972; Belloc, 1973). The effects of these behaviors on health have been found to be additive (Schoenborn, 1986) so the index is typically constructed by summing individual items. Components of the Alameda 7 In-

dex are frequently used to assess health behavior. Balia and Jones (2008), for example, use components of the Alameda 7 Index to investigate the complex relationship between mortality, lifestyle, and socioeconomic status, while Kenkel (1991) uses an abbreviated version of the Alameda 7 Index to explain the relationship between health behaviors, health knowledge and levels of schooling.

We construct an amended version of the Alameda 7 Index by summing over indicators of the following behaviors: (1) eating breakfast seven times a week; (2) drinking moderately (avoid binge-drinking), i.e. less than 7 (men) or 5 (women) standard drinks on any one occasion; (3) exercising at least three times per week at moderate or intensive physical exertion; and (4) not smoking.[12] We did not include BMI in our amended index because BMI is better seen as an outcome of health investments. However, when appropriate, we control for BMI in our regressions. Our Alameda 7 Index also ranges between 0 and 4 with higher values indicating healthier habits.

Figures 2 and 3 depict the relationship between locus of control, healthy habits (Alameda 7 Index), and diet (Healthy Eating Index) using bivariate kernel density estimates. The relationship between locus of control (horizontal axis) and health investments (vertical axis) is approximately linear. Non-linearities exist only among the small number of women ($N < 200$) at the extremes of the locus of control distribution. Thus, we estimate linear relationships.[13] For the regression analysis, we re-scale both the Alameda 7 and the Healthy Eating Index to be bounded between 0 and 1. A one-unit increase in the respective index is interpreted as moving from no to many healthy habits.

[Insert Figures 2 and 3 here]

4.2.3 Control Variables

Previous research suggests that individuals' decisions regarding diet and exercise are related to (i) their smoking behavior; (ii) whether or not they are currently dieting to lose weight; and (iii) the value they place on their health. In particular, smokers often have less healthy diets (Wardle et al., 2004), while dieters eat as a cognitive rather than

[12] Like Balia and Jones (2008), we use an indicator for not being a current smoker rather than never having smoked. Robustness checks reveal that the relationship between locus of control and smoking is somewhat weaker when using the latter measure.

[13] Estimation results remain robust to dropping individuals with extremely internal or external locus of control. Results provided upon request.

physiological process (Wardle et al., 2004; AbuSabha and Achterberg, 1997; Furnham and Greaves, 1994). Moreover, those who value their health more have a greater incentive to make health investments (Norman et al., 1998). Consequently, all of our estimation models control for these three factors. Specifically, we control for a binary indicator that takes the value 1 if the individual is currently on a diet to lose weight, and 0 otherwise. The importance that an individual attaches to his or her health is captured through an ordinal variable (measured in 2001) ranging from 0 (no importance) to 10 (high importance), but we standardize the variable to mean 0 and SD 1. Finally, we control for whether or not the individual smokes daily in all regressions that do not include our Alameda 7 Index.

Individuals' ability to eat well and exercise regularly may also be related to their current health status, so we control for both Body Mass Index (BMI) and current health conditions (type 1 and type 2 diabetes, chronic bronchitis, emphysema, coronary diseases, hypertension, arthritis, asthma, and cancer). We also account for individuals' Big Five personality traits, in order to isolate the effects of locus of control from other closely-related traits, in particular neuroticism (see Almlund et al., 2011) and conscientiousness (e.g. Lodi-Smith et al., 2010; Bogg and Roberts, 2004).

Finally, we control for a range of other socioeconomic and demographic variables including age, education, household income, marital status, the number of children in the household, and time dummies which account for any time trends in health behavior that are common to all individuals. Details and summary statistics for all variables are provided in Appendix Table A.1.

5 Empirical Strategy and Estimation Results

Our empirical strategy is straightforward. We begin by considering whether or not those with an internal locus of control are more likely to adopt a healthy lifestyle by eating well, exercising regularly, drinking moderately, and avoiding tobacco. Relying upon our conceptual framework (see Section 3), we then consider a number of possible explanations for the relationship between these health investments and locus of control.

5.1 How are locus of control and health investments related?

Previous researchers have found a weak and inconsistent association between health-related locus of control and health behavior (see Steptoe and Wardle, 2001). We revisit this issue using nationally-representative data and a measure of generalized locus of control. Specifically, we estimate the determinants of individuals' health investments (HI_{it}^k) allowing for random effects in the error structure for individual i at time t as follows:

$$HI_{it}^k = \alpha_1 + \alpha_2 LOC_i + X_{it}'\beta + \varepsilon_{it}, \tag{6}$$

where k represents the particular health investment, ε_{it} is a composite error term that consists of an individual-specific random effect μ_i and an idiosyncratic error ν_{it}:

$$\varepsilon_{it} = \mu_i + \nu_{it}. \tag{7}$$

In equation (6), HI_{it}^k refers to either the Alameda 7, the Healthy Eating Index, or their individual components; LOC_i is our generalized measure of locus of control; and the vector X_{it}' captures all other controls including Big-Five personality traits, age, equivalized household income, education, marital status, current health conditions, Body Mass Index, an index for the importance an individual attaches to health, being currently on a diet to lose weight, the number of children in the household, a time dummy for 2009, and in the case of the Healthy Eating Index an indicator for current smoking behavior.

The estimated association between locus of control and investments in health are reported in Table 1 separately for men and women. Column (1) presents results for the total sample and columns (2)-(5) present results for the age-groups 15-24, 25-39, 40-54, and 55-69, respectively. Full estimation results for our main models are reported in Table A.2. As all variables are bounded between 0 and 1, the estimated coefficients can be interpreted as the percentage point change in the probability of adopting a particular health behavior or, in the case of the Alameda 7 and Healthy Eating Index, as a percentage point change in the score of healthy habits or diet.

[Insert Table 1 here]

We find that those with an internal locus of control are significantly more likely to

invest in their own health by eating well. A one-standard deviation increase in internal sense of control is associated with a 1.4 percentage point (p.p.) increase for men and a 1.2 p.p. increase for women in the proportion of healthy eating habits adopted. These relationships are substantial. For men (women), it is equivalent to 18 (15) percent of the effect of graduating with a Bachelor's, degree versus dropping out, or 2 times (50 percent of) the effect of doubling household income on healthy eating (see Table A.2).

The link between locus of control and healthy eating is strongest for men in the oldest age group (55-69) (2.5 p.p.), while for women it is strongest for the second-oldest age-group (40-54)(1.6 p.p.). Analysis of the individual components of the Healthy Eating Index indicates that men's locus of control is associated with many diet decisions. Eating fruits and vegetables as well as drinking skimmed or low fat milk are all significantly related to men's locus of control. Eating fruit is most strongly associated with locus of control for older men (5.0 p.p.). Women's locus of control, on the other hand, is associated with eating vegetables regularly as well as avoiding fatty foods – the latter especially so for the youngest age group (2.9 p.p.). Interestingly, there is no relationship between locus of control and avoiding fatty foods for men and eating fruit for women.

Individuals' sense of control is even more strongly associated with their healthy habits more generally. In particular, a one standard deviation increase in the extent to which men and women have an internal locus of control is significantly associated with a 2.0 and 2.2 p.p. increase in the Alameda 7 Index. Again, it is useful to consider the size of these relationships in the context of other factors. For men, the link between locus of control and the Alameda 7 Index is equivalent to 27.4 percent of that of having a Bachelor's degree (versus dropping out). For women, it is equivalent to 24.2 percent of the effect of having a Bachelor's degree.

As with healthy eating, locus of control appears to be particularly important for understanding the healthy lifestyle choices of older men. For them, every one-standard deviation increase in internal locus of control is associated with a 2.6 p.p. increase in their healthy habits as measured by the Alameda 7 Index, while for men aged 15 - 24 there is no significant association between locus of control and adopting healthy habits. In contrast, the relationship among women is weaker, although still highly significant, within the the older age groups (1.6 p.p. and 1.9 p.p.) and is strongest for women aged 25-39 (2.6 p.p.).

The individual behaviors which appear to drive the association between sense of control and healthy habits for both men and women are in order of relevance (i) regular physical exercise; (ii) not smoking; (iii) and eating breakfast seven times a week. The strong effects of exercise for both men and women highlight the importance of perceptions of control in reducing the thresholds in engaging in physical activity. Interestingly, individuals are less likely to avoid binge-drinking the more internal is their locus of control. This may indicate that those who feel more in control of life's outcomes may also feel more able to cope with the effects of binge drinking. Alternatively, previous research has found that health-related locus of control measures often have little explanatory power in understanding alcohol consumption, perhaps because individuals do not view alcohol as affecting their health (Bennett et al., 1998).

To check the robustness of these results, we re-estimated our benchmark model using a linear latent factor structural equation model (SEM) which is a simplified version of the estimators proposed in Cunha and Heckman (2008) and Cunha et al. (2010). This allows us to account for the possibility that healthy lifestyle choices are simultaneously determined with the measurement system underpinning locus of control. We do this by simultaneously estimating seven measurement equations – one for each locus-of-control indicator – and a behavioral equation which links healthy lifestyle choices to our locus of control index. The SEM coefficients (i) are of the same sign; (ii) have the same statistical significance; and (iii) do not differ significantly in magnitude from our random-effects coefficients. In particular, the 95 percent confidence intervals are overlapping between our random effects model and the SEM in all cases. Thus, accounting for simultaneity in the determination of locus of control and healthy lifestyle choices does not appear to matter for our conclusions.

Taken together, our results indicate that generalized locus of control is systematically related to investments in eating well and maintaining healthy habits. In what follows, we consider a number of possible explanations for this relationship.

5.2 Why does an internal locus of control lead to healthier choices?

5.2.1 Do those with an internal locus of control care more about the future?

Chiteji (2010) motivates her empirical analysis of the effect of self-efficacy on health

behaviors by arguing that individuals' discount rates may be linked to their self-efficacy. If that is the case, individuals with higher self-efficacy may invest more in their health because they place greater weight on the future returns to those investments. Chiteji's reduced-form approach does not allow her, however, to identify whether self-efficacy is in fact linked to health behavior through discount rates or through some other means.

We can directly investigate this issue by re-estimating equation (6) accounting for the extent to which individuals are future-oriented. Specifically,

$$HI_{it}^{k} = \alpha_1 + \alpha_2 LOC_i + \alpha_3 TP_i + X_{it}'\beta + \varepsilon_{it}, \tag{8}$$

where TP_i captures future orientation,[14] $t = 2007, 2009$ when the data for the Healthy Eating and Alameda 7 indexes were collected, and ε_{it} is a composite error term that consists of an individual-specific random effect and an idiosyncratic error as before.

We estimate equation (8) using the same econometric specification and set of control variables as in equation (6). If locus of control is simply a proxy for the extent to which an individual is future oriented, we would expect that $\hat{\alpha}_2$ would become substantially smaller once his or her discount rate (TP_i) is controlled.

Table 2 presents results for the Healthy Eating and Alameda 7 Indexes. Estimated locus-of-control coefficients from models that exclude time preferences are reported in column (1) for men and column (4) for women (restricted models), while the estimated coefficients on both locus of control and future orientation obtained from equation (8) (unrestricted model) are reported in columns (2) and (3) for men and (5) and (6) for women.[15]

[Insert Table 2 here]

Accounting directly for individuals' time preferences does little to change the estimated relationship between men's health investments and their locus of control. In particular, the coefficients on locus of control decrease by less than 8 percent (Healthy

[14] In 2006, respondents were asked "In planning your saving and spending, which of the following time periods is most important to you?" TP_i takes the value 1 if the respondent replies "the next 5 to 10 years" or "more than 10 years ahead" and 0 otherwise.

