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THE STABILITY OF PERSONALITY TRAITS IN ADOLESCENCE AND YOUNG ADULTHOOD

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Abstract
Models of economic decision-making usually assume that personality is stable over time. We assess the validity of this assumption over an eight-year time frame in adolescence and young adulthood using nationally representative panel data from Australia. Our study shows that unconditional mean-level changes in personality traits are small—with the exception of Conscientiousness which increases by 0.38 SD—because most individuals do not change their scores in a statistically reliable way during adolescence and young adulthood, or changes occur in equal proportions in opposite directions. Controlling for systematic panel attrition and multiple hypothesis testing, we demonstrate that personality traits do not systematically respond to the majority of common one-off family-, income-, and health-related shocks. However, a small number of life events—marriage, family members detained in jail, leaving the workforce and long-term health problems—are associated with subsequent changes in personality. In particular, youth who experience long-term health problems including bodily pain increase their external locus of control by 0.5 to 0.9 SD, an economically meaningful change when expressed in terms of hourly wage penalty.

JEL CODES: J24, J10, J30,

KEYWORDS: Non-cognitive skills, Big-five personality traits, Locus of control, Stability, Adolescence, Life-events, HILDA.

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1 Introduction

Personality traits are an important component of human capital. Often referred to as life or non-cognitive skills, they comprise a great variety of traits that have positive or negative productivity effects in school, in the labor market, at the workplace, and in social relationships (see Almlund et al., 2011 for an overview). Traditionally, personality psychologists have assumed that personality traits are a stable component of human capital. Children were assumed to be endowed with a temperament from birth, which was thought to mature almost deterministically into a stable portfolio of behavioral styles and patterns of thought in adulthood (Costa and McCrae, 1988; McCrae and Costa, 1994). These assumptions of stability and deterministic evolution have been criticized in the past decade (see Roberts et al., 2009). Many empirical studies have since shown that most people experience increases in their levels of conscientiousness, agreeableness, and emotional stability between adolescence and young adulthood (e.g. Bleidorn et al. 2013, Hopwood et al. 2011), especially during the process of increased social responsibilities (Roberts et al. 2006).

What is less well understood is whether personality changes stochastically, or as a response to personal or environmental shocks. The question is, are there systematic deviations from underlying baseline personality traits as a response to shocks or can personality traits be completely reversed? An oft-cited case is *Phineas Gage*, a patient who experienced dramatic changes in his personality following a severe brain injury resulting from a work accident (Damasio et al., 2005). A small empirical literature has explored the role of more common life events and on-going life experiences in explaining personality change, demonstrating that personality-type reversal observed in the patient *Gage* is certainly not the norm (Schurer et al., 2015, Cobb-Clark and Schurer, 2012; 2013; Lüdtke et al., 2011; Specht et al., 2011; 2013).

Even more so, recent work by Cobb-Clark and Schurer (2012, 2013) showed for high-quality Australian personality data that over shorter time-periods of half a decade, both the Big-Five personality traits and locus of control, two of the most widely researched personality inventories, are surprisingly stable. Focusing on a working-age population of adults aged 25 to 60, they find that trait reversal is not common, mean-level changes are zero, and observed trait changes cannot be meaningfully predicted by individual or aggregated life events. Although personality traits are not perfectly stable, Cobb-Clark and Schurer (2012, 2013) conclude that adulthood personality traits are fixed and exogenous to most income-, health-, and family-related shocks, and most of the time-varying characteristics in personality change may be attributable to measurement error.

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In this article we extend the work of Cobb-Clark and Schurer (2012, 2013) by exploring the stability of the Big-Five personality traits and locus of control during the sensitive period of adolescence and very young adulthood and by considering a longer time horizon of eight, instead of four, years. We focus our analysis on a sample of 1100 Australian youth aged between 15 and 24 years at baseline to answer the following questions: (1) What are the mean-level changes in personality of adolescents over an eight-year window?; (2) How many individuals change in a statistically reliable way, and how many increase or decrease their traits in a significant way?; (3) Which life events – one-off or high-frequency – predict changes in personality traits? and (4) Are the observed changes in any way economically meaningful?

To conduct the analysis, we use nationally representative panel data from the Household, Income, and Labour Dynamics in Australia (HILDA) survey. The advantage of HILDA is that it has three waves of high-quality, consistently measured personality traits in addition to annually collected measures of a number of positive (e.g. promoted at work) and negative (e.g. unemployment) life events. These life-events data are particularly useful given that some of them may drive what psychologists refer to as 'non-normative' changes in personality, changes that occur to most people in the same way during specific periods of the life course (McCrae *et al.*, 2000). Moreover, many of these events are outside individuals' control (e.g. death of a spouse) and thus can be used to capture the important, exogenous shocks that Seligman (1975) suggests may cause helplessness. Because these event data were collected annually, we are able to study the impact of both one-off and high-frequency life events on long-term personality change. In the analyses we account for systematic attrition from the longitudinal survey, and adjust the statistical inference to the large amount of hypotheses we are testing.

We establish that most of the Big-Five personality traits and external locus of control show small to moderate changes between adolescence and young adulthood that do not exceed 0.15 standard deviations, with the exception of youth Conscientiousness, which increases by 0.38 standard deviations. The reason for small mean-level changes is that 73-88% of individuals do not change their scores in a statistically reliable way, and for those who do, some decrease and others increase their self-assessments. We conclude that Conscientiousness – often referred to as a proxy for executive function (Kern et al., 2009) – evolves strongly between adolescence and young adulthood.

Although intra-individual personality changes are generally not predicted by the most common one-off life events, we find some important exceptions when looking at high-frequency life events for locus of control and some events which are associated with declines

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in Openness to Experience, Conscientiousness, and Agreeableness. Most prominently, the experience of persistent health problems including the long-term experience of pain is significantly associated with an increase in external control tendencies by 0.5 and 0.9 standard deviations. These effects are economically meaningful as they are equivalent in magnitude to an hourly wage decline of up to A$2.20, or up to three times the health effects found for adults in Cobb-Clark and Schurer (2013). We conclude that persistent health problems may partially offset the maturation process of internal locus of control in adolescence and young adulthood.

Our results contribute to a still growing literature that seeks to better understand the factors that determine life-skill development and the windows of opportunity to intervene to boost such skills. First, the findings on mean-level changes identified in our study for a nationally representative sample may be used as one possibility to benchmark the effectiveness of education programs aimed at boosting life skills during adolescence in the Australian context (see Schurer, 2017 for a review of such outcomes).

Second, our findings demonstrate that personality traits in adolescence and young adulthood are not specifically malleable with respect to the most common family and income-related life events. For research purposes this finding implies that such personality traits can be considered largely exogenous in the context of family- or labor-market related outcomes. In contrast, as we show that ongoing health problems (including longer spells of bodily pain) increase external control tendencies, this implies that locus of control cannot be considered exogenous in the context of health-related life-time outcomes.

The remainder of the paper is as follows: In Section 2 we review the literature on what is known about mean-level and intra-individual changes in personality. Section 3 describes the HILDA data. In Section 4 we describe the estimation strategy and present our results. We discuss our findings and contributions to the literature in Section 5.

2 Literature Review

Personality is generally viewed in the economics literature as an alternative skill set that is reflected in economically-relevant outcomes and decisions in areas such as employment, educational attainment, and health (Almlund *et al.*, 2011). This conceptualization of personality as a set of skills motivates their incorporation into economic decision-making models—a development which enriches our understanding, firstly, of the complex manner in which personality drives human capital investments and returns, and secondly, of the value of

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investing in the enhancement of traits that are important for producing positive outcomes (Heckman, Stixrud and Urzua, 2006; Borghans *et al.*, 2008). These models fundamentally assume that such traits are stable and determined exogenously and therefore not subject to influence by the very outcomes they are often employed to predict. The validity of this assumption may be subject to particular scrutiny during the life stages of adolescence and young adulthood, given that it is a period characterized by dramatic physical and psychosocial changes including puberty, the development of mature relationships, important education and vocational decisions, and commencement of important social roles and associated adult responsibilities (Arnett, 2000; Robins *et al.*, 2001). If we incorrectly assume stability and exogeneity of traits over time, our models may be subject to bias from reverse causality or simultaneity (Cobb-Clark and Schurer, 2013).

The five-factor personality structure (Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism) is generally accepted by psychologists as a meaningful and reliable mechanism for describing and understanding human differences (Goldberg, 1992, 1993). An extensive array of literature has demonstrated the importance of the Big-Five traits, both in terms of their value to employers and in terms of the labor market returns to those who possess certain traits (Chamorro-Premuzic and Furnham, 2003; Nyhus and Pons, 2005; Mueller and Plug, 2006; Heineck and Anger, 2010; Fletcher, 2013). Conscientiousness, for example, is frequently credited as a super-trait that is associated with better health behaviors, academic performance (Chamorro-Premuzic and Furnham, 2003; Furnham, Chamorro-Premuzic and McDougall, 2003; Noftle and Robins, 2007; Trapmann *et al.*, 2007; Kappe and van der Flier, 2012) and higher wages at the beginning of young people's careers (Nyhus and Pons, 2005; Fletcher, 2013).

Locus of control describes a person's generalized expectancy about the degree of control they possess over the events and outcomes in their life (Rotter, 1966). An individual with a tendency to attribute life's outcomes to their own actions is considered to be internally controlled, whilst someone who tends to attribute life's outcomes to factors outside their control (such as chance or luck) is considered to have an external locus of control (Gatz and Karel, 1993). Locus of control has been the focus of extensive empirical research examining its role in important health, educational, and labor market outcomes (Andrisani, 1977; Findley and Cooper, 1983; Coleman and DeLeire, 2003; Adolfsson *et al.*, 2005; Heckman, Stixrud and Urzua, 2006; Ng, Sorensen and Eby, 2006; Heineck and Anger, 2010; Piatek and Pinger, 2010; McGee, 2015; Schurer, 2017). Of particular importance to the adolescence and young-adulthood period of development, the trait is related to human and health capital investment

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decisions, success in educational pursuits and academic performance (Coleman and DeLeire, 2003; Barón and Cobb-clark, 2010).

There are a number of different strategies for evaluating the consistency of personality traits. Measures of mean-level consistency can detect increases or decreases in the average personality score of a group, and are used to study normative changes that occur as a result of typical maturational or social processes (Roberts, Walton and Viechtbauer, 2006). Rank-order consistency, on the other hand, is about the relative position of peoples' personality scores over time (Roberts and Delvecchio, 2000). A third and less examined method of evaluating stability is intra-individual consistency, which is focused on how traits change within an individual over time.

Even if a trait is mean-level and rank-order consistent over time, this tells us little about how each individual in the sample may be shifting in absolute terms on each trait of interest; for example, if some individuals are increasing on a trait whilst others are decreasing, these offsetting effects may be largely obscured in group-level analyses (Roberts, Caspi and Moffitt, 2003; De Fruyt *et al.*, 2006; Cobb-Clark and Schurer, 2012; 2013).

In general, evidence pointing toward patterns of "stability and change" tend to characterize much of the personality development literature for the adolescent and young adulthood life stage (Stein, Newcomb and Bentler, 1986; Robins *et al.*, 2001; Helson *et al.*, 2002; De Fruyt *et al.*, 2006; Pullmann, Raudsepp and Allik, 2006; Neyer and Lehnart, 2007; Blonigen *et al.*, 2008). Despite considerable heterogeneity across findings, there is general agreement that individuals tend to demonstrate personality changes most strongly before they reach working age beyond which they become more consistent (Roberts and Delvecchio, 2000; Pullmann, Raudsepp and Allik, 2006; Terracciano, McCrae and Costa, 2010; Hopwood *et al.*, 2011; Lüdtke *et al.*, 2011; Specht, Egloff and Schmukle, 2011; Cobb-Clark and Schurer, 2012, 2013), and that the nature of these changes is toward increasing levels of Agreeableness, Conscientiousness, and Emotional Stability (Mcgue, Bacon and Lykken, 1993; Roberts, Walton and Viechtbauer, 2006; Vaidya *et al.*, 2008; Hopwood *et al.*, 2011; Lüdtke *et al.*, 2011; Soto *et al.*, 2011; Bleidorn *et al.*, 2013). These age-related patterns appear to be relatively consistent across cultures (McCrae *et al.*, 1999), and sex differences in age-related personality maturation are also frequently described (Roberts, Caspi and Moffitt, 2001; Branje, 2007; Klimstra *et al.*, 2009; Soto *et al.*, 2011). Studies specifically investigating age-related changes in locus of control over the adolescent period are sparse and have produced heterogeneous results (Doherty and Baldwin, 1985; Kulas, 1996; Chubb, Fertman and Ross, 1997). In one

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example, Lewis et al. (1999) find that internal control tendencies increase with age over the teenage years and decrease with age over young adulthood.

These studies provide little information about how personality responds to environmental factors or life experiences; in fact, few empirical studies have investigated this topic convincingly for either the Big-Five traits or locus of control, despite a diverse array of avenues through which exogenous factors may influence personality development.

First, there is some evidence that broad social institutional factors may impact on the personality at the cohort level (Agronick and Duncan, 1998; Twenge, 2000; Cameron *et al.*, 2013; Bianchi, 2014). One study suggests that China's One-Child Policy (OCP) made children born just after the OCP's introduction in 1979 less conscientious, more neurotic, and less optimistic relative to children born just before (Cameron *et al.*, 2013). It may also be possible for macroeconomic conditions to affect a cohorts' personality traits; a recent study indicated that very young adults in the US who enter the labor market in recessions exhibit fewer narcissistic traits (Bianchi, 2014).

Second, a recent literature has emerged exploring the effectiveness of the post-secondary education sector in influencing the development of personality traits in adolescence (see Schurer, 2017 for a review). Interest in the degree to which educational interventions may shape non-cognitive skills is motivated by the demonstrated long-term success of early childhood interventions such as the Perry Preschool Program (Heckman, Pinto and Savelyev, 2013). It is less clear, however, whether the educational environment can play a significant role in shaping personality at older ages.

Finally, a small amount of preliminary evidence suggests that specific life experiences may catalyse changes in personality development trajectories (Vaidya *et al.*, 2002; Löckenhoff *et al.*, 2009; Lüdtke *et al.*, 2011; Jeronimus *et al.*, 2013; Leikas and Salmela-Aro, 2015; Bleidorn, Hopwood and Lucas, 2016). Specht, Egloff and Schmukle (2011), for example, find evidence that individuals "developed in distinct ways depending on whether they experienced or did not experience a specific major life event" (pg. 879). In particular, they find that the events of retirement and having a baby are associated with declines in Conscientiousness, whilst starting a first job and divorce made people more conscientious. They also suggest that marriage is related to reductions in Extraversion and Openness. Leikas and Salmela-Aro (2015) suggest that chronic disease onset in the early 20s moderates the development of Extraversion and Neuroticism relative to their non-diagnosed peers; however, they also found that the experience increased levels of Conscientiousness.

Accepted Manuscript

A few studies have also specifically investigated the relationship between occupational experiences and personality (Kohn and Schooler, 1982; Roberts, Caspi and Moffitt, 2003; Peter, 2016), and between educational pathways and personality (Lüdtke *et al.*, 2011; Leikas and Salmela-Aro, 2015; Schurer, Kassenboehmer and Leung, 2015). Roberts, Caspi and Moffitt (2003), for example, report that personality traits measured at age 18 can predict certain self-reported work outcomes over an eight-year period—and that these outcomes cause corresponding changes in the same personality traits that predicted them in the first place.

Overall, however, results of studies to date leave us with a limited understanding of the degree to which personality responds to life experiences. We contribute to this area of study by investigating, over an eight-year window, the malleability of the Big-Five personality traits and locus of control in a nationally representative sample of Australian adolescents and young adults between 15 and 24 years of age (at baseline). Specifically, we analyze the degree to which a range of life events (both positive and negative) are related to changes in personality during this sensitive period of development. Some of these experiences are 'one-off' events, whilst others may be considered high-frequency and thus impact the individual over a longer span of time; in addition, some are more under the individual's control (e.g., promotion at work) whilst others may be considered beyond the individual's control (e.g., being the victim of a property crime).

3 Data

We conduct our analysis using individual-level data from the nationally representative Household Income and Labour Dynamics in Australia (HILDA) survey. The HILDA is a household-based panel survey that began in 2001 with 19,914 individuals from 7,682 households. In 2011 (wave 11), the sample was topped up with a further 2,153 households and 5,477 individuals. Data is collected annually from all household members aged 15 and older through face-to-face interviews and self-completion questionnaires covering a diverse range of social, health, education and economic topics. A broad set of standard topics are administered annually whilst others rotate periodically every couple of waves.

3.1 *Five Factor Model*

HILDA respondents were administered an inventory designed to elicit measures of the Big-Five personality traits in 2005, 2009, and 2013 (waves 5, 9 and 13, respectively). In 2005, there were 2000 individuals who provided full information on the Big-Five personality traits, and

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1386[1] of these were interviewed in 2013 (70%). Out of these 1386, 1161 individuals provided full information about their Big-Five personality traits in 2013 (84%). Systematic dropout from the sample could be undermining the validity of the statistical inference. Table A1 in the Online Appendix shows the strongest predictors at baseline of attrition by wave 13. The chance of dropout is increased for youth who had changed jobs in 2005 or who experienced a property crime, who were more conscientious and less emotionally stable, who were already studying at university of a TAFE college, who were no longer living at home, and who had higher levels of household income. We therefore use this information to correct for potential estimation biases with Inverse Probability Weighting (IPW) in the main estimation results (e.g. Johnston and DiNardo, 1997). The method of IPW assigns a larger weight to individuals in the final estimation sample who have similar characteristics as individuals who dropped out of the sample at the baseline measurement, and smaller weight to final sample members who had different characteristics from the drop-outs at baseline.[2]

The Big-Five personality traits of respondents were measured using a 36-item personality inventory based on Goldberg (1992) and Saucier's (1994) trait descriptive adjective approach. The inventory was included as part of the HILDA self-completion questionnaire in relevant waves. Respondents are asked to indicate by self-report the degree to which each of 36 adjectives describe them, on a scale from 1 ("not at all") to 7 ("very well"). The adjectives include (see Table A1 for a list):

- *Extroversion*—talkative, bashful (reversed), quiet (reversed), shy (reversed), lively, and extroverted.
- *Agreeableness*—sympathetic, kind, cooperative, and warm.
- *Conscientiousness*—orderly, systematic, inefficient (reversed), sloppy (reversed), disorganised (reversed), and efficient.
- *Emotional Stability*—envious (reversed), moody (reversed), touchy (reversed), jealous (reversed), temperamental (reversed), and fretful (reversed).

[1] Only 263 individuals could no longer be tracked (the individual is lost from the follow-up sample), while 351 individuals could be tracked but they were not available for a full interview in 2013. All household members from wave 1 (including new children and entrants to a household who have a child with a wave 1 household member) are tracked even if their household moves, splits or moves and splits. If a household splits, a new household is formed and all household members are interviewed. We therefore have individuals in our sample who moved out of a household as well as those who stayed in the same household which reduces the problem of selective attrition due to moving (Summerfield et al, 2013).

[2] IPW is a standard method used in longitudinal data analysis to address systematic dropout from the sample. Such methods have been used in recent research articles that followed a cohort of children into adulthood. For a recent application, see for instance Campbell et al. (2014).

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- *Openness to Experience*—deep, philosophical, creative, intellectual, complex, imaginative.

Following testing for item reliability and principal components factor analysis, eight items are discarded on the basis that their reliability is low or their highest loading is not on the expected factor (see Losoncz, 2009). Thus, the Big-Five personality dimensions are derived from a total of 28 trait descriptive adjective items, and are considered to represent personality "at the broadest level of abstraction" (John and Srivastava, 2001). The five dimensions have a very high internal consistency in terms of identifying one underlying factor, with Cronbach alphas ranging between 0.75 (Openness to Experience) and 0.79 (Emotional Stability). Previous evidence has suggested that the personality of adolescents can be meaningfully understood through the Big-Five framework, and also that self-report is a valid and reliable strategy by which to elicit Big-Five traits in this age group (De Fruyt *et al.*, 2006; Soto *et al.*, 2011).

3.2 *Locus of control*

Data on locus of control was collected in 2003, 2004, 2007, and 2011 (waves 3, 4, 7 and 11, respectively) as part of the self-completion component of the HILDA survey. In a similar fashion to the Big-Five sample, our locus of control sample was restricted to those who were between 15 and 24 years of age in 2003 (the locus of control base year) and were again interviewed with complete information on locus of control in wave 11. Again, systematic attrition in this sample may be a concern, as only 1070 of the original 1919 individuals – or 56% – who provided complete locus of control information in wave 3 could be followed up successfully. We use IPW to adjust our main estimation results for this selective attrition.