[15] These results are based on a smaller sample due to missing observations on the future-orientation measure. For comparability, we have also re-estimated equation (6) with the restricted sample.

Eating Index) and 8.2 percent (Alameda 7 Index) for men and remain statistically significant once future orientation is controlled. The estimated relationship between women's locus of control and the extent to which they adopt a healthy diet is only slightly more sensitive to the inclusion of time preferences in the model. In particular, the locus-of-control coefficient is 17.8 percent smaller, and statistically significant at the 10 percent level, in the unrestricted model of the Healthy Eating Index. At the same time, locus of control continues to be significantly related to women's adoption of healthy lifestyles generally. As for men, there is virtually no difference in the restricted and unrestricted coefficients for women in the Alameda 7 Index (-7.9 percent), exercising (-3.1 percent), or smoking models (-6.6 percent). As we use the same estimation sample, we can use the 95 percent confidence intervals as a test of statistical difference between the restricted and unrestricted coefficients. The 95 percent confidence intervals between the restricted and unrestricted coefficients are overlapping for all cases considered.

Interestingly, being future-oriented – i.e. planning saving and spending five years or more ahead – is strongly related to eating well and adopting a healthy lifestyle, particularly for women. Specifically, a one standard deviation increase in future orientation in women is associated with a 2.2 p.p. increase in the score of good eating habits adopted (Healthy Eating Index). Similarly, there is a 2.1 p.p. increase in the score of healthy habits (Alameda 7 Index). A test of equal coefficients between locus of control and future orientation cannot be rejected in those two cases. Future orientation is however less important than locus of control in determining exercising behavior and more important in determining whether women avoid binge-drinking.

Thus, individuals' investments in good diets and physical exercise are clearly related to the extent to which they are looking to the future. At the same time, future orientation does not provide an explanation for the relationship between locus of control and health investments. Those with a more internal locus of control continue to make significantly larger investments in their health even after their time preferences are taken into account.

5.2.2 Do those with an internal locus of control expect higher returns?

Previous research suggests that locus of control influences human capital investments – e.g., in education (Coleman and Deleire, 2003) and job search (Caliendo et al., 2010; McGee and McGee, 2011; McGee, 2010) – in part through beliefs about the returns

to such investments. Thus, one possibility is that individuals with an internal locus of control invest more in their health simply because they are more likely than their external counterparts to believe those investments will result in better health in the future. In short, they invest more because the expected returns are higher.

We investigate this hypothesis by analyzing how individuals' beliefs about their future health status vary with their current health status and locus of control. Two measures are used to capture individuals' expectations about their future health status. The first is based on individuals' responses to a direct question about the probability (from 0 to 100 percent) that their health will be the same or better in four years time (see Table A.1 for details). The second measure is based on individuals' beliefs about the likelihood (on a four point scale) that they will live to age 75 or more. Subjective longevity questions such as these have been previously used, e.g., in Smith et al. (2001) to investigate the relationship between health shocks and expected longevity for smokers and non-smokers using the Health and Retirement Study (HRS). Using these data, we construct an indicator that takes the value 1 if the individual responds that it is "very likely" he will live to 75 and 0 otherwise. We then re-scale our first measure to be bounded between 0 and 1 so that the marginal effects of the two measures are directly comparable.

As these expectations measures are only available in 2009, we estimate the following cross-sectional model using a linear probability model:

$$P_i = \alpha_1 + \alpha_2 LOC_i + \alpha_3 HI_i^k + \alpha_4 HI_i^k \times LOC_i + X_i'\beta + \varepsilon_i, \tag{9}$$

where k indexes a particular health investment (e.g. Alameda 7 Index, Healthy Eating Index) measured in 2009, P_i is the individual's health expectation and the vector X_i' includes all control variables as outlined in the previous sections.

To allow for heterogeneity in health expectations and the effects of all covariates on these expectations, we re-estimate equation (9) with a finite mixture model with a mixture of two normal distributions. These models often fit the data better when the outcome measure is multimodally distributed (e.g. McLachlan and Peel, 2000) and/or if there is discrete heterogeneity in the effect of the regressors (e.g. Deb and Trivedi, 2002). The marginal effects are calculated as the weighted average of the coefficients of each

class, where the weights are the class-probabilities.[16]

A finding that $\hat{\alpha}_2 > 0$ implies that those with an internal locus of control are more optimistic about their future health status, while $\hat{\alpha}_3 > 0$ implies that health investments are associated with better expected health. Lastly, $\hat{\alpha}_4 > 0$ implies that the gain in expected health associated with any health investment is larger for those with an internal – rather than external – locus of control.

Table 3 presents the estimated coefficients for our main variables for both dependent variables separately by gender. The results in each panel stem from separate regressions. The finite mixture robustness checks are presented in columns (5) and (6). Full estimation results for our main models are reported in Table A.3.

[Insert Table 3 here]

Not surprisingly, men and women are more likely to believe that they will be able to maintain their health and live to age 75 if they eat well and adopt a healthy life-style. For example, moving from zero to four healthy eating habits is associated with a 4.6 percentage point increase in the probability that a man believes his health will remain stable (or improve) over the next four years and a 13 percentage point increase in his probability of expecting to be very likely to live to age 75. For women, these associations are 2.6 p.p. (maintaining health) and 17.2 p.p. (living to age 75) respectively. We find even stronger relationships when we focus instead on those health investments captured in the Alameda 7 Index. Adopting four rather than zero healthy habits is associated with an increase of approximately 7.1 and 6.4 p.p in men's and women's anticipated probability of maintaining their health, respectively, and with more than a 20 p.p. increase in their expected probability of being very likely to live to age 75. Since for both men and women the base probability is 50 percent, these percentage point changes imply an increase of 40 percent.

Not smoking, exercising, and eating breakfast are all consistently associated with improvements in men's and women's expected future health status. At the same time, there are gender differences in the anticipated health benefits of eating well. Women,

[16] We can use this approach only for the continuous outcome variable "Probability that health will remain or improve within the next four years". No convergence is achieved using the binary outcome variable "very likely to reach age 75".

for example, associate the avoidance of milk fat and regular exercise with greater future health benefits than do men, while men are more likely than women to expect to maintain their health if they eat more fruit and vegetables and refrain from smoking.

Individuals' expectations about their future health are also related to the extent to which they believe that life's outcomes are under their control. In particular, a one-standard deviation increase in internal control tendencies is associated with a 3.9 p.p. increase in the probability that women assign to maintaining (or improving) their health irrespective of which health investment index we consider. The link between men's locus of control and expected future health status is slightly weaker (1.3 to 3.2 p.p.), but continues to be statistically significant in all cases except for the Alameda 7 Index. In short, those with an internal locus of control are generally more optimistic about their future health status than are their more external peers. This relationship is particularly striking given that we have controlled for the effects of other personality traits (Big Five), Body Mass Index, a vast range of health conditions, and socioeconomic status.

Importantly, men's expected health investment returns are generally higher the more internal is their locus of control irrespective of the health expectations measure we consider. In all but one case, $\hat{\alpha}_4 > 0$. Moreover, $\hat{\alpha}_4$ is statistically significant in a number of cases including: (i) Healthy Eating Index (ii) avoiding milk fat; (iii) adopting healthy habits as measured by the Alameda 7 Index; (iv) abstaining from smoking; (v) exercising regularly; and (vi) and eating breakfast regularly. The effects are sizeable: a one-standard deviation increase in internal control tendencies for men who refrain from smoking is associated with an additional 1.5 p.p. increase in the probability of expecting health to remain the same for the next four years or an additional 4.5 p.p. increase in the probability of expecting to be very likely to live to age 75. Thus, these current health investments improve the expected future health of men with an internal locus of control significantly more than that of men with an external locus of control. These effects are even stronger, and more precisely estimated, in the finite mixture model as reported in column (5) of Table 3 that allows for both intercept and slope heterogeneity.

We find less evidence, however, that women with an internal locus of control expect a larger return to their health investments than do their counterparts with a more external locus of control. In particular, the interaction between women's locus of control and their level of health investments is often statistically insignificant. Moreover, women with an

internal locus of control in fact have significantly more modest expectations of the future health benefits of exercising regularly than do their more external peers. Even though drinking in moderation and eating well (due to eating vegetables regularly) do result in significantly larger expected health and longevity benefits for those women with an internal locus of control, these effects fully disappear in the finite mixture specification (see column (6) of Table 3).

These results raise the possibility that men with an internal sense of control invest more in their own health because they expect higher returns to their investment. This would be consistent with previous evidence indicating that the positive relationship between an internal sense of control and investments in education (Coleman and Deleire, 2003) and job search (Caliendo et al., 2010; McGee and McGee, 2011; McGee, 2010) stems from beliefs about investment returns. There is less evidence, however, that this explains the higher propensity of women with an internal locus of control to eat well and adopt healthy habits.

5.2.3 Do those with an internal locus of control invest more efficiently?

It is also possible that individuals with an internal locus of control invest more in their own health because they are more efficient in transforming those health investments into good health. In effect, their actual – rather than simply their expected – investment returns are in fact higher. In observational data, it is impossible to separately identify the effects of subjective beliefs about investment returns and actual investment returns without data on both (see Caliendo et al., 2010 and McGee and McGee, 2011). Fortunately, we are able to use: (i) information about individuals' expected future health status to assess the former (see Section 5.2.2) and (ii) the longitudinal nature of our data to investigate the latter. Specifically, we estimate a health determination model in which general health status (GH_{it}) is the dependent variable:

$$GH_{it} = \alpha_1 + \alpha_2 HI^k_{it-1} + \alpha_3 LOC_i + \alpha_4 GH_{it-1} + \alpha_5 LOC_i \times HI^k_{it-1} + X'_{it}\beta + \varepsilon_{it}, \quad (10)$$

where t refers to 2008 or 2010, X'_{it} is a vector of control variables, and, as before, ε_{it} is a composite error term that consists of an individual-specific random effect and an idiosyncratic error.

Information on individuals' general health status is taken from the Medical Outcomes Study Short Form (SF-36) questionnaire which is administered annually in the HILDA Survey. The SF-36 was developed to permit group comparisons, enable profiling of functional health and well-being, and quantify disease burden (Ware and Gandek, 1998). It has become one of the most widely used measures of self-assessed health status. HILDA's SF-36 data have excellent psychometric properties, with high internal consistency, in particular a Cronbach's alpha ranging between 0.82 (mental and physical health) and 0.93 (physical functioning) (Butterworth and Crosier, 2004). Using these data, we construct a summary measure of general health (GH_{it}) that is bounded between 0 and 100 with higher values reflecting better health.[17] This measure is standardized to mean 0 and a standard deviation of 1. The inclusion of a lagged general health (GH_{it-1}) captures the dynamics in health implied by the Grossman (1972) model, although we refrain from interpreting the coefficient α_4 as causal.[18]

Table 4 reports selected estimation results for our main parameters of interest, i.e. the relationship between health investment and general health ($\hat{\alpha}_2$), the association of locus of control and general health ($\hat{\alpha}_3$), and the interaction effect of locus of control and health investment ($\hat{\alpha}_5$). We consider two specifications – one which includes individuals' expected longevity (columns (2) and (4)) and one which does not (columns (1) and (3)). See Table A.4 for full estimation results for our main models.

[Insert Table 4 here]

Not all current health investments are associated with better self-reported health status in the future. Healthy eating, for example, is not associated with significantly better health except for those women who eat vegetables regularly. Self-assessed health outcomes for both men and women are more closely aligned with their other lifestyle choices. Adopting four rather than none of the healthy habits captured in the Alameda 7 Index is associated with a 0.078 SD improvement in the general health of men and a 0.087 SD improvement for women (see columns (1) and (3)). The major drivers of this statistical relationship are abstaining from smoking and exercising regularly, both

[17] See Table A.1 for definitions.