In HILDA, respondents' locus of control is elicited using the seven-item Psychological Coping Resources inventory, which is one component of Pearlin and Schooler's (1978) Mastery Module. Mastery measures the degree to which a person believes that the outcomes in their life are under their control. Respondents were asked to indicate by self-report the extent to which each of seven statements is true of them on a scale of 1 ("strongly disagree") to 7 ("strongly disagree"). The seven items are: (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 am being pushed around in life (f) What happens to me in the future mostly depends on me; and (g) I can do just about anything I really set my mind to do. The seven items have very high internal consistency in measuring one underlying

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factor, with a Cronbach alpha of 0.85 (see Table A1 in the Appendix for individual items and alpha estimates).

Factor analysis suggests that the items load onto two factors, which are generally interpreted as *external* (items (a) to (e)) and *internal* ((f) and (g)) attribution tendencies. Someone with an internal attribution style has a tendency to believe that life's outcomes are attributable to their actions; in other words, they believe they have a lot of control over what happens to them. A person with external control beliefs, on the other hand, tends to attribute outcomes in their life to factors outside their control.

We create a combined locus of control scale that is increasing in external control tendencies by averaging the answers to each of the seven questions, reversing items (f) and (g)). Alternatively, we could add up all answers to the seven questions (Cobb-Clark and Schurer, 2013; Pearlin and Schooler, 1978) or use factor analysis to derive the first predicted factor (Piatek and Pinger, 2015). We use the averaged answers to make the locus of control scale comparable to the Big Five personality scales, however such parameterization does not affect our estimation results (provided upon request). Our locus of control scale thus ranges from 1 (completely internal) to 7 (completely external).

4 Estimation Results

The aim of our paper is to analyse personality trait stability and malleability over the developmentally interesting periods of adolescence and young adulthood, focussing on the Big-Five taxonomy and locus of control. Here we present our results on: (1) mean-level trait stability over an eight-year period and variation in trait stability across age and sex; (2) the degree to which the Big-Five and locus of control are responsive to important life events experienced by individuals; and (3) whether the observed changes are economically meaningful.

4.1. How stable are personality traits during adolescence and young adulthood?

We first examine the degree of stability in personality over adolescence and young adulthood by calculating the overall mean-level consistency of traits over an eight-year period. Mean-level consistency measures the degree to which a group increases or decreases on average in a particular trait over time and provides a method by which to detect normative changes that may

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be driven by typical maturational and social processes (Caspi and Roberts, 1999). We are interested in better understanding which traits change over this developmental period, as well as the direction and magnitude of observed shifts.

Our measure of the eight-year mean-level change for each of the Big-Five traits is constructed according to $\Delta Big5^{j} = T^{j}_{2013} - T^{j}_{2005}$, where $j \in$ {extraversion, agreeableness, conscientiousness, emotional stability, openness to experience} and T represents the average trait score for the specified year. The equivalent mean-level change measure for locus of control is $\Delta LoC = T_{2011} - T_{2003}$. Changes in Big-Five traits and locus of control can range from -6 to 6, with negative values indicating a self-reported reduction in the particular trait over time and positive values indicating an increase.

Table 1 Mean-level changes of personality traits

Personality trait	**N**	**Mean change (SD)**	**Min**	**Max**	**Cohen's *d***
Agreeableness	1161	0.16 (0.96)	-3.25	5.00	0.17*
Conscientiousness	1161	0.38 (0.99)	-2.50	5.00	0.38*
Emotional Stability	1161	0.14 (1.10)	-3.50	4.33	0.13*
Extraversion	1161	-0.11 (0.93)	-3.50	3.50	-0.10*
Openness to Experience	1161	-0.03 (1.02)	-4.33	3.67	-0.03
External locus of control	1070	-0.15 (1.18)	-4.00	4.00	-0.14*

Note: The Big-Five scores are bound between 1 (low) and 7 (high) in 2005 and 2013, which are averaged scores across four (Agreeableness) to six (Conscientiousness) items. The original external locus of control scores are bound between 7 (low=internal) and 7 (high=external) in 2003 and 2011. Cohen's *d* is calculated according to $(Mean_2 - Mean_1)/SD_{pooled}$. Statistical significance levels: * $p<0.05$.

The mean-level changes in each dimension of the Big-Five and locus of control over an eight-year period are presented in Table 1. For comparability, we report the Cohen's *d* effect size for the mean change in each trait, which defines the change in terms of standard deviations

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(SD) of changes in Big-Five traits and locus of control (see column 6). On average, respondents' self-reported scores indicate that they become somewhat more agreeable (d = 0.17) and emotionally stable (d = 0.13), and somewhat less extraverted (d = −0.10) over an eight-year period. No significant mean-level change is found for Openness to Experience and the largest mean-level change is observed for Conscientiousness (d = 0.38). Mean-level changes for External locus of control scores are negative, suggesting that youth become more internal in their attributional tendencies (d = −0.14).

Moreover, we are able to demonstrate in Figure 1[3] that mean-level changes in personality traits tend to decrease over the age-groups and approach zero from early 20s onward, with the exception of Conscientiousness (Figure (1b)) and Emotional Stability for women (Figure 1(e))—both of which continue to increase throughout young adulthood. Also of interest are the gender differences in changes in Openness to Experience (Figure 1(d)); male youth tend to exhibit significant, yet declining, increases in Openness up until age 18, whilst female youth (age 18-23) show significant reductions in the trait.

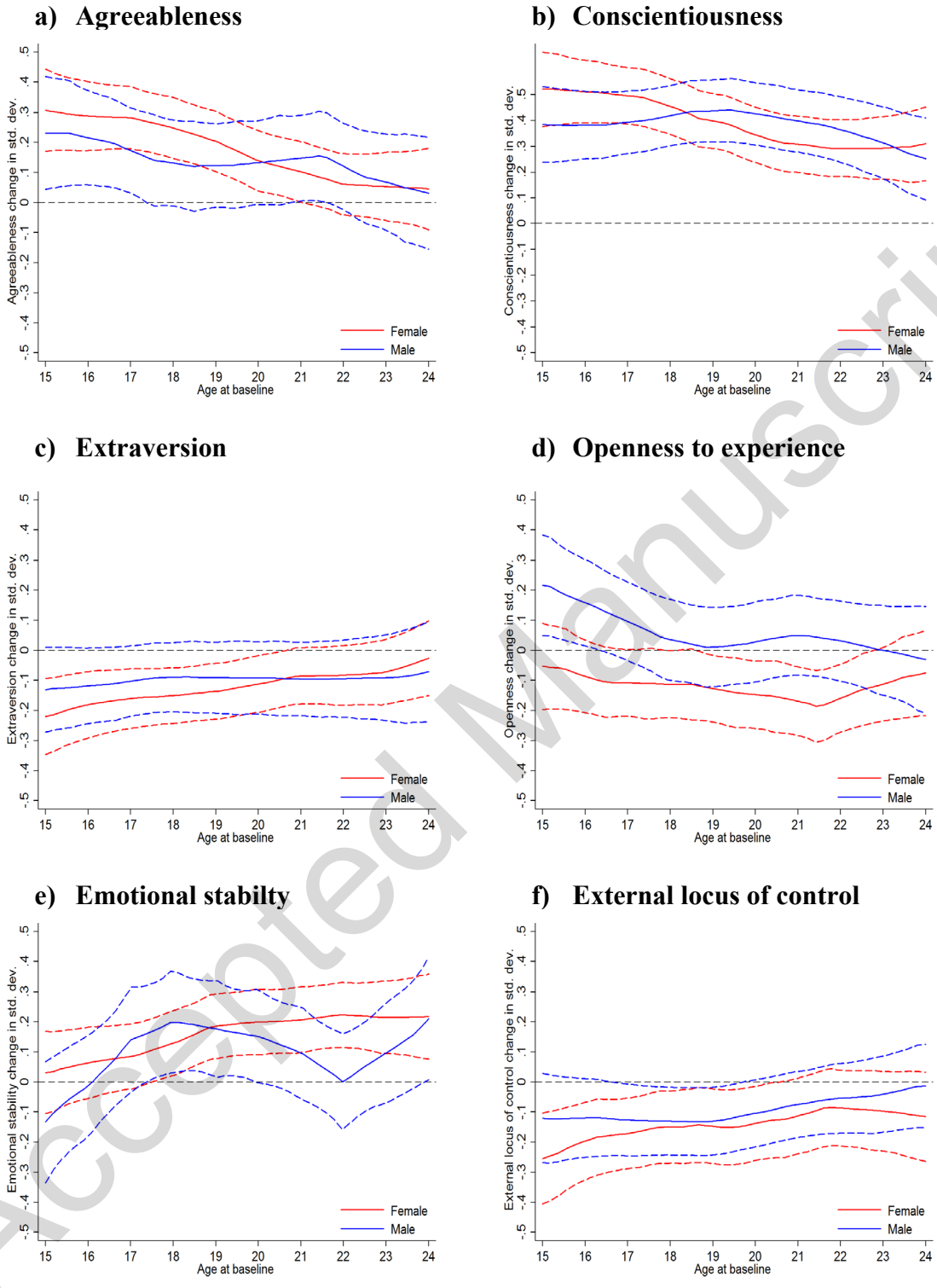
With the exception of Conscientiousness, we interpret our mean-level changes as small to modest; their magnitude shows no particularly dramatic normative shift in personality traits over adolescence and young adulthood. Yet, in comparison to working age individuals, these changes are relatively large. As demonstrated in Cobb-Clark and Schurer (2012, 2013), mean-level changes over a four-year window in all six personality traits are close to zero both in statistical significance and magnitude.[4]

Accepted Manuscript

[3] Figure 1 displays the age gradient in changes separately for men (blue lines) and women (red lines) using non-parametric bivariate regression estimates of mean-level changes expressed in terms of standard deviations (Cohen's *d*). Dashed lines represent the corresponding 95% confidence intervals.

[4] For men and women the mean-level changes expressed in terms of standard deviation (change/SD) in external locus of control over a four-year window is 0.02 SD for men and a 0.03 SD for women (See Table A1; Cobb-Clark and Schurer; 2013). The mean-level changes for the Big-Five are: -0.03 SD Extraversion;-0.01 SD Agreeableness, 0.01 SD Conscientiousness, 0.11 SD Emotional Stability, -0.10 SD Openness to Experience (see Table 1; Cobb-Clark and Schurer (2012).

Figure 1 Changes in personality traits over eight years by age



Note: Presented are non-parametric, bivariate estimates of the relationship between mean change in personality and age. Magnitudes of change are Cohen's *d* effect sizes, representing mean-level changes relative to baseline in standard deviation units. Black dashed line represents no self-reported change in personality trait relative to baseline; values above mean indicate increases in the trait; values below the mean indicate reductions in the trait. Dashed lines are the 95% confidence intervals corresponding to mean changes, which are represented by the solid colored lines. Locus of control is increasing in external control tendencies.

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Our results—particularly our findings on Conscientiousness—also partially reflect those of previous studies that rely on similar samples and age-groups. For instance, Roberts et al. (2006) find an increase in Conscientiousness of 0.22 SD between the ages 22 to 30 in a meta-analysis of many studies. Specht et al. (2013) show for German data an increase of 0.3-0.4 SD for sample members below age 20 over a four-year window. Lüdtke *et al.* (2011) find a significant increase of 0.5 SD over a four-year window focusing mainly on students in training. Klimstra et al (2009) find increases in Conscientiousness of 0.28 SD and 0.18 SD for boys and girls, respectively from middle to late adolescence. In contrast, studies that explore Conscientiousness changes in younger ages (below age 18) find little evidence for changes (De Fruyt et al., 2006, Pullmann et al., 2006, Roberts et al., 2006, Klimstra et al., 2009), suggesting that increases in Conscientiousness may occur at later stages of adolescence.

Our findings on relatively small mean-level changes for external locus of control and no dominant gender differences are in stark contrast to two previous studies that analysed mean-level changes over eight and 12 years based on US data from the 1960s and 1970. Doherty and Baldwin (1985) analyse the stability of locus of control for young (14-22 years) and mature (27-35 years) men and women with data from the National Longitudinal Survey of Labour Market Experiences (NLS) over an eight-year window. Both mature and younger women tend to become more external by 1 SD, which is 3 to 10 times larger than what we find for our female adolescent sample. In contrast, control perceptions of men remain fixed over the same time period, which is a smaller effect than we find. The authors interpret this increase in external control tendencies as the consequence of a cultural shift in the 1970s, which made women more aware of their external constraints on their ability to meet their goals in the labor force and other settings. Lewis et al. (1999) find using longitudinal data from the National Longitudinal Study of Youth (NLSY) that in teenage years, internal control tendencies increase with age, while in young adulthood internal control perceptions decrease over time.[5]

One possible reason that we find only small mean-level changes for most personality traits is that some individuals increase while others decrease their traits, obscuring larger but more heterogeneous shifts in individuals' personality traits over this developmental period. To

[5] They explain this reversed trend with the observation that the youngest sample members (age 14) had the lowest score on locus of control in the first measurement period, and therefore this group could experience the largest increase.

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understand the proportion of respondents who increased or decreased in their personality traits in a statistically reliable way, we calculated a *Reliable Change Index* (RCI; Jacobson and Truax, 1991) for each individual in the sample, on each trait of interest. The RCI compares the individual's change score to the spread of scores that would be expected in a benchmark population where no true change, apart from measurement error, occurs.[6] This measure has been used previously in the literature to assess reliability in personality changes over time (see Lüdtke et al., 2011, p. 3 for an overview of this literature).

Table 2 presents the RCI results for all six personality traits. Columns (2), (3) and (4) report, respectively, the proportion of individuals who reliably decreased in their trait scores; whose changes were too small to be considered reliable; and who reliably increased their trait scores. For each trait of interest, the overwhelming majority of respondents neither reliably increased nor decreased their scores over the eight-year period. For each of the Big-Five traits, between 12% and 21% of the sample changed their scores in either direction, with Conscientiousness demonstrating the greatest magnitude of reliable change. The proportion of those demonstrating reliable change was larger for locus of control than any of the Big-Five traits (approximately 27%). Conscientiousness was notable in that around four times more respondents increased than decreased on the trait (17% compared to 4%).

Table 2 Reliable Change Index for changes in personality over an eight-year period between 2005 and 2013 for the Big-Five traits, and between 2011 and 2003 for locus of control

[6] Equation (1) below describes the construction of the Reliable Change Index (RCI) using personality trait PT^j from both period 1 and 2, Cronbach's α_j, and the spread of change in personality across the two time periods that would be expected if no actual change had occurred ($\sigma\Delta\text{PT}_j$). The latter is usually approximated by the spread in the personality score in the general population (in our case - all adult groups[6]) weighted by the reliability of the personality measurement (α_j), i.e. $\sigma\Delta\text{PT}_j = \sqrt{\sqrt{2(\sigma\Delta PT_j)}(1-\alpha_j)^2}$.

$$RCI_i = \frac{PT_{i,2}^j - PT_{i,1}^j}{\sqrt{\sqrt{2(\sigma\Delta\text{PTj})}(1-\alpha_j)^2}}. \quad (1)$$

If the personality measure contains a lot of noise (small α_j)[6], then large changes in personality scores from period 1 to 2 cannot be reliably interpreted as true changes. Further, if the spread in the general population score of personality is very large ($\sigma\Delta\text{PT}_j$), which implies a large deviation from the population norm, then any changes in personality must be very large as well to be considered as true changes. Assuming a normal distribution of the personality scores in the population in both time periods considered (which we find to be true in our data), the individual change in personality scores is considered reliable if the absolute value of the RCI is greater than 1.96; below this cut-off, it is considered unreliable.

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Personality trait	Decrease (%)	No reliable change (%)	Increase (%)
Agreeableness	4.73	86.40	8.86
Conscientiousness	4.13	78.68	17.20
Emotional Stability	5.67	86.67	7.65
Extraversion	6.96	87.79	5.25
Openness to Experience	8.10	84.15	7.75
External locus of control	15.89	72.52	11.59

Note: Reliable Change Index is calculated according to Equation (1).

These results are comparable to those of several previous studies (e.g., Roberts, Caspi and Moffitt, 2001; Vaidya *et al.*, 2002; Pullmann, Raudsepp and Allik, 2006), each finding that between 70% and 90% of adolescents do not change reliably in the Big-Five traits, though the periods of study range from two to eight years and there is variation in the method of personality measurement. Patterns of asymmetry between reliable increases and decreases across the various traits, however, are highly inconsistent across studies, and we found no comparison studies for locus of control.

4.2. Are personality traits shaped by important life events?

Consistent with prior research on personality development, our results show evidence of small to modest age-related personality trait changes in adolescence and young adulthood. These results, however, do not tell us about how environment and individual experiences can operate to shape personality development. The results presented in this section are relevant to an important econometric challenge faced by researchers who are interested in the impacts of personality traits on a wide range of economic outcomes: Personality may not only play a role in driving the behavior and choices of individuals, but also be endogenously shaped by, or simultaneously determined with, certain life events and experiences. If the latter is true, and researchers treat personality traits as exogenous inputs when they are in fact likely to respond endogenously to life experiences, their estimations can suffer from bias due to simultaneity and reverse causality (see Cobb-Clark and Schurer, 2013 for an in-depth discussion).

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Examining the impact of shocks on individual personality changes can develop our understanding of the extent to which these traits are endogenously determined, and may challenge the assumption inherent in many economic decision-making models that such constructs are "given". In addition, understanding the degree to which personality is malleable in response to experiences, especially during the adolescent period, may inform us about the value of investing in the enhancement of those aspects of personality that are linked to positive outcomes (e.g. successful labor market outcomes).

Therefore, this section describes the results of an investigation into the degree to which personality changes are impacted by both more common and rare life events. We examine whether changes in our traits of interest respond to a range of experiences – some that are typically seen as positive (e.g. an improvement in finances) and others that are considered adverse (e.g. the death of close family member). In addition, some of the life events are perceived to be somewhat under the control of the individual (e.g., a promotion at work), whilst others are more outside the individual's control (e.g. being a victim of a property crime). This latter distinction may be particularly important for the locus of control trait, given previous research suggesting that the repeated experience of uncontrolled or unanticipated events can drive a tendency for a more external style of attribution (i.e. Goldsmith et al, 1996).

As some of the life events could be endogenous, we consider personality change (relative to baseline) only after the life event of interest occurred. It is important to note that this specification does not rule out reverse causality between personality change and life events. For instance, biological changes in the brain due to aging may cause changes in personality, and these changes may cause the occurrence of certain life events because the personality change may have occurred before its measurement. Moreover, it is possible that unobserved factors shape the relationship between life events and associated trait changes. For example, difficult-to-observe family background and peer groups may impact both on the probability of being detained in jail and on the personality change trajectory; in such a case, there is a risk of falsely attributing personality trait changes to time spent in jail. Controlling for a range of confounding factors is thus pertinent. In the event of reverse causality and unobserved heterogeneity, we therefore interpret our estimates as upper bounds.

To better understand the malleability of personality to life experiences, we investigate the impact of 16 one-off life events and six high-intensity life events (see Appendix A2 for full description). High-frequency events are constructed to explore whether the dose matters in affecting personality change. We only included shocks that occurred after the baseline measure of personality. This means we define life events to have occurred between 2006 (wave 6) and

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2013 (wave 13) for the Big-Five sample, and between 2004 (wave 4) and 2011 (wave 11) for locus of control sample.

To understand the impact of each shock upon changes in personality, we enter individual trait change as the dependent variable, and estimated regressions of the form:

$$\Delta PT_{i,t}^{j} = S_i^k \gamma^{j,k} + \boldsymbol{X}_{i,BL}\boldsymbol{\beta}^{j,k} + \varepsilon_i^{j,k}. \quad (2)$$

Following Cobb-Clark and Schurer (2012), Eq. (2) is estimated separately for each of the Big-Five traits and locus of control (indexed by j) and for each shock (indexed by k) using Ordinary Least Squares and Inverse Probability Weighting to control for selective attrition, as described in Section 3.1. In each regression equation, S_i^k represents an indicator variable which is equal to 1 if shock k occurred after baseline period (BL) up until the re-assessment period, and 0 otherwise. The term $\boldsymbol{X}_{i,BL}^k$ is a vector of control variables measured at baseline including as many background variables as possible: age, sex, parental occupation, parental educational attainment, household income, education level, employment status, marital status, number of children, whether or not the individual still lives at home or attends university or college, country of birth, Indigenous status, and location of residence (see Table A3 for summary statistics for both estimation samples).[7] Each personality trait change measure is standardized to have a mean of 0 and standard deviation of 1; thus, the treatment effect of each shock can be interpreted in terms of standard deviation changes in the relevant trait.

For each personality trait, we test 16 (nine) different hypotheses in which the null hypothesis states that the one-off (high-frequency) life event has no predictive power in personality change, against the alternative hypothesis that the respective one-off (high-frequency) life event has predictive power. With 16 (nine) independent hypotheses tested, the chance of finding at least one significant treatment effect is over 80%.[8] To reduce the chance of Type I errors due to multiple hypothesis testing, we adjust the p-values for each hypothesis test. There are different ways how p-values can be adjusted, each of which has advantages and disadvantages. All methods reduce Type I errors at the cost of increasing Type II errors, but

[7] As a sensitivity test, we also investigate whether the results are sensitive to the inclusion of different cognitive ability measures as control variables. We do not include the cognitive ability measures in our main set of variables, as they are only available in 2012 and therefore do not precede the personality change. We find that the results are robust to including cognitive ability measures (provided upon request).