[18] Due to our limited longitudinal data structure, we are unable to separate out state dependence from unobserved heterogeneity and autocorrelation of independent variables. There is however a some evidence for state dependence in health and well-being (see Heiss, 2011, for an overview).

of which have positive health benefits. Consistent with Kenkel (1995), eating breakfast regularly has no apparent health benefits. In contrast to some researchers, we find that moderate drinking is associated with men reporting slightly poorer health in the future.

Men and women with internal control tendencies consistently report that their health is better irrespective of the measure of health investment that is applied. A one-standard deviation increase in internal control tendencies is associated with just under a 0.10 SD improvement in men's general health status. This relationship is about the same for women. A one-standard deviation increase in women's internal control tendencies is associated with between a 0.07 SD (avoiding heavy drinking) and 0.10 SD (Healthy Eating Index) increase in their self-assessed health. This strong association between internal control tendencies and better self-assessed health is consistent with the previous literature (Gale et al., 2008; Mackenbach et al., 2002).

We are particularly interested in whether those with an internal sense of control are more efficient when investing in their health. In other words, do those with internal control tendencies have higher health investment returns? If so, this provides one important explanation for the positive relationship between locus of control and health investment. The results in Table 4 provide only weak evidence for this proposition for men. When we do not control for men's expected future health status (column (1)), the estimated interaction between health investment and locus of control ($\hat{\alpha}_5$) is positive in nine out of ten cases, but is statistically significant only when we consider the Healthy Eating Index. Moreover, this interaction effect is no longer statistically significant when controlling for life expectancy (column (2)).

There is no evidence that women with an internal locus of control are more effective than their external counterparts in turning their current health investments into better health in the future. The estimated interaction between locus of control and health investment ($\hat{\alpha}_5$) is negative in eight of our ten equations (see column (1)), but is statistically significant only when we consider the Healthy Eating Index. As is true for men, controlling for women's expected longevity does little to alter the relationship between locus of control and the returns to health investments.

Thus, we find no evidence that men and women with an internal locus of control appear to be more efficient in transforming their investments in a good diet and a healthy lifestyle into better health in the future.

5.2.4 Do those with an internal locus of control prefer health investments?

Kenkel (1994) argues that it is important to distinguish between the investment versus consumption motives for demanding health inputs. In particular, some health behaviors like getting immunized, visiting the dentist, or taking vitamins can reasonably be argued to have only investment and no (or perhaps negative) consumption benefits. Other behaviors, e.g. eating well or exercising regularly, may have consumption benefits. In effect, people may demand healthy food or gym memberships because they provide direct utility. This then opens up the possibility that those with an internal locus of control make more health investments than their external counterparts because they get more pleasure out of eating healthy food, exercising regularly, or eating breakfast in the morning.

We investigate this issue by following the applied happiness literature in approximating utility with a measure of life satisfaction based on individuals' responses to the following question: "All things considered, how satisfied are you with your life?". Possible responses range from 0 (extremely dissatisfied) to 10 (extremely satisfied). Like most happiness studies, we make two assumptions about our measures of subjective well-being. We assume these measures provide genuine information about the quality of people's lives (Oswald and Wu, 2010; Krueger and Schkade, 2008) that they are good proxies for experienced utility allowing us to use them to estimate individuals' preference parameters (e.g. Layard et al., 2008). The following linear random effects model of life satisfaction (LS_{it}) is estimated:

$$LS_{it} = \alpha_1 + \alpha_2 HI^k_{it-1} + \alpha_3 LOC_i + \alpha_4 LOC_i \times HI^k_{it-1} + \alpha_5 LS_{it-1} + X'_{it}\beta + \varepsilon_{it}, \qquad (11)$$

where t refers to 2008 or 2010 and ε_{it} is a composite error term that consists of an individual-specific random effect and an idiosyncratic error, and LS_{it} is a continuous measure of life satisfaction (standardized to mean 0 with standard deviation 1). The inclusion of a lagged value of life satisfaction LS_{it-1} captures the dynamics of well-being. The vector X'_{it} is defined as in equation (10). To account for the large degree of heterogeneity in life satisfaction (e.g. Ferrer-i-Carbonell and Frijters, 2004) we re-estimate equation (11) with a correlated random effects model (CRE), by including the mean values of all time-varying regressors (see Mundlak, 1978). Selected estimation results are reported separately by gender in Table 5 (see Table A.5 for full estimation results).

[Insert Table 5 here]

There is no evidence that individuals are happier if they have a healthy diet. Neither the Healthy Eating Index nor its individual components are significantly related to either men's or women's life satisfaction. Maintaining healthy habits in general as measured by the Alameda 7 Index is associated with both men's and women's life satisfaction (0.08 SD). Irrespective of gender, exercising and refraining from smoking are associated with greater levels of life satisfaction. For men the consumption benefits of exercising are larger (0.063 SD) than for women (0.045 SD), whereas the reverse is true for not smoking.

Individuals who believe that they are in control of life's outcomes are happier than their more external peers. In particular, a one-standard-deviation increase in internal control tendencies is associated with between a 0.14 (regular breakfast) and 0.16 (Healthy Eating Index) SD increase in men's life satisfaction, and between a 0.10 (Alameda 7 Index) and 0.16 (eating fruit regularly) SD increase in women's life satisfaction.

There is disparity, however, in the extent to which the consumption benefits of men's and women's health investments are related to their locus of control. Recall that α_5 captures the additional utility that individuals with an internal locus of control receive from their health investments. There is no evidence that men with an internal locus of control derive significantly more utility from eating well and adopting a healthy lifestyle. Across all health investment measures, $\hat{\alpha}_5$ is (i) typically negative rather than positive; (ii) not statistically significant; and (iii) not economically meaningful except in the case of the Healthy Eating Index.

In stark contrast, there is evidence that women with an internal locus of control may receive additional consumption benefits from their health investments. Specifically, we find that in nine out of ten cases $\hat{\alpha}_5$ is positive. In three cases $\hat{\alpha}_5$ is also statistically significant. For example, making four rather than none of the Alameda 7 healthy lifestyle choices leads to an additional increase in women's life satisfaction (0.09 SD) for each one-standard-deviation increase in internal control tendencies. In addition, there is an additional 0.04 SD increase in life satisfaction associated with increasing internal control tendencies for women who exercise regularly. Finally, there is a similar effect associated with the avoidance of binge drinking (0.04 SD).

We obtain identical results when re-estimating all models with a correlated random

effects model, which gives us some reassurance that these relationships are not primarily driven by a systematic correlation between individual-specific heterogeneity and the regressors of the model (see columns (2) and (4) of Table 5).[19]

Thus, women with an internal locus of control may invest more in their own health because they derive greater utility from those investments. There is no evidence, however, that the positive relationship between men's investment behavior and their locus of control can be attributed to any differential consumption benefits from those investments.

6 Conclusions

As living standards continue to rise, modifiable health risks will play an increasingly important role in driving population health in countries around the world. The World Health Organization (2009), for example, has recently concluded that, although some people may be genetically predisposed toward weight gain, "the fundamental causes of the obesity epidemic are societal, resulting from an environment that promotes sedimentary lifestyles and the consumption of high-fat, energy-dense diets" (pg. 240). Clearly, there is a great deal to be gained by deepening our understanding of the factors underpinning both consumption behavior and physical activity. This paper contributes to this effort by examining the link between individuals' locus of control and their choices to eat well, exercise regularly, drink in moderation, and avoid tobacco. Building upon extensive research in health psychology, we revisit the link between perceived control and these health investments from an economic rather than psychological perspective. Specifically, we take advantage of large-scale, nationally-representative data and extend standard economic models to assess the multiple pathways through which individuals' locus of control influences their health choices. This is an important step in shedding light on not just whether, but why, locus of control matters for health behavior.

We find strong evidence that those with an internal locus of control eat healthier food, exercise more, smoke less, and avoid drinking to excess. Interestingly, these relationships persist even after we account for the extent to which individuals are future-oriented and

[19] We also estimated a fixed effects model and obtained similar results for the interaction between the Alameda 7 index and locus of control (0.090, SE 0.085). There is little variation in health habits over the two time-periods which results in large standard errors and therefore in an insignificant interaction effect. Results provided upon request.

value their health. Moreover, gender plays an important role in shaping these relationships. Men with an internal locus of control both expect higher returns in terms of future health benefits to their health investments than do their more external counterparts. On the other hand, women with an internal locus of control invest more in their health because they appear to derive greater consumption benefits than their external peers.

To date, the main policy response to the obesity epidemic has been the provision of better information, despite the fact that there is little evidence that information alone is sufficient to change people's eating habits (Downs et al., 2009). Ruhm's (2010) "dual-decision" approach in which food consumption is the result of (i) a far-sighted, deliberative process and (ii) an immediate affective response has been important in explaining why informed consumers might engage in short-run eating behavior which is inconsistent with their long-run goals. As a result, many researchers have begun calling for policy initiatives – for example, making healthy choices the default rather than the option, increasing the relative convenience of healthy options – which directly support individuals' ability to avoid affective responses and engage in more deliberative behavior (Just, 2006; Downs et al., 2009; Ruhm, 2010). Our finding that having an internal locus of control is associated with eating better and maintaining a healthier lifestyle is consistent with the notion that internal control tendencies assist individuals in making more deliberative and fewer affective choices. Future research which uses experimental approaches to estimate the causal effect of locus of control on dieting and exercising decisions would be particularly useful in establishing the extent to which this is the case.

Finally, our finding that there are gender differences in the likely mechanism linking control tendencies to health choices opens up the possibility for even more nuanced policy responses. Put in the most basic terms, what works well for women may work less well for men. It is important, therefore, to increase the focus on gender-specific health initiatives. Women appear to be particularly sensitive to the consumption benefits of eating well and exercising, while men may be more sensitive to the future health benefits. Gender-specific policy initiatives which respond to these objectives may be particularly helpful in promoting healthy lifestyle choices.

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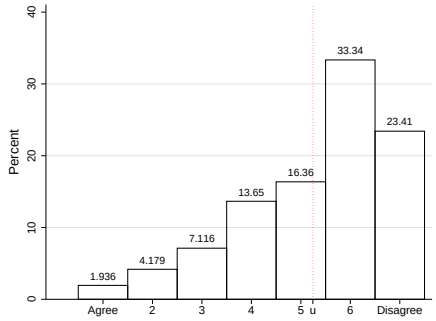
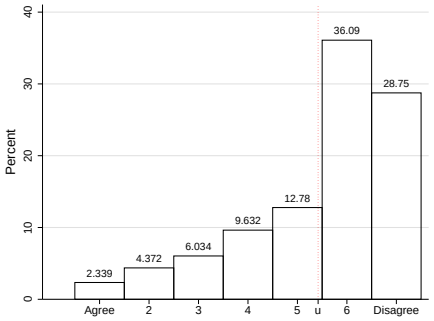
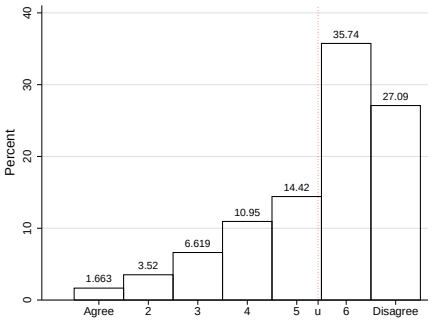


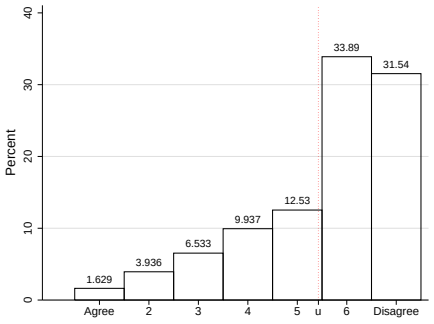
(a) I have little control over the things that happen to me