[8] The calculation is based on a significance level of $\alpha = 0.10$, $m=16$, and the following calculation: Probability of at least one significant effect due to chance$=1 - (1 - \alpha)^m$.

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may lead to a reduction in power of each test (see for a review: Blakesley et al. (2009) in psychology literature; List et al. (2016) in the experimental economics literature).

We use a variety of standard methods to adjust the p-values of the 16 (nine) estimated treatment effects for each personality trait to ensure that our findings are not sensitive to one specific method. We use both step-up and step-down approaches, which either control the false discovery rate—the proportion of false positives among the set of rejected hypotheses— or control the family-wise error rate, which is the probability that at least one true null hypothesis is rejected (Hochberg, 1988; Hochberg and Benjamini, 1990; Benjamini and Hochberg, 1995; Benjamini and Yekutieli, 2001).[9] A priori, it is not straightforward to decide which method is more appropriate without a more detailed discussion of the nature of the data and the hypotheses tested (see Blakesley et al., 2009). To err on the conservative side, we consider the impact of a life effects as statistically significant if it remains significant for the majority of seven possible adjustment methods. Table A5 in the Appendix reports the test results for all seven adjustment methods.

Table 3 reports the estimated coefficients $\gamma^{j,k}$ and their standard errors obtained from Eq. (2). Stars indicate statistical significance for unadjusted p-values, while bold numbers indicate that the treatment effect is statistically significant after p-value adjustment due to multiple hypothesis testing. Overall, one-off life events do not significantly predict changes in personality traits, with the exception of three interesting effects on Openness to Experience, Agreeableness, and Conscientiousness. First, sample members who were married over the eight-year window become less open to new experiences by a magnitude of 0.22 SD. This finding is consistent with the idea that married couples have left the marriage market and therefore become less open to external influences, a result that was also found in Specht, Egloff and Schmukle (2011). We do not, however, find the same corresponding decreases in Extraversion.

Second, individuals who say they have retired from the workforce reduce their Conscientiousness scores by 0.70 SD. In our Big-Five estimation sample, 19 individuals in our sample reported to have retired from the work force, which is unusual because the sample members are no older than 32 years. None of them is in full-time education, more than half are female (N=11), and almost all of these females are married and have 1-3 children (N=9). We

[9] We use the STATA program -- multproc – that implements these different methods (see Newson (2003)). We consider an effect statistically significant if the majority of seven possible adjustment methods, including Bonferroni, step-up, and step down approaches, yield the same conclusion. We use as false discovery rate (FDR) a level of 0.10.

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therefore assume retiring from the workforce captures married women who have left the labor force to raise their children. This negative treatment effect on Conscientiousness is consistent with Specht, Egloff and Schmukle (2011) who find that retirement and having a baby are associated with declines in Conscientiousness.

Finally, individuals in families where one family member was admitted to jail significantly reduced their levels of Agreeableness by 0.43 SD. It is difficult to interpret this finding, but one explanation could be that these individuals perceive this event as an unfair act of society.

Otherwise, we cannot find any other statistically significant effects of life events on any of the six personality traits after adjusting for multiple hypothesis testing. We conclude that although some personality traits do change moderately over an eight-year window, common positive and negative one-off life events are not predicting such changes. This finding contradicts a number of aforementioned studies. For example, unlike Lüdtke *et al.*, (2011) we do not observe any trait changes associated with changes in financial situation, whilst they find significant negative and positive correlations between worsened financial position and Extraversion, and Neuroticism, respectively. Furthermore, we do not find that life events are related to significant changes in Neuroticism; contradicting the results of Vaidya *et al.* (2002), Löckenhoff *et al.* (2009) and Jeronimus *et al.* (2013), all of whom find that negative life events are related to increased Neuroticism. Our findings are in line with Cobb-Clark and Schurer (2012; 2013), who also find no predictive power of the same one-off life events on adult personality change.

Table 3 Regression results – treatment effect of one-off positive and negative shocks on Big-Five personality traits (columns 2 to 5) and locus of control (column 6).

	(1) Open	(2) Consc	(3) Extrv	(4) Agree	(5) Emote	(6) Ext. Loc
Positive life events						
Got married	**-0.216****	-0.0147	-0.0224	-0.0907	-0.0125	0.0666
(N_{Big5}= 288; N_{LoC} = 293)	(0.0776)	(0.0876)	(0.0763)	(0.0757)	(0.0807)	(0.0785)
Back together with spouse	0.119	-0.0716	-0.251*	0.112	-0.188	0.0663
(N_{Big5}= 72; N_{LoC} = 82)	(0.122)	(0.131)	(0.115)	(0.124)	(0.144)	(0.154)
Birth of new child	-0.0595	-0.00321	-0.136+	-0.0816	-0.111	-0.0196
(N_{Big5}= 336; N_{LoC} = 321)	(0.0826)	(0.0936)	(0.0819)	(0.0815)	(0.0865)	(0.0794)
Major improvement in	-0.0892	0.0193	0.0177	0.0880	0.177*	-0.0204

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finances (N_{Big5}= 148; N_{LoC} = 172)	(0.0891)	(0.100)	(0.0983)	(0.0953)	(0.0882)	(0.0804)
Promoted at work (N_{Big5}= 512; N_{LoC} = 522)	-0.0982 (0.0643)	0.139* (0.0708)	-0.0704 (0.0665)	0.0590 (0.0671)	0.0505 (0.0671)	-0.0955 (0.0650)
Negative life events						
Retired from workforce (N_{Big5}= 19; N_{LoC} = 21)	0.178 (0.292)	**-0.696**** (0.152)	-0.284 (0.249)	-0.343+ (0.186)	-0.292 (0.209)	-0.262 (0.246)
Serious personal injury/illness (N_{Big5}= 286; N_{LoC} = 284)	0.128+ (0.0746)	0.0280 (0.0877)	-0.106 (0.0771)	0.0526 (0.0772)	-0.0756 (0.0785)	0.126 (0.0784)
Illness family member (N_{Big5}= 531; N_{LoC} = 521)	-0.00133 (0.0662)	0.0572 (0.0659)	0.0295 (0.0640)	-0.0784 (0.0625)	0.0669 (0.0628)	-0.0811 (0.0660)
Death of spouse/child (N_{Big5}= 19; N_{LoC} = 20)	-0.301 (0.257)	0.194 (0.293)	-0.509 (0.378)	-0.00337 (0.277)	-0.371 (0.340)	0.296 (0.317)
Death of close relative (N_{Big5}= 545; N_{LoC} = 508)	0.0815 (0.0665)	0.103 (0.0683)	0.0583 (0.0638)	0.0488 (0.0642)	0.148* (0.0636)	0.0425 (0.0649)
Victim of phys. violence (N_{Big5}= 140; N_{LoC} = 142)	-0.148 (0.110)	0.00507 (0.105)	-0.146 (0.106)	-0.140 (0.101)	0.0544 (0.104)	0.182+ (0.103)
Victim property crime (N_{Big5}= 329; N_{LoC} = 314)	-0.0486 (0.0708)	-0.00135 (0.0825)	0.0927 (0.0730)	-0.0193 (0.0714)	-0.0517 (0.0717)	0.108 (0.0765)
In jail (N_{Big5}= 25; N_{LoC} = 20)	0.124 (0.222)	-0.0784 (0.299)	-0.385 (0.321)	-0.190 (0.337)	-0.145 (0.302)	0.335 (0.217)
Family member in jail (N_{Big5}= 69; N_{LoC} = 78)	-0.287* (0.136)	-0.0917 (0.141)	0.171 (0.145)	**-0.431**** (0.140)	0.250+ (0.141)	0.0106 (0.131)
Fired/made redundant (N_{Big5}= 278; N_{LoC} = 239)	-0.0638 (0.0759)	0.0231 (0.0834)	-0.0160 (0.0788)	0.0185 (0.0741)	0.0280 (0.0786)	0.0309 (0.0875)
Major worsening finances (N_{Big5}= 128; N_{LoC} = 121)	-0.0841 (0.104)	0.0766 (0.137)	-0.0592 (0.117)	0.0261 (0.101)	-0.0991 (0.117)	0.240* (0.117)
Observations	1,163	1,163	1,163	1,163	1,163	1,068

Note: Standard errors in parentheses: + p<0.10, * p<0.05, ** p<0.01; trait changes are standardized to mean = 0 and standard deviation = 1; effects can be interpreted as standard deviation changes in the relevant trait. **Bold** numbers highlight significant effects after adjusting the p-value for multiple hypothesis testing within each personality trait by the majority of seven possible adjustment methods, including Bonferroni, step-up, and step down approaches described in Newson (2003). We use as false discovery rate (FDR) a level of 0.10. Each

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model controls for the full set of baseline controls. To control for systematic attrition from the survey, we used inverse probability weights to give more weight to individuals who stay in the sample but who look at baseline like individuals who will drop out from the sample. Inverse Probability Weights are derived from results provided in Table A4 in the Online Appendix.

It may be possible that these one-off life events have no lasting impact on the individual's personality assessment because individuals adapt to new situations or because the dose is not strong enough. We therefore consider the effect of high-frequency shocks including longer spells of unemployment (3+ years), having been fired several times (3+ times), health conditions including long-term health problems that impair every day functioning (3+ years), the experience of bodily pain (3+ years), three serious injuries (3+ years), at least three deaths in the family, being a victim of a property crime (3+ times), and witnessing a family member detained in jail in at least three years.[10]

Table 4 shows that most high-frequency shocks do not predict changes in any of the Big-Five personality traits after adjusting for multiple hypothesis testing (bold font), with one exception. Individuals who were fired three or more times, increase their levels of emotional stability by 0.55 SD.[11] Only 27 individuals experienced such a rare event. More common are the experiences of long-term (LT) health problems, and such on-going experience (N=151) is found to significantly impact on external control tendencies by 0.49 SD. Long-term experiences of bodily pain, which is a rare event in our sample (N=14), shifts external control tendencies by 0.93 SD. These treatment effects are slightly smaller in magnitude for adolescents aged 15 to 18 at baseline (0.4 SD for LT health condition, and 0.55 SD for chronic pain; full estimation results for adolescents are provided upon request). This latter finding contradicts Malmendier and Nagel (2016), who suggested that exposure to certain life events (e.g. long periods of inflation) may have a larger impact on beliefs the larger the fraction of an individual's life is affected by the incidence.

[10] We report only high-frequency life events for which we have ten or more observations or which are most interesting from a policy perspective. We also exploited the full information on each life event over the full time period of eight years, constructing an index that sums the total number of times that the specific life event occurred between baseline and follow-up period. We then included indicator variables representing each number of life events in the benchmark regression model to test whether increasing intensities in life events impact on personality change. However, the data do not allow us to conduct such analysis convincingly because we do not have enough observations in each life-event category. For some of the life events very high intensities (5-6 times) are associated significantly with personality change, but there are only 1 or 2 observations available for such high intensities. For this reason we restrict the dose-response analysis to creating indicator variables that represent exposure to a specific life event to three times or years.

[11] Individuals who have had a family member detained in jail in at least three years reduce significantly their levels of agreeableness by more than 1 SD. However, this effect does not persist after adjusting for multiple hypothesis testing and, as this is a very rare event, and only about ten youth in our sample reported its experience. However, this is more than twice as strong as the impact of a family member being in jail for one year.

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The personality changes we observe in response to these health-related experiences may be contrasted with the findings of Leikas and Salmela-Aro (2015), who find that chronic illness diagnosis between 20 and 23 years old moderates the development of Extraversion and Neuroticism, and diagnosis at 20 increases age 23 Conscientiousness. The authors did not investigate locus of control, but we find none of the same effects on Big-Five traits for any of our high-frequency health-related events. Our finding that high-frequency unemployment was unrelated to personality changes is in line with Specht, Egloff and Schmukle (2011) but contradicts the results of Boyce *et al.* (2015) who report significant changes in Openness, Agreeableness, and Conscientiousness in response to this experience.

As we have found a small number of large and statistically significant relationships between life events and personality trait changes, we next consider the extent to which these changes in personality induced by life-events are economically meaningful.

Table 4 Regression results—treatment effect of high-frequency negative life events (3+ times or years) on Big-Five personality traits (columns 2 to 5) and external locus of control (column 6).

	(1) Open	(2) Consc	(3) Extrv	(4) Agree	(5) Emote	(6) Ext. Loc
Unemployed 3+	-0.166	0.220	-0.0466	-0.374^{+}	0.234	0.411
(N_{Big5}= 44; N_{LoC} = 32)	(0.183)	(0.183)	(0.188)	(0.220)	(0.185)	(0.263)
Fired from job 3+ times	-0.181	0.410	0.00416	-0.163	**0.553****	0.135
(N_{Big5}= 27; N_{LoC} = 16)	(0.223)	(0.257)	(0.231)	(0.215)	(0.184)	(0.321)
Recurring pain 3+ yrs	-0.0206	-0.160	-0.302	-0.530*	-0.542	**0.927****
(N_{Big5}= 17; N_{LoC} = 14)	(0.253)	(0.373)	(0.412)	(0.221)	(0.338)	(0.335)
Health condition 3+ yrs	0.174	-0.149	0.0736	-0.383	-0.530^{+}	0.494*
(N_{Big5}= 21; N_{LoC} = 30)	(0.205)	(0.278)	(0.256)	(0.298)	(0.272)	(0.227)
Illness/injury 3+ yrs	0.0248	0.0343	0.143	-0.430	-0.182	0.275
(N_{Big5}= 27; N_{LoC} = 23)	(0.175)	(0.213)	(0.214)	(0.271)	(0.220)	(0.213)
LT health cond. 3+ yrs	-0.0865	-0.131	-0.103	-0.132	-0.162	**0.492****
(N_{Big5}= 161; N_{LoC} = 156)	(0.0896)	(0.111)	(0.105)	(0.0961)	(0.100)	(0.108)
Death 3+ family member	-0.106	0.194	-0.0194	-0.176	0.0682	-0.0239
(N_{Big5}= 54; N_{LoC} = 49)	(0.158)	(0.152)	(0.156)	(0.140)	(0.150)	(0.139)
Family member in jail 3+	-0.522+	-0.263	-0.448	-1.049**	0.435	-0.213
(N_{Big5}= 11; N_{LoC} = 12)	(0.310)	(0.212)	(0.287)	(0.345)	(0.416)	(0.342)
Victim property crime	0.175	-0.335	-0.0824	-0.280	-0.0564	0.338+

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3+ (N_{Big5}= 18; N_{LoC} = 23)	(0.277)	(0.290)	(0.277)	(0.214)	(0.189)	(0.201)
Observations	1,163	1,163	1,163	1,163	1,163	1,068

Note: Standard errors in parentheses: + p<0.10, * p<0.05, ** p<0.01. **Bold** numbers highlight significant effects after adjusting the p-value for multiple hypothesis testing within each personality trait by the majority of seven possible adjustment methods, including Bonferroni, step-up, and step down approaches described in Newson (2003). We use as false discovery rate (FDR) a level of 0.10. Table A5 summarised the test results. The dependent variable is standardized to mean = 0 and standard deviation = 1. Each model controls for the full set of baseline controls. To control for systematic attrition from the survey, we used inverse probability weights to give more weight to individuals who stay in the sample but who look at baseline like individuals who will drop out from the sample. Inverse Probability Weights are derived from results provided in Table A4 in the Online Appendix.

4.3. Are the observed changes in personality traits economically meaningful?

Can we judge whether the above-discussed changes in personality traits in response to life events are large or small? One way to express the magnitude of the personality trait change over time has been provided in Cobb-Clark and Schurer (2012, 2013). The authors expressed the change in personality traits observed for an adult population over a four-year window as the implied wage equivalent. By knowing the effects of personality traits on hourly wages – usually expressed in terms of the effect of a standard deviation change in a personality trait on the percentage increase in wages—one can calculate the hourly wage difference for the estimated standard-deviation change in personality over four years.

We follow this approach in Table 5**.** In column (1) we reproduce the statistically significant estimates of the impact of life events obtained from Tables 3 and 4. In columns (2) and (4) we calculate the corresponding wage equivalents (in percent) based on the minimum and maximum of the absolute value of wage effects of personality traits found in two of the most cited studies (Mueller and Plug, 2006; Heineck and Anger, 2010) and our own estimates based on a HILDA sample of 35 to 50 years old individuals. Details on the specification and estimates of these log hourly wage regressions can be found in Appendix Tables A5 and A6.

Wage equivalents in percent (%) are calculated by multiplying the estimates in column (1) with the wage effects reported in Table A6. Wage equivalents in dollar values are calculated by multiplying the wage equivalents in percent (divided by 100) in columns (2) and (4) with the average hourly wage rate. The average hourly wage in the main job is A$35.4 for our wage regression sample based on 2013 data (consistent with the average hourly wage provide by the Australian Bureau of Statistics).

The biggest wage equivalent is found for the effect of recurring pain on external locus of control. The associated increase in external locus of control of 0.93 SD translates into a

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decrease in wages of between -2.6% (0.93*-2.8) and -6.3% (0.93*-6.8) which is equivalent to a decrease in average hourly wages of between A$0.92 ((-2.6/100)*35.4) and A$2.23 (-6.3/100)*35.4)). Similarly, the effect of any long-term health condition on external locus of control translates into an hourly average wage reduction of between A$0.49 and A$1.19. The negative marriage effect on Openness to Experience is equivalent to an hourly wage decrease of between A$0.05 and A$0.29. The effect of retiring from the workforce on Conscientiousness in the worst-case scenario is associated with a reduction in hourly wages of up to A$0.79. Because having a family member detained in jail has a negative effect on Agreeableness, and because Agreeableness is negatively related to wages, the wage equivalent is positive of up to A$0.64.

The maximum wage equivalent change in external locus of control due to experiencing chronic pain in the magnitude of 2.23$ is 1.5 times as large as the largest changes identified in Cobb-Clark and Schurer (2013) (experiences of multiple death in the family), and about three times as large as the effect of repeated health shocks on external control tendencies (see Table 4 in Cobb-Clark and Schurer, 2013). [12] We therefore conclude that the magnitude by which health problems effect locus of control for adolescents and young adults is substantially larger than for working-age populations.

Accepted Manuscript

[12] The wage equivalents in Cobb-Clark and Schurer (2012; 2013) are expressed in Euro dollars. We translated the Euro dollars into Australian dollars using a standard currency converter at 21 November 2013 prices. Due to the high variability of the Australian dollar/Euro dollar exchange rate, we highlight that our conclusion may change when using exchange rates from different dates.

Table 5: Wage equivalent of personality trait change.

	Est. effect of shock on changes personality	Wage equivalent Minimum		Wage equivalent Maximum	
	SD	%	$	%	$
	(1)	(2)	(3)	(4)	(5)
Got married on Open. to Exp.	-0.216**	-0.15	-0.05	-0.82**	-0.29**
Retired from workforce on Consc.	-0.696**	0.07	0.025	-2.23**	-0.79**
Family member in jail on Agreeab.	-0.431**	0.88+	0.31+	1.81**	0.64**
Fired from job 3+ times on Emot. Stab.	0.553**	0.33	0.12	1.11+	0.39+
Recurring pain in 3+ years on Ext. Loc.	0.927**	-2.60+	-0.92+	-6.30**	-2.23**
Any LT health condition in 3+ years on Ext. Loc	0.492**	-1.38+	-0.49+	-3.35**	-1.19**

Note: Wage effects and their significance levels in columns (2) and (4) are based on the minimum and maximum of the absolute value of wage effects of personality traits found in Mueller and Plug (2006), Heineck and Anger (2010) and based on own estimations. Details on theses wage effects are shown in Appendix Tables A6 and A7. Wage equivalents in % are calculated by multiplying the estimates in column (1) with the wage effects reported in Table A6. Wage equivalents in dollar values are calculated by multiplying the wage equivalents in percent divided by 100 in columns (2) and (4) with the average hourly wage rate. The average hourly wage in the main job is 35.4$ for our wage regression sample (consistent with the average hourly wage provide by the Australian Bureau of Statistics). +p < 0.10, *p < 0.05, **p < 0.01.

5 Discussion and Conclusion

In this study we explore the stability of the Big-Five personality traits and locus of control from adolescence into young adulthood. Using nationally representative, high-quality panel data, we demonstrate that most of these traits change between adolescence and young adulthood, although mean population changes do not exceed 0.17 standard deviations (SD). The one exception to this pattern of small changes is Conscientiousness, often referred to as a proxy for executive function (Kern et al., 2009), which increases by 0.38 SD. The magnitude of this increase is similar to that reported in a number of recent studies (Lüdtke *et al.*, 2011; Specht, Egloff and Schmukle, 2011; Leikas and Salmela-Aro, 2015), but contradicts the findings of a

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number of other studies whose results suggest that Conscientiousness remains relatively stable throughout adolescence (De Fruyt *et al.*, 2006; Pullmann, Raudsepp and Allik, 2006; Roberts, Walton and Viechtbauer, 2006; Klimstra *et al.*, 2009). The reason for otherwise small mean-level changes is that most individuals in our sample do not change their scores in a statistically reliable way, and for those who do, some decrease and others increase their self-assessments.