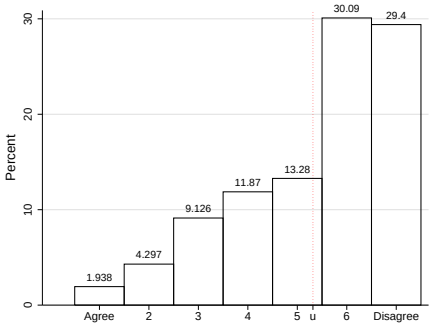
(b) There is really no way I can solve some of the problems I have



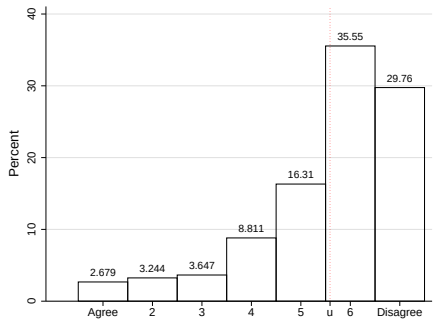
(c) There is little I can do to change many of the important things in my life



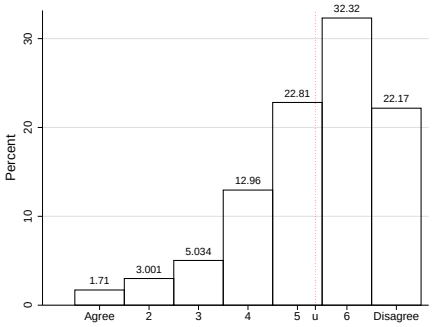
(d) I often feel helpless in dealing with the problems of life



(e) Sometimes I feel that I'm being pushed around in life

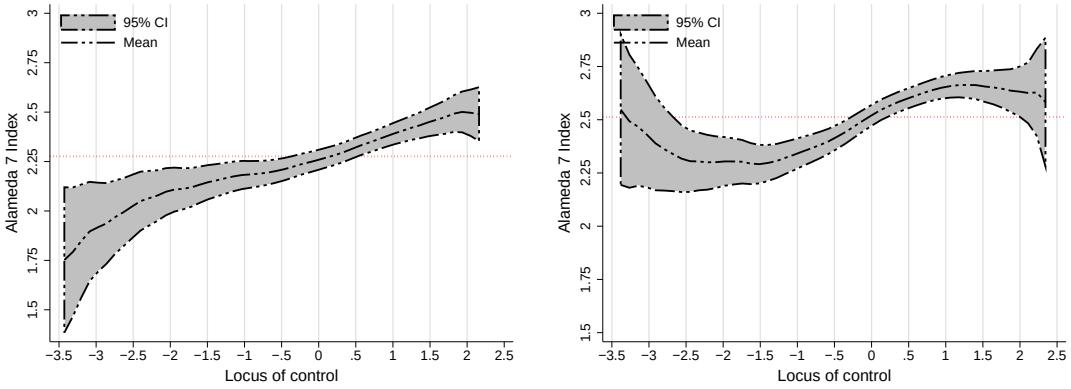


(f) What happens to me in the future mostly does not depends on me (*)



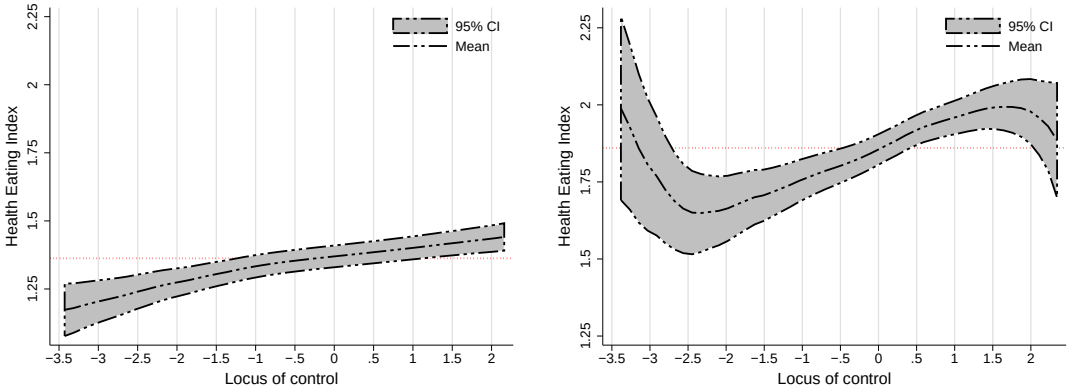
(g) I cannot do just about anything I really set my mind to do (*)

Figure 1: Distribution of subcomponents of locus of control (*wording reversed)



(a) Men (b) Women

Figure 2: Relationship between Alameda 7 Index and Locus of Control



(a) Men (b) Women

Figure 3: Relationship between Healthy Eating Index and Locus of Control

Table 1: Link between locus of control[a] and health investments

	All	15-24	25-39	40-54	55-69
Men					
Healthy eating index	0.0140***	0.0051	0.0172**	0.0027	0.0249***
	(0.0043)	(0.0107)	(0.0081)	(0.0073)	(0.0089)
Low fat/skinny milk	0.0182**	-0.0046	0.0117	0.0258*	0.0125
	(0.0085)	(0.0212)	(0.0167)	(0.0143)	(0.0169)
Avoid fatty food	0.0077	-0.0004	0.0090	-0.0011	0.0174
	(0.0062)	(0.0099)	(0.0101)	(0.0105)	(0.0152)
Eat vegetables regularly	0.0138*	0.0157	0.0337**	-0.0060	0.0243
	(0.0082)	(0.0223)	(0.0163)	(0.0138)	(0.0159)
Eat fruit regularly	0.0192**	0.0107	0.0140	-0.0050	0.0493***
	(0.0078)	(0.0186)	(0.0151)	(0.0134)	(0.0161)
Alameda 7 index	0.0202***	0.0072	0.0286***	0.0102	0.0262***
	(0.0046)	(0.0119)	(0.0091)	(0.0076)	(0.0085)
Not Smoking	0.0302***	0.0219	0.0511***	0.0131	0.0307**
	(0.0075)	(0.0210)	(0.0155)	(0.0124)	(0.0124)
Not binge-drinking	-0.0317***	-0.0391**	-0.0207	-0.0326**	-0.0375**
	(0.0082)	(0.0188)	(0.0152)	(0.0139)	(0.0170)
Exercise regularly	0.0453***	0.0410*	0.0368**	0.0260*	0.0724***
	(0.0083)	(0.0215)	(0.0173)	(0.0139)	(0.0159)
Eat breakfast regularly	0.0273***	-0.0008	0.0272*	0.0335**	0.0275**
	(0.0079)	(0.0233)	(0.0165)	(0.0133)	(0.0132)
Number of individuals	3,412	481	1,031	1,332	872
Women					
Healthy eating index	0.0118***	0.0142	0.0106	0.0163**	0.0040
	(0.0043)	(0.0122)	(0.0085)	(0.0072)	(0.0084)
Low fat/skinny milk	-0.0055	-0.0122	0.0069	-0.0081	-0.0067
	(0.0080)	(0.0222)	(0.0162)	(0.0131)	(0.0153)
Avoid fatty food	0.0128*	0.0285*	-0.0000	0.0161	0.0047
	(0.0071)	(0.0155)	(0.0130)	(0.0120)	(0.0155)
Eat vegetables regularly	0.0289***	0.0316	0.0300*	0.0401***	0.0146
	(0.0077)	(0.0224)	(0.0157)	(0.0126)	(0.0148)
Eat fruit regularly	0.0113	0.0073	0.0055	0.0201	0.0046
	(0.0077)	(0.0212)	(0.0156)	(0.0128)	(0.0150)
Alameda 7 index	0.0222***	0.0180	0.0260***	0.0166**	0.0187***
	(0.0042)	(0.0116)	(0.0085)	(0.0070)	(0.0071)
Not Smoking	0.0300***	0.0232	0.0431***	0.0081	0.0319***
	(0.0065)	(0.0178)	(0.0136)	(0.0105)	(0.0105)
Not binge-drinking	-0.0128*	-0.0063	-0.0241	-0.0192	0.0007
	(0.0077)	(0.0204)	(0.0154)	(0.0129)	(0.0149)
Exercise regularly	0.0404***	0.0042	0.0366**	0.0544***	0.0420***
	(0.0078)	(0.0219)	(0.0159)	(0.0128)	(0.0152)
Eat breakfast regularly	0.0199***	0.0393*	0.0344**	0.0220**	-0.0103
	(0.0067)	(0.0227)	(0.0141)	(0.0107)	(0.0108)
Number of individuals	3,901	543	1,231	1,530	926

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. [a] Locus of control is measured as the predicted first factor from a factor analysis and standardized to mean 0 and SD 1 (average over LOC data from 2003, 2004, and 2007). All health investments are bounded between 0 and 1. Each row corresponds to a separate regression (linear random effects and linear random effects probability models, data 2007 and 2009) including all explanatory variables outlined in Table A.1 in the Appendix and a time dummy variable for 2009. Except for outcomes "Alameda 7" and "Not smoking", all models also control for "smoking daily".

Table 2: The relationship between locus of control and health investment with and without time preference[a] controls

	Males			Females		
	No Time Pref	Time Pref incl.		No Time Pref	Time Pref incl.	
	LOC	LOC	TP	LOC	LOC	TP
	(1)	(2)	(3)	(4)	(5)	(6)
Healthy eating index	0.0135***	0.0125***	0.0104**	0.0101**	0.0083*	0.0217***‡
	(0.0045)	(0.0045)	(0.0041)	(0.0045)	(0.0045)	(0.0041)
Low fat/skinny milk	0.0161*	0.0149*	0.0130	-0.0106	-0.0107	0.0019
	(0.0089)	(0.0089)	(0.0081)	(0.0084)	(0.0084)	(0.0077)
Avoid fatty food	0.0063	0.0050	0.0134**	0.0128*	0.0109	0.0239***
	(0.0065)	(0.0065)	(0.0059)	(0.0074)	(0.0074)	(0.0067)
Eat vegetables regularly	0.0152*	0.0146*	0.0065	0.0279***	0.0256***	0.0295***
	(0.0086)	(0.0086)	(0.0078)	(0.0080)	(0.0080)	(0.0073)
Eat fruit regularly	0.0197**	0.0188**	0.0095	0.0104	0.0080	0.0311***‡
	(0.0081)	(0.0082)	(0.0074)	(0.0080)	(0.0080)	(0.0073)
Alameda 7 index	0.0196***	0.0180***	0.0163***	0.0228***	0.0210***	0.0207***
	(0.0047)	(0.0047)	(0.0043)	(0.0043)	(0.0043)	(0.0039)
Not Smoking	0.0301***	0.0275***	0.0251***	0.0302***	0.0282***	0.0220***
	(0.0077)	(0.0077)	(0.0071)	(0.0067)	(0.0067)	(0.0061)
Not binge-drinking	-0.0341***	-0.0349***	0.0087†	-0.0108	-0.0121	0.0157**‡
	(0.0086)	(0.0086)	(0.0078)	(0.0081)	(0.0081)	(0.0074)
Exercise regularly	0.0471***	0.0468***	0.0035†	0.0420***	0.0407***	0.0171**‡
	(0.0087)	(0.0087)	(0.0079)	(0.0081)	(0.0081)	(0.0074)
Eat breakfast regularly	0.0266***	0.0247***	0.0206***	0.0192***	0.0175**	0.0205***
	(0.0082)	(0.0082)	(0.0075)	(0.0069)	(0.0069)	(0.0063)
Number of individuals	3,191	3,191		3,688	3,688	
Person-year observations	5,494	5,494		6,254	6,254	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; † and ‡ indicate significant differences between effect of time preference and locus of control at 1% and 5% level. [a] Time preference (TP) is a dummy variable that takes the value 1 if the individual answers the following question in 2006: "In planning your saving and spending, which of the following time periods is most important to you?" with "The next 5 to 10 years" or "More than 10 years ahead", and 0 otherwise. We standardized this variable to mean 0, and standard deviation 1, so that time preference and locus of control can be compared to each other. Every row in column (1) is a separate regression (random effects and linear random effects probability models, data 2007 and 2009) of health investment on locus of control and explanatory variables outlined in Table A.1 in the Appendix and a time dummy variable for 2009. All estimates reported in columns (2) and (4) stem from the same regression model as in column (1), except for including the time preference proxy.