With few exceptions, one-off life events do not systematically predict changes in personality traits. However, youth become less open to experiences in response to getting married; become less agreeable after one of their family members is detained in jail short- or long-term; and youth who claim to have retired from the workforce become significantly less conscientious. Some of these findings confirm the conclusions drawn in Specht et al. (2011).

More importantly, we find that the frequent experience of health problems in particular (including bodily pain) are associated with subsequent changes in individuals' external control perceptions by up to 0.9 SD. This impact is equivalent to the effect of an hourly wage decline of up to A$2.20, which is three times the largest effect of life events on personality traits found in Cobb-Clark and Schurer (2013) for working-age adults over a four-year time window. To the best of our knowledge, this is a unique finding not reported elsewhere in the literature. Therefore, we conclude that the impact of long-term health problems on control perceptions is partially offsetting a general trend in the population of decreasing external control tendencies.

Our finding that long-lasting or recurring health problems are associated with a more external locus of control has also been demonstrated in Cobb-Clark and Schurer (2013) for working age women, although the effect sizes are much smaller (0.2 SD). This finding is important from a policy perspective as it implies that programs aimed at increasing health in adolescents may have positive effects on participants' personality over and above the obvious health benefits later in life. Furthermore, this finding has implications for applied researchers who seek to identify and interpret the effects of young adulthood control perceptions on life-time outcomes: Without controlling adequately for differences in past health, researchers cannot interpret the treatment effects of control perceptions as causal.

Our results contribute to the literature in two important ways. First, our findings on mean-level changes for a nationally-representative sample may be used as one possibility to benchmark the effectiveness of youth education programs aimed at boosting life skills. Reviewing the empirical evidence on the role of the education sector in building life skills during adolescence, Schurer (2017) highlights that those education programs or reforms with positive impact, are boosting life skills between 0.1 and 0.3 SD. These effect sizes are similar in magnitude to personality developments observed during adolescence and young adulthood

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for our nationally-representative sample. One may thus conclude that the impact of these education programs or reforms is reasonably large.

Second, our findings demonstrate that – if at all – personality traits in adolescence are not specifically malleable with respect to most common one-off or high-frequency life events. For instance, adolescents who have lost a close family member or a partner do not seem to become less emotionally stable or more externally controlled, although such life events may be associated with the characteristic of "hopelessness" as described by Seligman (1975). Our results are however consistent with Cobb-Clark and Schurer (2012; 2013) who also do not find evidence that one-off life events have statistically or economically significant effects on personality development over four years for working-age adults.

There are two important limitations to our personality-change analysis. First, we cannot overcome the problem of reference bias inherent in self-assessed personality data that may confound our conclusions. West et al. (2016) have proposed that studies seeking to identify the effect of an education intervention on personality traits may not find any effects or even negative treatment effects, because the subjects may lift the benchmark against which they compare themselves. This may be an issue in our sample too, because some of the adolescents in our sample have started their post-secondary education or training after the baseline measurement of personality.

However, these issues are common among all studies that elicit personality through surveys and aim to assess the effect of shocks or interventions on personality development. Some studies use behavioral measures of personality such as absences from school, school engagement, and on-time graduation. Yet, this literature has not validated whether such measures correlate strongly with measures of personality, except for West et al. (2016). Kassenboehmer, Leung and Schurer (2015) evaluated for HILDA data whether survey non-response behavior could function as a proxy for personality traits, but find that such measure only weakly correlates with self-reported measures of personality. An alternative method to adjust for reference bias is the use of vignettes which are not available in our data and which are not commonly used yet (see Schurer, 2017 for a review of these methods and issues).

Another limitation is that, although most estimates of the effects of more common life events (e.g. birth of a new child, promotion, illness of a family member) are precisely estimated and insignificant, some of the point estimates of very rare life events (e.g. death of a spouse or child, long-term unemployment, being fired frequently, frequent property crime experiences) are relatively large in size despite being insignificant. Given these large confidence intervals, the results for rare life events are comparably more inconclusive and future research based on

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larger sample sizes would be needed to draw stronger conclusions on the personality effect of such rare one-off or ongoing events.

Despite these limitations, the nature of our data yields various advantages. On the one hand, we are able to study more precisely personality development over an eight-year window because the data includes the same high-quality personality questionnaire and response scale in every time period. Furthermore, because our data is nationally representative, we are able to make statements about the general youth population of Australia. Finally, because the data includes annually collected measures of life events, we are able to evaluate the longer-term effects of aggregated or high-frequency events. As the same personality traits will be reassessed again in this Australian longitudinal survey, it will be possible to follow youth personality development over even longer time spans. This will enable us to study more effectively and reliably the impact of repeated life-events on personality change in the future.

References

Adolfsson, B., Andersson, I., Elofsson, S., Rössner, S., & Undén, A. L. (2005). Locus of control and weight reduction. *Patient Education and Counseling*, *56*(1), 55–61.

Agronick, G. S. and Duncan, L. E. (1998). Personality and social change: Individual differences, life path, and importance attributed to the women's movement. *Journal of personality and social psychology*, *74*(6), 1545–1555.

Almlund, M., Lee Duckworth, A., Heckman, J.J., & Kautz, T., (2011). Personality psychology and economics. In E.A. Hanushek, S. Machin, L. Woessmann (Eds.), Handbook of the Economics of Education, vol. 4. North-Holland, Amsterdam, 1–181.

Andrisani, P. J. (1977). Internal-external attitudes, personal initiative, and the labor market experience of black and White Men. *The Journal of Human Resources*, *12*(3), 308-328.

Arnett, J. J. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist*, *55*(5), 469–480.

Barón, J. D., & Cobb-Clark, D. (2010). Are young people's educational outcomes linked to their sense of control? IZA Discussion Paper Series No. 4907, Institute for the Study of Labor. IZA Bonn.

Benjamini, Y. and D. Yekutieli. (2001). The control of the false discovery rate in multiple testing under dependency. *The Annals of Statistics*, 29, 1165–1188.

Benjamini, Y. and Y. Hochberg. (1995). Controlling the false discovery rate: a practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society, Series B*,

Accepted Manuscript

57, 289–300.

Bianchi, E. C. (2014). Entering adulthood in a recession tempers later narcissism. *Psychological Science*, *25*(7), 1429–1437.

Blakesley, R. E., Mazumdar, S., Dew, M. A., Houck, P. R., Tang, G., Reynolds, C. F., & Butters, M. A. (2009). Comparisons of methods for multiple hypothesis testing in neuropsychological research. *Neuropsychology*, *23*(2), 255–264.

Bleidorn, W., Hopwood, C. J. and Lucas, R. E. (2016). Life events and personality trait change. *Journal of Personality*.

Bleidorn, W., Klimstra, T. A., Denissen, J. J. A., Rentfrow, P. J., Potter, J. and Gosling, S. D. (2013). Personality maturation around the world: A cross-cultural examination of social-investment theory. *Psychological Science*. *24*(12), 2530–2540.

Blonigen, D. M., Carlson, M. D., Hicks, B. M., Krueger, R. F. and Iacono, W. G. (2008). Stability and change in personality traits from late adolescence to early adulthood: A longitudinal twin study. *Journal of Personality*, *76*(2), 229–266.

Borghans, L., Duckworth, A. L., Heckman, J. J., & ter Weel, B. (2008). The economics and psychology of personality traits. *The Journal of Human Resources*, *43*(4), 972–1059.

Boyce, C. J., Wood, A. M., Daly, M., & Sedikides, C. (2015). Personality change following unemployment. *Journal of Applied Psychology*, *100*(4), 991–1011.

Branje, S., Vam Lieshout, C.F.M., & Gerris, R.M. (2007). Big Five personality development in adolescence and adulthood. *European Journal of Personality*, *21*(1), 45–62.

Caliendo, M., Cobb-Clark, D., & Uhlendorff, A. (2015). Locus of Control and Job Search Strategies. *Review of Economics and Statistics*, 97(1), 88-103.

Cameron, L., Erkal, N., Gangadharan, L., & Meng, X. (2013). Little emperors: Behavioral impacts of China's one-child policy. *Science*, *339*(6122), 953–957.

Campbell, F., Conti, G., Heckman, J.J., Moon, S.H., Pinto, R., Pungello, E., Pan, Y. (2014). Early Childhood Investments Substantially Boost Adult Health. *Science* 343, 1478-1485.

Caspi, A. and Roberts, B. W. (1999) Personality continuity and change across the life course. In L. A. Pervin and O. P. John (Eds.), Handbook of Personality Psychology: Theory and Research, 2nd ed. New York, Guilford Press, 300–326.

Chamorro-Premuzic, T., & Furnham, A. (2003). Personality predicts academic performance: Evidence from two longitudinal university samples. *Journal of Research in Personality*, *37*(4), 319–338.

Chubb, N. H., Fertman, C. I., & Ross, J. L. (1997). Adolescent self-esteem and locus of control: A longitudinal study of gender and age differences. *Adolescence*, *32*(125), 113–129.

Cobb-Clark, D. A. (2015). Locus of control and the labor market. *IZA Journal of Labor Economics*, *4*(1), 3.

Accepted Manuscript

Cobb-Clark, D. A. and Schurer, S. (2012). The stability of big-five personality traits. *Economics Letters*, *115*(1), pp. 11–15.

Cobb-Clark, D. A. and Schurer, S. (2013). Two economists' musings on the stability of locus of control. *The Economic Journal*, *123*(570), F358–F400.

Coleman, M., & DeLeire, T. (2003). An economic model of locus of control and the human capital investment decision. *The Journal of Human Resources*, *38*(3), 701-721.

Costa, P. T., & McCrae, R. R. (1988). Personality in adulthood: A six-year longitudinal study of self-reports and spouse ratings on the NEO Personality Inventory. *Journal of Personality and Social Psychology*, *54*(5), 853–863.

Damasio, H., Grabowski, T., Frank, R., Galaburda, A.M., & Damasio, A.R. (2005). The return of Phineas Gage: Clues about the brain from the skull of a famous patient. In: Cacioppo, J.T., Berntson, G.G. (Eds.), Social Neuroscience: Key Readings. Psychology Press, New York, NY, 21–28.