Table 3: Locus of control and health expectations (2009)

	Likely to live to age 75 (0,1)		**Likely to maintain/improve health next 4 yrs (0-1)**			
	Men LPM	**Women** LPM	**Men** LPM	**Women** LPM	**Men** Finite mixture (2 classes)	**Women**
Healthy eating index	0.1280***	0.1724***	0.0456***	0.0264**	0.0371***	0.0192*
	(0.0357)	(0.0319)	(0.0144)	(0.0132)	(0.0127)	(0.0114)
LOC	0.0339**	0.0210	0.0262***	0.0390***	0.0142***	0.0241***
	(0.0151)	(0.0165)	(0.0061)	(0.0068)	(0.0051)	(0.0055)
LOC × Healthy eating index	0.0675**	0.0576*	0.0204	-0.0002	0.0221*	0.0055
	(0.0343)	(0.0295)	(0.0139)	(0.0122)	(0.0117)	(0.0099)
Low fat/skim milk	0.0283	0.0474***	0.0096	0.0165**	0.0080	0.0085
	(0.0184)	(0.0176)	(0.0074)	(0.0072)	(0.0065)	(0.0062)
LOC	0.0372***	0.0469***	0.0274***	0.0447***	0.0154***	0.0269***
	(0.0123)	(0.0134)	(0.0050)	(0.0055)	(0.0041)	(0.0045)
LOC × Low fat/skim milk	0.0552***	0.0045	0.0163**	-0.0103	0.0185***	-0.0013
	(0.0182)	(0.0172)	(0.0074)	(0.0070)	(0.0062)	(0.0058)
Avoid fatty foods	0.0126	0.0342*	-0.0021	-0.0022	-0.0029	-0.0046
	(0.0242)	(0.0191)	(0.0098)	(0.0078)	(0.0089)	(0.0069)
LOC	0.0517***	0.0436***	0.0330***	0.0352***	0.0213***	0.0251***
	(0.0111)	(0.0116)	(0.0045)	(0.0047)	(0.0039)	(0.0039)
LOC × Avoid fatty foods	0.0358	0.0163	0.0044	0.0125*	0.0036	0.0047
	(0.0228)	(0.0183)	(0.0092)	(0.0075)	(0.0077)	(0.0062)
Eat vegetables regularly	0.0652***	0.0680***	0.0173**	0.0115	0.0133**	0.0079
	(0.0186)	(0.0180)	(0.0075)	(0.0074)	(0.0066)	(0.0064)
LOC	0.0639***	0.0278**	0.0327***	0.0381***	0.0205***	0.0228***
	(0.0125)	(0.0128)	(0.0051)	(0.0053)	(0.0041)	(0.0044)
LOC × Eat vegetables regularly	-0.0162	0.0395**	0.0018	0.0016	0.0038	0.0076
	(0.0181)	(0.0173)	(0.0073)	(0.0071)	(0.0063)	(0.0058)
Eat fruit regularly	0.0422**	0.0701***	0.0261***	0.0059	0.0226***	0.0103
	(0.0191)	(0.0178)	(0.0077)	(0.0073)	(0.0067)	(0.0064)
LOC	0.0499***	0.0370***	0.0315***	0.0398***	0.0207***	0.0277***
	(0.0119)	(0.0126)	(0.0048)	(0.0052)	(0.0040)	(0.0043)
LOC × Eat fruit regularly	0.0226	0.0250	0.0044	-0.0014	0.0011	-0.0025
	(0.0190)	(0.0173)	(0.0077)	(0.0071)	(0.0065)	(0.0058)
Alameda 7 index	0.2048***	0.2069***	0.0709***	0.0644***	0.0519***	0.0445***
	(0.0360)	(0.0349)	(0.0145)	(0.0144)	(0.0126)	(0.0124)
LOC	0.0135	0.0242	0.0132	0.0386***	0.0017	0.0219***
	(0.0211)	(0.0217)	(0.0085)	(0.0089)	(0.0071)	(0.0075)
LOC × Alameda 7 index	0.0741**	0.0343	0.0348**	-0.0008	0.0351***	0.0070
	(0.0336)	(0.0309)	(0.0135)	(0.0127)	(0.0114)	(0.0107)
Not smoking	0.1345***	0.1329***	0.0480***	0.0188*	0.0374***	0.0068
	(0.0224)	(0.0237)	(0.0091)	(0.0098)	(0.0079)	(0.0084)
LOC	0.0211	0.0402**	0.0220***	0.0430***	0.0101*	0.0273***
	(0.0173)	(0.0194)	(0.0070)	(0.0080)	(0.0057)	(0.0068)
LOC × Not smoking	0.0474**	0.0075	0.0146*	-0.0053	0.0155***	-0.0011
	(0.0198)	(0.0213)	(0.0080)	(0.0088)	(0.0066)	(0.0074)
Not binge-drinking	0.0321	0.0034	-0.0050	-0.0033	-0.0028	-0.0027
	(0.0196)	(0.0182)	(0.0079)	(0.0075)	(0.0071)	(0.0064)
LOC	0.0583***	0.0470***	0.0328***	0.0321***	0.0219***	0.0245***
	(0.0123)	(0.0137)	(0.0050)	(0.0056)	(0.0042)	(0.0047)
LOC × Not binge-drinking	0.0038	0.0042	0.0022	0.0132*	-0.0001	0.0035
	(0.0183)	(0.0173)	(0.0074)	(0.0071)	(0.0062)	(0.0058)
Exercise regularly	0.0374**	0.0571***	0.0202***	0.0416***	0.0101	0.0303***
	(0.0183)	(0.0173)	(0.0074)	(0.0071)	(0.0065)	(0.0061)
LOC	0.0417***	0.0421***	0.0260***	0.0441***	0.0121***	0.0265***
	(0.0134)	(0.0126)	(0.0054)	(0.0051)	(0.0045)	(0.0043)
LOC × Exercise regularly	0.0312*	0.0111	0.0140*	-0.0144**	0.0198***	-0.0011
	(0.0180)	(0.0174)	(0.0073)	(0.0071)	(0.0061)	(0.0059)
Eat regularly breakfast	0.0653***	0.0993***	0.0295***	0.0200**	0.0254***	0.0172***
	(0.0196)	(0.0207)	(0.0079)	(0.0085)	(0.0069)	(0.0075)
LOC	0.0443***	0.0265	0.0230***	0.0384***	0.0146***	0.0243***
	(0.0156)	(0.0166)	(0.0063)	(0.0068)	(0.0053)	(0.0058)
LOC × Eat regularly breakfast	0.0199	0.0290	0.0157**	0.000	0.0112*	0.0031
	(0.0186)	(0.0190)	(0.0075)	(0.0078)	(0.0063)	(0.0065)
Number of individuals	2,909	3,251	2,863	3,213	2,863	3,213

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Every paragraph is a linear probability (LPM) or OLS model of health expectations on locus of control, health investment, and interactions between health investment and locus of control (2009). These variables as well as other control variables are described in the lower panel of Table A.1 in the Appendix.

Table 4: Locus of control and general health

	Men		Women	
	RE	Incl. "Likely to live to age 75"	RE	Incl. "Likely to live to age 75"
Healthy eating index(t-1)	0.0128	-0.0015	0.0328	0.0207
	(0.0352)	(0.0351)	(0.0305)	(0.0305)
LOC	0.0850***	0.0829***	0.1003***	0.0950***
	(0.0156)	(0.0156)	(0.0163)	(0.0164)
LOC × Healthy eating index(t-1)	0.0593*	0.0527	-0.0466*	-0.0416
	(0.0337)	(0.0336)	(0.0281)	(0.0282)
Low fat/skim milk (t-1)	0.0146	0.0110	0.0117	0.0103
	(0.0186)	(0.0185)	(0.0170)	(0.0170)
LOC	0.0929***	0.0918***	0.0923***	0.0898***
	(0.0132)	(0.0131)	(0.0138)	(0.0139)
LOC × Low fat/skim milk (t-1)	0.0294	0.0207	-0.0233	-0.0240
	(0.0182)	(0.0182)	(0.0167)	(0.0168)
Avoid fatty foods (t-1)	-0.0136	-0.0168	-0.0028	-0.0065
	(0.0233)	(0.0233)	(0.0179)	(0.0179)
LOC	0.1034***	0.0990***	0.0879***	0.0838***
	(0.0119)	(0.0119)	(0.0116)	(0.0117)
LOC × Avoid fatty foods (t-1)	0.0051	0.0048	-0.0267	-0.0233
	(0.0219)	(0.0219)	(0.0172)	(0.0173)
Eat vegetables regularly (t-1)	0.0166	0.0080	0.0368**	0.0323*
	(0.0180)	(0.0179)	(0.0168)	(0.0168)
LOC	0.0980***	0.0927***	0.0780***	0.0746***
	(0.0134)	(0.0133)	(0.0129)	(0.0129)
LOC × Eat vegetables regularly (t-1)	0.0150	0.0173	0.0010	0.0020
	(0.0177)	(0.0177)	(0.0162)	(0.0163)
Eat fruit regularly (t-1)	-0.0090	-0.0102	-0.0046	-0.0098
	(0.0188)	(0.0188)	(0.0166)	(0.0166)
LOC	0.0973***	0.0934***	0.0872***	0.0827***
	(0.0127)	(0.0126)	(0.0126)	(0.0127)
LOC × Eat fruit regularly (t-1)	0.0230	0.0213	-0.0171	-0.0140
	(0.0188)	(0.0187)	(0.0162)	(0.0162)
Alameda 7 index (t-1)	0.0777**	0.0548	0.0866***	0.0745**
	(0.0358)	(0.0358)	(0.0335)	(0.0336)
LOC	0.0898***	0.0863***	0.0951***	0.0936***
	(0.0211)	(0.0211)	(0.0210)	(0.0211)
LOC × Alameda 7 index (t-1)	0.0256	0.0242	-0.0268	-0.0291
	(0.0327)	(0.0327)	(0.0296)	(0.0297)
Not smoking (t-1)	0.0755***	0.0582***	0.0721***	0.0566**
	(0.0217)	(0.0218)	(0.0221)	(0.0222)
LOC	0.0916***	0.0899***	0.1016***	0.0996***
	(0.0170)	(0.0170)	(0.0178)	(0.0179)
LOC × Not smoking (t-1)	0.0154	0.0125	-0.0230	-0.0242
	(0.0192)	(0.0192)	(0.0193)	(0.0194)
Not binge-drinking (t-1)	-0.0364*	-0.0372*	-0.0224	-0.0238
	(0.0195)	(0.0195)	(0.0173)	(0.0173)
LOC	0.1023***	0.0968***	0.0709***	0.0667***
	(0.0130)	(0.0130)	(0.0137)	(0.0137)
LOC × Not binge-drinking (t-1)	-0.0016	0.0013	0.0244	0.0270
	(0.0181)	(0.0181)	(0.0165)	(0.0166)
Exercise regularly (t-1)	0.0330*	0.0296*	0.0418***	0.0419***
	(0.0169)	(0.0168)	(0.0158)	(0.0158)
LOC	0.0917***	0.0903***	0.0893***	0.0872***
	(0.0132)	(0.0132)	(0.0120)	(0.0120)
LOC × Exercise regularly (t-1)	0.0220	0.0162	-0.0100	-0.0130
	(0.0162)	(0.0162)	(0.0155)	(0.0156)
Eat breakfast regularly (t-1)	0.0186	0.0117	0.0257	0.0187
	(0.0195)	(0.0195)	(0.0195)	(0.0195)
LOC	0.0987***	0.0932***	0.0901***	0.0882***
	(0.0158)	(0.0158)	(0.0163)	(0.0163)
LOC × Eat breakfast regularly (t-1)	0.0088	0.0106	-0.0156	-0.0173
	(0.0183)	(0.0182)	(0.0178)	(0.0179)
Person-year observations	5,206	5,206	5,899	5,899
Number of individuals	3,192	3,192	3,650	3,650

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Every paragraph is a separate linear random effects model of general health (2008, 2010) on locus of control (LOC), health investment (2007, 2009), their interactions, and lagged general health. All control variables are described in Table A.1. The coefficients on "Likely to live to age 75" is 0.17*** for men and 0.12*** for women in each model.

Table 5: Locus of control and life satisfaction

	Men		Women	
	RE	CRE[c]	RE	CRE[c]
Healthy eating index(t-1)	0.0480	0.0500	0.0368	0.0295
	(0.0423)	(0.0426)	(0.0390)	(0.0394)
LOC	0.1646***	0.1625***	0.1451***	0.1436***
	(0.0190)	(0.0191)	(0.0209)	(0.0210)
LOC × Healthy eating index(t-1)	-0.0760*	-0.0763*	0.0184	0.0185
	(0.0406)	(0.0407)	(0.0361)	(0.0361)
Low fat/skim milk (t-1)	0.0154	0.0149	-0.0109	-0.0169
	(0.0224)	(0.0226)	(0.0219)	(0.0220)
LOC	0.1495***	0.1468***	0.1405***	0.1388***
	(0.0160)	(0.0161)	(0.0175)	(0.0176)
LOC × Low fat/skim milk (t-1)	-0.0254	-0.0236	0.0240	0.0243
	(0.0220)	(0.0221)	(0.0214)	(0.0214)
Avoid fatty foods (t-1)	0.0209	0.0254	0.0124	0.0147
	(0.0280)	(0.0281)	(0.0229)	(0.0230)
LOC	0.1476***	0.1454***	0.1498***	0.1477***
	(0.0144)	(0.0145)	(0.0149)	(0.0149)
LOC × Avoid fatty foods (t-1)	-0.0385	-0.0389	0.0118	0.0133
	(0.0262)	(0.0263)	(0.0221)	(0.0221)
Eat vegetables regularly (t-1)	-0.0027	-0.0031	0.0279	0.0245
	(0.0216)	(0.0217)	(0.0215)	(0.0217)
LOC	0.1528***	0.1511***	0.1490***	0.1474***
	(0.0162)	(0.0163)	(0.0164)	(0.0165)
LOC × Eat vegetables regularly (t-1)	-0.0301	-0.0314	0.0083	0.0086
	(0.0213)	(0.0214)	(0.0208)	(0.0208)
Eat fruit regularly (t-1)	0.0267	0.0268	0.0157	0.0136
	(0.0226)	(0.0227)	(0.0213)	(0.0214)
LOC	0.1411***	0.1392***	0.1615***	0.1607***
	(0.0153)	(0.0154)	(0.0161)	(0.0162)
LOC × Eat fruit regularly (t-1)	-0.0045	-0.0052	-0.0172	-0.0188
	(0.0226)	(0.0227)	(0.0207)	(0.0207)
Alameda 7 index (t-1)	0.0879**	0.0907**	0.0828*	0.0772*
	(0.0428)	(0.0432)	(0.0428)	(0.0431)
LOC	0.1630***	0.1598***	0.0975***	0.0981***
	(0.0256)	(0.0258)	(0.0269)	(0.0269)
LOC × Alameda 7 index (t-1)	-0.0439	-0.0418	0.0890**	0.0857**
	(0.0395)	(0.0396)	(0.0380)	(0.0381)
Not smoking (t-1)	0.0487*	0.0445*	0.0704**	0.0592**
	(0.0265)	(0.0267)	(0.0278)	(0.0279)
LOC	0.1382***	0.1333***	0.1420***	0.1434***
	(0.0209)	(0.0210)	(0.0223)	(0.0223)
LOC × Not smoking (t-1)	-0.0023	0.0011	0.0183	0.0154
	(0.0235)	(0.0236)	(0.0243)	(0.0243)
Not binge-drinking (t-1)	-0.0122	-0.0117	-0.0175	-0.0191
	(0.0238)	(0.0239)	(0.0221)	(0.0222)
LOC	0.1425***	0.1390***	0.1305***	0.1300***
	(0.0160)	(0.0161)	(0.0173)	(0.0173)
LOC × Not binge-drinking (t-1)	-0.0074	-0.0048	0.0439**	0.0429**
	(0.0220)	(0.0221)	(0.0210)	(0.0210)
Exercise regularly (t-1)	0.0626***	0.0638***	0.0445**	0.0451**
	(0.0203)	(0.0203)	(0.0197)	(0.0197)
LOC	0.1397***	0.1381***	0.1397***	0.1393***
	(0.0160)	(0.0161)	(0.0148)	(0.0148)
LOC × Exercise regularly (t-1)	-0.0081	-0.0106	0.0371*	0.0352*
	(0.0197)	(0.0198)	(0.0194)	(0.0194)
Eat breakfast regularly (t-1)	0.0011	0.0019	0.0048	0.0038
	(0.0235)	(0.0236)	(0.0250)	(0.0251)
LOC	0.1354***	0.1319***	0.1412***	0.1408***
	(0.0192)	(0.0194)	(0.0208)	(0.0208)
LOC × Eat breakfast regularly (t-1)	0.0076	0.0098	0.0176	0.0160
	(0.0220)	(0.0221)	(0.0229)	(0.0229)
Person-year observations	5,227	5,227	5,927	5,927
Number of individuals	3,197	3,197	3,658	3,658

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. [c]CRE: The correlated random effects model includes mean values of time-varying regressors. Every paragraph is a separate linear (correlated) random effects model of life satisfaction (2008, 2010) on locus of control (LOC), health investment, lagged life satisfaction, interaction of locus of control with health investment and all control variables as described in Table A.1.

APPENDIX

Table A.1: Summary Statistics

Variable	Description	Mean	Std. Dev.	Min.	Max.	N
Locus of control (mean 0, SD 1)	Based on Pearlin and Schooler (1978); constructed from predicted first factor (factor analysis) Index is an average of up to three values of predicted factors from years 2003, 2004, and 2007.	0	1	-4.676	2.435	2412
			2007 and 2009 sample			
Health investments used as dependent and independent variables						
Healthy eating index	Sum of avoid fat in milk, avoid fatty food, eats vegetables, eats fruits (divided by 4 for analysis)	1.657	1.156	0	4	12412
Low fat/skim milk	Drink low fat or skinny milk	0.506	0.5	0	1	12412
Avoid fatty foods	Less than once a month eat fried potatoes, French fries, hot chips or wedges	0.246	0.431	0	1	12412
Eat regularly vegetables	Eats vegetables seven days a week	0.485	0.5	0	1	12412
Eat regularly fruit	Eats fruit seven days a week	0.42	0.494	0	1	12412
Alameda 7 index	Sum of no smoke, no binge drinking, regular sport, regular breakfast (divided by 4 for analysis)	2.426	1.087	0	4	12412
Currently not smoking	Currently not being a smoker	0.792	0.406	0	1	12412
Avoid binge drinking	Drinks did not exceed (sex-based) threshold in the last year	0.423	0.494	0	1	12412
Regular physical exercise	Exercises at least three times/week, moderately to intensive	0.518	0.5	0	1	12412
Eat breakfast regularly	Eats breakfast seven times a week	0.693	0.461	0	1	12412
Standard control variables						
Extraversion (mean 0, SD 1)	Big-Five, 2005, standardized for 2007-2010, by gender	-0.013	1.002	-3.247	2.637	12412
Agreeableness (mean 0, SD 1)	Big-Five, 2005, standardized for 2007-2010, by gender	0.004	0.974	-5.469	2.042	12412
Conscientiousness (mean 0, SD 1)	Big-Five, 2005, standardized for 2007-2010, by gender	0.037	0.996	-3.97	2.057	12412
Emotional stability (mean 0, SD 1)	Big-Five, 2005, standardized for 2007-2010, by gender	0.016	0.993	-3.863	1.815	12412
Openness to experience (mean 0, SD 1)	Big-Five, 2005, standardized for 2007-2010, by gender	0.003	0.99	-3.233	2.625	12412
Married or de facto relationship	-	0.69	0.463	0	1	12412
Divorced, separated, widowed		0.107	0.309	0	1	12412
Logarithm of equivalized household income	Divided by square root of household members	10.564	0.605	5.033	13.119	12412
Number of children in household	-	0.663	1.022	0	9	12412
Total work-hours per week	-	27.489	20.875	0	112	12412
Not in the labor force (Base: unemployed)	-	0.202	0.402	0	1	12412
Full-time study	-	0.054	0.227	0	1	12412
Masters or doctorate (Base: drop-out)	-	0.045	0.206	0	1	12412
Grad diploma, grad certificate	-	0.069	0.254	0	1	12412
Bachelor or honours	-	0.156	0.362	0	1	12412
Adv diploma, diploma	-	0.097	0.295	0	1	12412
Year 12	-	0.167	0.373	0	1	12412
Professional qualification	Any certificate (I,II,III,IV)	0.226	0.418	0	1	12412
Health Importance, 2001 (0 to 10)	measured in 2001	7.461	3.481	0	10	12412
Health Importance Missing (0,1)	-	0.16	0.367	0	1	12412
BMI	Body Mass Index (weight in kg/(height in m)^2	26.709	5.537	12.4	85.2	12412
Regular smoker (0,1)	-	0.173	0.378	0	1	12412
Ch. Bronchitis	-	0.022	0.146	0	1	12412
Diabetes	-	0.04	0.196	0	1	12412
Heart disease	-	0.043	0.202	0	1	12412
High blood pressure / Hypertension	-	0.15	0.358	0	1	12412
Arthritis	-	0.156	0.363	0	1	12412
Asthma	-	0.131	0.337	0	1	12412
Any type of cancer	-	0.04	0.195	0	1	12412
Additional controls for ISCO-88 occupation coding, age and years are included.						
Additional control variables for health investment equations						
Currently on a diet to lose weight (0,1)	-	0.169	0.374	0	1	12412
Saving for the next 5-10 years, 2006	-	0.246	0.431	0	1	11739
Other dependent variables						
			2009 sample			
Expect to live to 75 or more?	asked if aged under 65: How likely do you think it is that you will live to be 75 or more? Very likely, likely, unlikely or very unlikely? Coded as 1 if very likely, otherwise 0	0.495	0.5	0	1	6076
Percent chance health same in 4 yrs	What do you think is the per cent chance that your health will still be excellent (if currently excellent), still be very good or better (if currently very good), still be good or better (if currently good), still be fair or better (if currently fair), have improved significantly (if currently poor) four years from now? Standardized to 0-1 bounds for analysis	79.091	21.758	0	100	6160
			2008 and 2010 sample			
General life satisfaction	Self-assessed general life satisfaction (Standardized to mean 0, SD 1 for analysis)	69.997	20.074	0	100	11105
SF-36 general health	Transformed (SF-36) from the following questions: (1) Self-assessed health, (2) Get sick a little easier than other people, (3) As healthy as anybody I know, (4) Expect my health to get worse and (5) My health is excellent. (Standardized to mean 0, SD 1 for analysis)	7.854	1.316	0	10	11099

Table A.2: Determinants of health investment

	Healthy Eating Index		Alameda 7 Index	
	Men	Women	Men	Women
Locus of control (mean 0, SD 1)	0.014***	0.012***	0.020***	0.022***
	(0.004)	(0.004)	(0.005)	(0.004)
BMI	-0.001	-0.002***	-0.002**	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Health importance (2001) (0,1)	0.001	0.010**	0.005	0.009**
	(0.004)	(0.005)	(0.005)	(0.004)
Currently on a diet to lose weight (0,1)	0.054***	0.074***	0.028***	0.033***
	(0.010)	(0.008)	(0.010)	(0.007)
Extraversion (mean 0, SD 1)	0.000	0.006	-0.009**	-0.026***
	(0.004)	(0.004)	(0.004)	(0.004)
Agreeableness (mean 0, SD 1)	0.005	-0.002	0.000	0.001
	(0.004)	(0.004)	(0.005)	(0.004)
Conscientiousness (mean 0, SD 1)	0.009**	0.014***	0.020***	0.032***
	(0.004)	(0.004)	(0.005)	(0.004)
Emotional stability (mean 0, SD 1)	0.006	0.024***	0.013***	0.023***
	(0.004)	(0.005)	(0.005)	(0.004)
Openness to experience (mean 0, SD 1)	0.010**	0.027***	0.002	0.010**
	(0.004)	(0.004)	(0.005)	(0.004)
Ch. Bronchitis	-0.028	-0.041*	-0.064***	-0.040**
	(0.023)	(0.021)	(0.022)	(0.019)
Diabetes	0.066***	0.039*	0.064***	0.057***
	(0.017)	(0.020)	(0.017)	(0.019)
Heart disease	0.002	0.033*	-0.000	-0.003
	(0.016)	(0.018)	(0.015)	(0.017)
High blood pressure/Hypertension	0.013	-0.006	-0.003	0.004
	(0.010)	(0.010)	(0.010)	(0.010)
Arthritis	-0.015	0.009	-0.012	0.002
	(0.011)	(0.010)	(0.010)	(0.009)
Asthma	0.001	-0.004	0.002	-0.019**
	(0.011)	(0.010)	(0.011)	(0.009)
Any type of cancer	-0.012	-0.010	0.031**	0.003
	(0.016)	(0.017)	(0.015)	(0.016)
Age-group 25-39 (Base: 15-24)	0.015	0.046***	-0.012	0.021
	(0.015)	(0.015)	(0.014)	(0.014)
Age-group 40-54	0.086***	0.114***	0.048***	0.078***
	(0.016)	(0.016)	(0.016)	(0.015)
Age-group 55-69	0.176***	0.202***	0.137***	0.151***
	(0.018)	(0.018)	(0.018)	(0.017)
Regular smoker (0,1)	-0.086***	-0.092***		
	(0.009)	(0.010)		
Logarithm of equivalized household income	0.007	0.024***	-0.005	0.011**
	(0.006)	(0.006)	(0.006)	(0.005)
Number of children in household	-0.016***	-0.021***	0.007*	-0.013***
	(0.004)	(0.004)	(0.004)	(0.004)
Total work-hours per week	0.000	-0.001***	-0.000	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Not in the labor force	0.009	0.046**	0.067***	0.055***
	(0.022)	(0.021)	(0.021)	(0.019)
Full-time study	0.018	0.027	0.117***	0.056**
	(0.025)	(0.025)	(0.023)	(0.022)
Masters or doctorate (Base: drop-out)	0.119***	0.108***	0.121***	0.140***
	(0.020)	(0.022)	(0.021)	(0.021)
Grad diploma, grad certificate	0.132***	0.118***	0.092***	0.098***
	(0.019)	(0.016)	(0.020)	(0.016)
Bachelor or honours	0.078***	0.082***	0.073***	0.091***
	(0.015)	(0.013)	(0.015)	(0.013)
Adv diploma, diploma	0.066***	0.081***	0.044***	0.057***
	(0.015)	(0.015)	(0.016)	(0.014)
Year 12	0.039***	0.036***	0.029**	0.038***
	(0.013)	(0.012)	(0.013)	(0.011)
Professional qualification	0.040***	0.014	0.016	-0.004
	(0.011)	(0.012)	(0.012)	(0.011)
Constant	0.131*	0.106	0.608***	0.431***
	(0.069)	(0.066)	(0.067)	(0.060)
Observations	5,831	6,581	5,831	6,581
Number of id	3,412	3,901	3,412	3,901

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Linear random effects estimation. All models control for marital status, occupation and year fixed effects.

Table A.3: Determinants of health expectations

	Very likely to live to age 75 or at least another 10 years (0,1)				Probability of maintaining or improving health in 4 yrs (0-1)			
	Healthy Eating Index		Alameda 7 Index		Healthy Eating Index		Alameda 7 Index	
	Men	Women	Men	Women	Men	Women	Men	Women
Health investment	0.128***	0.172***	0.205***	0.207***	0.046***	0.026**	0.071***	0.064***
	(0.036)	(0.032)	(0.036)	(0.035)	(0.014)	(0.013)	(0.014)	(0.013)
Locus of control (LOC) (mean 0, SD 1)	0.034**	0.021	0.014	0.024	0.026***	0.039***	0.013	0.039***
	(0.015)	(0.016)	(0.021)	(0.022)	(0.006)	(0.007)	(0.009)	(0.009)
Health investment × LOC	0.068**	0.058*	0.074**	0.034	0.020	-0.000	0.035**	-0.001
	(0.034)	(0.030)	(0.034)	(0.031)	(0.014)	(0.012)	(0.014)	(0.013)
BMI	-0.003*	-0.001	-0.002	-0.000	-0.001	-0.001	-0.000	-0.001
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Importance of health (2001) (0,1)	0.029***	0.015	0.028***	0.016	0.007	0.001	0.006	0.001
	(0.011)	(0.010)	(0.011)	(0.010)	(0.004)	(0.004)	(0.004)	(0.004)
Extraversion (mean 0, SD 1)	0.027***	0.024***	0.028***	0.030***	0.008**	-0.003	0.008**	-0.001
	(0.009)	(0.009)	(0.009)	(0.009)	(0.004)	(0.004)	(0.004)	(0.004)
Agreeableness (mean 0, SD 1)	0.030***	0.016*	0.031***	0.015	0.015***	0.009**	0.016***	0.009**
	(0.010)	(0.010)	(0.010)	(0.010)	(0.004)	(0.004)	(0.004)	(0.004)
Conscientiousness (mean 0, SD 1)	-0.006	0.017*	-0.008	0.013	0.004	0.009**	0.004	0.007*
	(0.010)	(0.009)	(0.010)	(0.009)	(0.004)	(0.004)	(0.004)	(0.004)
Emotional stability (mean 0, SD 1)	0.027***	0.025**	0.024**	0.025**	0.006	-0.002	0.005	-0.002
	(0.010)	(0.010)	(0.010)	(0.010)	(0.004)	(0.004)	(0.004)	(0.004)
Openness to experience (mean 0, SD 1)	0.023**	0.007	0.024**	0.009	0.006	-0.001	0.006	-0.001
	(0.010)	(0.010)	(0.010)	(0.010)	(0.004)	(0.004)	(0.004)	(0.004)
Ch. Bronchitis	-0.083	-0.104*	-0.068	-0.095*	-0.178***	-0.090***	-0.173***	-0.087***
	(0.063)	(0.057)	(0.063)	(0.057)	(0.026)	(0.023)	(0.026)	(0.023)
Diabetes	-0.037	-0.143***	-0.041	-0.148***	-0.014	-0.038*	-0.015	-0.040**
	(0.043)	(0.049)	(0.043)	(0.049)	(0.017)	(0.020)	(0.017)	(0.020)
Heart disease	-0.105**	-0.125**	-0.108***	-0.123**	-0.088***	-0.117***	-0.088***	-0.115***
	(0.041)	(0.050)	(0.041)	(0.050)	(0.017)	(0.020)	(0.017)	(0.020)
High blood pressure / Hypertension	-0.074***	-0.123***	-0.071***	-0.122***	-0.030***	-0.029***	-0.029***	-0.029***
	(0.027)	(0.026)	(0.027)	(0.026)	(0.011)	(0.011)	(0.011)	(0.011)
Arthritis	-0.045	-0.070***	-0.043	-0.067***	-0.076***	-0.062***	-0.075***	-0.062***
	(0.028)	(0.025)	(0.028)	(0.025)	(0.011)	(0.010)	(0.011)	(0.010)
Asthma	-0.057*	0.016	-0.059**	0.015	-0.007	-0.020**	-0.008	-0.019*
	(0.029)	(0.024)	(0.029)	(0.024)	(0.012)	(0.010)	(0.012)	(0.010)
Any type of cancer	-0.121***	-0.066	-0.136***	-0.056	-0.043**	-0.058***	-0.048***	-0.056***
	(0.043)	(0.047)	(0.043)	(0.047)	(0.017)	(0.019)	(0.017)	(0.019)
Age-group 25-39 (Base: 15-24)	-0.053	-0.071*	-0.055	-0.073*	-0.039**	-0.043***	-0.040**	-0.044***
	(0.041)	(0.039)	(0.041)	(0.039)	(0.017)	(0.016)	(0.017)	(0.016)
Age-group 40-54	-0.049	-0.025	-0.057	-0.027	-0.083***	-0.080***	-0.087***	-0.083***
	(0.045)	(0.042)	(0.045)	(0.042)	(0.018)	(0.017)	(0.018)	(0.017)
Age-group 55-69	0.037	-0.002	0.023	-0.002	-0.089***	-0.067***	-0.095***	-0.072***
	(0.050)	(0.047)	(0.050)	(0.047)	(0.020)	(0.020)	(0.020)	(0.019)
Married or de facto relationship	0.069**	0.037	0.074***	0.026	0.002	0.013	0.004	0.009
	(0.028)	(0.028)	(0.028)	(0.028)	(0.011)	(0.012)	(0.011)	(0.012)
Divorced, separated, widowed	0.046	0.044	0.053	0.041	-0.013	0.006	-0.010	0.006
	(0.040)	(0.036)	(0.040)	(0.036)	(0.016)	(0.015)	(0.016)	(0.015)
Logarithm of equivalized household income	-0.014	0.026	-0.015	0.031**	-0.009	0.019***	-0.009	0.019***
	(0.017)	(0.016)	(0.017)	(0.016)	(0.007)	(0.006)	(0.007)	(0.006)
Number of children in household	0.011	0.010	0.008	0.010	0.000	0.012***	-0.001	0.012***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.004)	(0.004)	(0.004)	(0.004)
total work hours	-0.000	-0.000	-0.000	0.000	0.001**	0.000	0.001**	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Not in the labor force	-0.063	-0.040	-0.073	-0.048	-0.063**	-0.016	-0.065***	-0.022
	(0.063)	(0.063)	(0.063)	(0.063)	(0.025)	(0.026)	(0.025)	(0.026)
Full-time study	0.141*	-0.001	0.118	-0.008	0.044	0.003	0.037	-0.003
	(0.074)	(0.074)	(0.074)	(0.074)	(0.030)	(0.031)	(0.030)	(0.031)
Masters or doctorate (Base: drop-out)	0.053	0.040	0.044	0.039	0.007	0.026	0.005	0.021
	(0.048)	(0.049)	(0.048)	(0.049)	(0.019)	(0.020)	(0.019)	(0.020)
Grad diploma, grad certificate	0.101**	0.024	0.099**	0.028	0.005	0.032**	0.005	0.030*
	(0.045)	(0.037)	(0.045)	(0.037)	(0.018)	(0.015)	(0.018)	(0.015)
Bachelor or honours	0.016	0.010	0.011	0.010	0.001	0.023*	-0.001	0.020
	(0.035)	(0.031)	(0.035)	(0.031)	(0.014)	(0.013)	(0.014)	(0.013)
Adv diploma, diploma	-0.008	-0.006	-0.010	0.000	0.012	0.003	0.011	0.002
	(0.036)	(0.033)	(0.036)	(0.033)	(0.014)	(0.014)	(0.014)	(0.014)
Year 12	0.012	-0.008	0.003	-0.009	0.015	0.022*	0.012	0.021*
	(0.032)	(0.029)	(0.032)	(0.029)	(0.013)	(0.012)	(0.013)	(0.012)
Professional qualification	0.022	-0.017	0.022	-0.016	-0.003	0.003	-0.003	0.003
	(0.027)	(0.027)	(0.027)	(0.027)	(0.011)	(0.011)	(0.011)	(0.011)
Legislators (Base: not working)	-0.012	0.059	0.014	0.087	0.012	0.024	0.019	0.033
	(0.075)	(0.078)	(0.075)	(0.078)	(0.030)	(0.032)	(0.030)	(0.032)
Professionals	0.088*	0.055	0.091*	0.064	0.029	0.057**	0.030	0.059**
	(0.048)	(0.058)	(0.048)	(0.058)	(0.019)	(0.024)	(0.019)	(0.024)
Technicians	0.073	0.023	0.070	0.034	0.006	0.019	0.005	0.021
	(0.048)	(0.051)	(0.048)	(0.050)	(0.019)	(0.021)	(0.019)	(0.021)
Clerks	0.077	0.069	0.080*	0.084*	0.012	0.047**	0.013	0.049**
	(0.048)	(0.050)	(0.047)	(0.049)	(0.019)	(0.020)	(0.019)	(0.020)
Service	0.027	0.081*	0.022	0.084*	0.024	0.036*	0.022	0.037*
	(0.054)	(0.049)	(0.054)	(0.049)	(0.022)	(0.020)	(0.022)	(0.020)
Skilled agricultural	0.045	0.059	0.041	0.068	0.006	0.043**	0.004	0.044**
	(0.054)	(0.051)	(0.054)	(0.051)	(0.022)	(0.021)	(0.022)	(0.021)
Craft	-0.022	0.229**	-0.027	0.227**	0.003	0.065	0.001	0.061
	(0.063)	(0.100)	(0.062)	(0.100)	(0.025)	(0.041)	(0.025)	(0.041)
Operator	-0.018	-0.298**	-0.015	-0.298**	0.013	0.004	0.013	0.001
	(0.046)	(0.140)	(0.046)	(0.140)	(0.019)	(0.058)	(0.019)	(0.058)
Elementary	0.024	0.083	0.029	0.111	0.011	-0.099**	0.012	-0.095**
	(0.050)	(0.110)	(0.050)	(0.110)	(0.020)	(0.046)	(0.020)	(0.046)
Individuals	2,863	3,213	2,863	3,213	2,909	3,251	2,909	3,251
R-squared	0.108	0.092	0.113	0.093	0.231	0.189	0.235	0.193

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Dependent variable as self-assessed probability that health will not deteriorate (range 0 to 100).

Table A.4: Locus of control and general health[a]

	Healthy eating index		Alameda 7 index	
	Men	Women	Men	Women
Health investment (t-1)	0.013	0.033	0.078**	0.087***
	(0.035)	(0.030)	(0.036)	(0.034)
Locus of control (mean 0, SD 1)	0.085***	0.100***	0.090***	0.095***
	(0.016)	(0.016)	(0.021)	(0.021)
LOC × Healthy eating index	0.059*	-0.047*	0.026	-0.027
	(0.034)	(0.028)	(0.033)	(0.030)
Health status t-1	0.668***	0.682***	0.665***	0.680***
	(0.011)	(0.010)	(0.011)	(0.010)
BMI	-0.010***	-0.010***	-0.010***	-0.010***
	(0.002)	(0.001)	(0.002)	(0.001)
Importance of health (2001)	-0.004	-0.002	-0.004	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)
Extraversion (mean 0, SD 1)	0.027***	0.010	0.028***	0.012
	(0.010)	(0.009)	(0.010)	(0.009)
Agreeableness (mean 0, SD 1)	0.015	0.018*	0.015	0.018*
	(0.011)	(0.010)	(0.011)	(0.010)
Conscientiousness (mean 0, SD 1)	0.013	-0.003	0.012	-0.005
	(0.011)	(0.010)	(0.011)	(0.010)
Emotional stability (mean 0, SD 1)	0.028***	0.026**	0.027**	0.026**
	(0.011)	(0.010)	(0.011)	(0.010)
Openness to experience (mean 0, SD 1)	0.006	-0.010	0.006	-0.010
	(0.011)	(0.010)	(0.011)	(0.010)
Age-group 25-39 (Base: 15-24)	-0.034	0.063*	-0.032	0.064*
	(0.043)	(0.038)	(0.043)	(0.038)
Age-group 40-54	-0.054	0.014	-0.057	0.009
	(0.046)	(0.041)	(0.046)	(0.041)
Age-group 55-69	-0.063	0.031	-0.071	0.023
	(0.050)	(0.045)	(0.050)	(0.045)
Married or de facto relationship	-0.051*	0.007	-0.051*	0.004
	(0.029)	(0.027)	(0.029)	(0.027)
Divorced, separated, widowed	-0.081*	0.013	-0.078*	0.017
	(0.042)	(0.035)	(0.042)	(0.035)
Logarithm of equivalized household income	0.036**	0.036**	0.037**	0.037**
	(0.017)	(0.015)	(0.017)	(0.015)
Number of children in household	0.008	0.030***	0.007	0.030***
	(0.011)	(0.010)	(0.011)	(0.010)
Total work hours	0.002*	0.001	0.002**	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Not in the labor force	-0.224***	-0.078	-0.231***	-0.079
	(0.063)	(0.057)	(0.063)	(0.057)
Full-time study	-0.173**	0.066	-0.186**	0.064
	(0.074)	(0.068)	(0.074)	(0.068)
Masters or doctorate (Base: drop-out)	0.025	-0.065	0.018	-0.075
	(0.050)	(0.049)	(0.050)	(0.049)
Grad diploma, grad certificate	0.031	-0.021	0.025	-0.028
	(0.048)	(0.038)	(0.048)	(0.038)
Bachelor or honours	0.050	0.006	0.045	-0.001
	(0.037)	(0.031)	(0.037)	(0.031)
Adv diploma, diploma	0.042	0.025	0.039	0.022
	(0.038)	(0.033)	(0.038)	(0.033)
Year 12	0.058*	0.037	0.054	0.033
	(0.034)	(0.029)	(0.034)	(0.029)
Professional qualification	0.042	-0.012	0.040	-0.012
	(0.029)	(0.027)	(0.029)	(0.027)
Person-year observations	5,206	5,899	5,206	5,899
Number of individuals	3,192	3,650	3,192	3,650

[a] Dependent variable is general health derived from the SF-36 and is standardized to mean 0 and standard deviation 1. Coefficients are obtained from a linear random effects model. Omitted from table are occupation dummy variables and year fixed effects. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.5: Locus of control and life satisfaction[a]

	Healthy eating index		Alameda 7 index	
	Men	Women	Men	Women
Health investment (t-1)	0.048	0.037	0.088**	0.083*
	(0.042)	(0.039)	(0.043)	(0.043)
Locus of control (mean 0, SD 1)	0.165***	0.145***	0.163***	0.097***
	(0.019)	(0.021)	(0.026)	(0.027)
LOC × Health investment (t-1)	-0.076*	0.018	-0.044	0.089**
	(0.041)	(0.036)	(0.040)	(0.038)
Life satisfaction (t-1)	0.432***	0.416***	0.432***	0.415***
	(0.012)	(0.012)	(0.012)	(0.012)
BMI	-0.003	-0.004**	-0.003	-0.003*
	(0.002)	(0.002)	(0.002)	(0.002)
Importance of health (2001)	0.003	0.000	0.003	0.000
	(0.004)	(0.004)	(0.004)	(0.004)
Extraversion (mean 0, SD 1)	0.023*	0.019	0.024**	0.021*
	(0.012)	(0.012)	(0.012)	(0.012)
Agreeableness (mean 0, SD 1)	0.062***	0.048***	0.063***	0.049***
	(0.013)	(0.013)	(0.013)	(0.013)
Conscientiousness (mean 0, SD 1)	0.027**	0.008	0.025*	0.006
	(0.013)	(0.012)	(0.013)	(0.012)
Emotional stability (mean 0, SD 1)	0.032**	0.022*	0.032**	0.021
	(0.013)	(0.013)	(0.013)	(0.013)
Openness to experience (mean 0, SD 1)	-0.013	-0.005	-0.012	-0.005
	(0.013)	(0.013)	(0.013)	(0.013)
Age-group 25-39 (Base: 15-24)	-0.146***	-0.190***	-0.140***	-0.192***
	(0.052)	(0.049)	(0.052)	(0.049)
Age-group 40-54	-0.178***	-0.156***	-0.175***	-0.160***
	(0.056)	(0.053)	(0.056)	(0.052)
Age-group 55-69	-0.081	-0.059	-0.082	-0.064
	(0.061)	(0.058)	(0.061)	(0.058)
Married or de facto relationship	0.047	0.128***	0.048	0.126***
	(0.035)	(0.035)	(0.035)	(0.035)
Divorced, separated, widowed	-0.076	-0.076*	-0.074	-0.073
	(0.051)	(0.046)	(0.051)	(0.046)
Logarithm of equivalized household income	0.046**	0.070***	0.047**	0.071***
	(0.020)	(0.020)	(0.020)	(0.020)
Number of children in household	-0.006	-0.043***	-0.006	-0.043***
	(0.013)	(0.013)	(0.013)	(0.013)
Total work hours	-0.004***	-0.004***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Not in the labor force	0.042	0.301***	0.041	0.300***
	(0.074)	(0.073)	(0.074)	(0.073)
Full-time study	0.074	0.227***	0.072	0.229***
	(0.088)	(0.087)	(0.088)	(0.087)
Masters or doctorate (Base: drop-out)	-0.046	-0.115*	-0.051	-0.119*
	(0.062)	(0.064)	(0.062)	(0.064)
Grad diploma, grad certificate	-0.061	-0.054	-0.063	-0.058
	(0.058)	(0.049)	(0.058)	(0.049)
Bachelor or honours	-0.017	-0.029	-0.019	-0.031
	(0.046)	(0.041)	(0.045)	(0.041)
Adv diploma, diploma	-0.069	-0.085**	-0.068	-0.087**
	(0.047)	(0.043)	(0.046)	(0.043)
Year 12	0.013	-0.016	0.012	-0.017
	(0.042)	(0.038)	(0.041)	(0.038)
Professional qualification	0.021	-0.031	0.022	-0.029
	(0.035)	(0.035)	(0.035)	(0.035)
Constant	-0.121	-0.412*	-0.177	-0.459**
	(0.227)	(0.219)	(0.229)	(0.220)
Observations	5,227	5,927	5,227	5,927
Number of id	3,197	3,658	3,197	3,658

[a] Dependent variable is life satisfaction that is standardized to mean 0 and standard deviation 1. Coefficients are obtained from a linear random effects model. Omitted from table are occupation dummy variables and year fixed effects. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.