De Fruyt, F., Bartels, M., Van Leeuwen, K. G., De Clercq, B., Decuyper, M., & Mervielde, I. (2006). Five types of personality continuity in childhood and adolescence. *Journal of Personality and Social Psychology*, *91*(3), 538–552.

Doherty, W.J., Baldwin, C., (1985). Shifts and stability in locus of control during the 1970s: Divergence of the sexes. *Journal of Personality and Social Psychology,* 48, 1048–1053.

Findley, M. J., & Cooper, H. M. (1983). Locus of control and academic achievement: A literature review. *Journal of Personality and Social Psychology*, *44*(2), 419–427.

Fletcher, J.M. (2013). The effects of personality traits on adult labor market outcomes: Evidence from siblings. *Journal of Economic Behavior and Organization, 89*, 122–135.

Furnham, A., Chamorro-Premuzic, T., & McDougall, F. (2003). Personality, cognitive ability, and beliefs about intelligence as predictors of academic performance. *Learning and Individual Differences*, *14*(1), 49–66.

Gatz, M., & Karel, M. J. (1993). Individual change in perceived Control over 20 years. *International Journal of Behavioral Development*, *16*(2), 305–322.

Goldberg, L.R. (1992). The development of markers for the big-five factor structure. *Psychological Assessment, 4*, 26.

Goldberg, L.R. (1993). The structure of phenotypic personality traits. *American Psychologist, 48*, 26–34.

Goldsmith, A. H., Veum, J.R., & Darity, W. (1996). The psychological impact of unemployment and joblessness. *Journal of Socio-Economics*, *15*(3), 333-358.

Heckman, J. J., Pinto, R. and Savelyev, P. (2013). Understanding the mechanisms through which an influential early childhood program boosted adult outcomes. *American Economic Review*, *103*(6), 2052-2085.

Heckman, J. J., Stixrud, J., & Urzua, S. (2006). The effects of cognitive and noncognitive abilities

Accepted Manuscript

on labor market outcomes and social behavior. *Journal of Labor Economics*, *24*(3), 411-482.

Heineck, G., & Anger, S. (2010). The returns to cognitive abilities and personality traits in Germany. *Labour Economics, 17*, 535–546.

Hochberg Y. (1988). A sharper Bonferroni procedure for multiple tests of significance. *Biometrika*, *75*, 800–802.

Hochberg Y., Benjamini Y. (1990). More powerful procedures for multiple significance testing. *Statistics in Medicine*, *9*, 811–818.

Hopwood, C., M. Donnellan, D. Blonigen, R. Krueger, M. McGue, W. Iacono, & Burt, S. (2011). Genetic and environmental influences on personality trait stability and growth during the transition to adulthood: A three wave longitudinal study. *Journal of Personality & Social Psychology,* 100(3), 545–556.

Jacobson, N. S. and Truax, P. (1991) Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology*, *59*(1), 12–19.

Jeronimus, B. F., Ormel, J., Aleman, A., Penninx, B. W. J. H. and Riese, H. (2013). Negative and positive life events are associated with small but lasting change in neuroticism. *Psychological Medicine*, *43*(11), 2403–2415.

John, O., & Srivastava, S. (2001). The Big-Five trait taxonomy: History, measurement, and theoretical perspectives. In: L. Pervin & O. John (Eds.), Handbook of Personality: Theory and Research, 2nd ed. Guilford Press, New York, pp. 102–138 (Chapter 4).

Johnston, J., DiNardo, J. E. (1997). Econometric Methods. McGraw-Hill, New York, NY, ed. 4.

Kappe, R., & van der Flier, H. (2012). Predicting academic success in higher education: What's more important than being smart? *European Journal of Psychology of Education*, *27*(4), 605–619.

Kassenboehmer, S., Leung, F., Schurer, S. (2015). Testing the validity of item non-response as a proxy for cognitive and non-cognitive skills. IZA Discussion Paper Nr 8874.

Kern, M.L., Friedman, H.S., Martin, L.R., Reynolds, C.A., & Luong, G. (2009). Conscientiousness, career success, and longevity: A lifespan analysis. *Annals of Behavioral Medicine,* 37, 154–163.

Klimstra, T. A., Hale, W. W., Raaijmakers, Q. A. W., Branje, S. J. T., & Meeus, W. H. (2009). Maturation of personality in adolescence. *Journal of Personality and Social Psychology*, *96*(4), 898–912.

Kohn, M. L. and Schooler, C. (1982) Job conditions and personality: A longitudinal assessment of their reciprocal effects. *American Journal of Sociology*, *87*(6), 1257-1286.

Kulas, H. (1996). Locus of control in adolescence: A longitudinal study. *Adolescence*, *31*(123), 721-9.

Accepted Manuscript

Leikas, S. and Salmela-Aro, K. (2015). Personality trait changes among young Finns: The role of life events and transitions. *Journal of Personality*, *83*(1), 117–126.

Lewis, S.K., Ross, C.E., Mirowsky, J. (1999). Establishing a sense of personal control in the transition to adulthood. *Social Forces*, *77*, 1573–1599.

List, J.A., Azeem, M.S., Xu, Y. (2016). Multiple hypothesis testing in experimental economics. NBER Working Paper No. 21875.

Löckenhoff, C. E., Terracciano, A., Patriciu, N. S., Eaton, W. W. and Costa, P. T. (2009) Self-reported extremely adverse life events and longitudinal changes in five-factor model personality traits in an urban sample. *Journal of Traumatic Stress*, *22*(1), 53–59.

Losoncz, I. (2009). Personality traits in HILDA. *Australian Social Policy, 8*, 169–198.

Lüdtke, O., Roberts, B. W., Trautwein, U., & Nagy, G. (2011). A random walk down university avenue: Life paths, life events, and personality trait change at the transition to university life. *Journal of Personality and Social Psychology*, *101*(3), 620–637.

Malmendier, U., Nagel, S. (2016). Learning from inflation experiences. *The Quarterly Journal of Economics*, *131*(1), 53-87.

McCrae, R. R., & Costa, P. T. (1994). The stability of personality: Observations and evaluations. *Current Directions in Psychological Science*, *3*(6), 173–175.

McCrae, R. R., Costa, Jr., P. T., Ostendorf, F., Angleitner, A., Hrebícková, M., Avia, M. D., Sanz, J. and Bernardos, M. L. S. (2000) Nature over nurture: Temperment, personality, and life span development. *Journal of Personality and Social Psychology*, *78*(1), 173–186.

McCrae, R. R., Costa, P. T., Pedroso de Lima, M., Simões, A., Ostendorf, F., Angleitner, A., Marusić, I., Bratko, D., Caprara, G. V., Barbaranelli, C., Chae, J. H. and Piedmont, R. L. (1999). Age differences in personality across the adult life span: Parallels in five cultures. *Developmental Psychology*, *35*(2), 466–477.

McGee, A. D. (2015). How the perception of control influences unemployed job search. *Industrial and Labor Relations Review*. 184–211.

McGue, M., Bacon, S. and Lykken, D. T. (1993) Personality stability and change in early adulthood: A behavioral genetic analysis. *Developmental Psychology*, *29*(1), 96–109.

Mueller, G., & Plug, E. (2006). Estimating the effects of personality on male and female earnings. *Industrial and Labor Relations Review, 60*(1), 3–22.

Newson, R. (2003). Multiple-test procedures and smile plots. *The Stata Journal*, *2*(2). 109–132.

Neyer, F. J. and Lehnart, J. (2007). Relationships matter in personality development: Evidence from an 8-year longitudinal study across young adulthood. *Journal of Personality*, *75*(3), 535–568.

Ng, T. W. H., Sorensen, K. L., & Eby, L. T. (2006). Locus of control at work: A meta-analysis. *Journal of Organizational Behavior*, *27*(8), 1057–1087.

Accepted Manuscript

Noftle, E. E., & Robins, R. W. (2007). Personality predictors of academic outcomes: Big five correlates of GPA and SAT scores. *Journal of Personality and Social Psychology*, *93*(1), 116–130.

Nyhus, E. K., & Pons, E. (2005). The effects of personality on earnings. *Journal of Economic Psychology*, *26*(3), 363–384.

Pearlin, L. I. and Schooler, C. (1978) The structure of coping. *Journal of Health and Social Behavior*, *19*, 2–21.

Peter, F. (2016) The effect of involuntary maternal job loss on children's behaviour and non-cognitive skills. *Labour Economics*, *42*, 43–63.

Piatek, R. and Pinger, P. (2010) Maintaining (Locus of) Control? Assessing the Impact of Locus of Control on Education Decisions and Wages. IZA Discussion Paper Series No. 5289, Institute for the Study of Labor. IZA Bonn.

Piatek, R. and Pinger, P. (2015). Maintaining (locus of) control? Data combination for the identification and inference of factor structure models. *Journal of Applied Econometrics*.

Pullmann, H., Raudsepp, L., & Allik, J. (2006). Stability and change in adolescents' personality: a longitudinal study. *European Journal of Personality*, *20*(6), 447–459.

Roberts, B. W. (2009). Back to the future: personality and assessment and personality development. *Journal of Research in Personality, 43*(2), 137–145.

Roberts, B. W., & Delvecchio, W. F. (2000). The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin*, *126*(1), 3-25.

Roberts, B. W., Caspi, A. and Moffitt, T. E. (2001). The kids are alright: Growth and stability in personality development from adolescence to adulthood. *Journal of Personality*, *81*(4), 670–683.

Roberts, B. W., Caspi, A. and Moffitt, T. E. (2003). Work experiences and personality development in young adulthood. *Journal of Personality and Social Psychology*, *84*(3), 582–593.

Roberts, B. W., Walton, K. E., & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: a meta-analysis of longitudinal studies. *Psychological Bulletin*, *132*(1), 1–25.

Robins, R. W., Fraley, R. C., Roberts, B. W., & Trzesniewski, K. H. (2001). A longitudinal study of personality change in young adulthood. *Journal of Personality*, *69*(4), 617–640.

Rotter, J. B. (1966). Generalized expectancies of internal versus external control of reinforcements. *Psychological Monographs*, *80*(1), 1–28.

Saucier, G. (1994). Mini-markers: A brief version of Goldberg's unipolar Big-five markers. *Journal of Personality Assessment, 63*, 506–516.

Schurer, S. (2017). Bouncing back from health shocks: Locus of control and labour supply.

Accepted Manuscript

Journal of Economic Behavior & Organization, 133, 1-20.

Schurer, S. (2017), Are life skills of adolescence fixed for life? IZA World of Labor. IZA Bonn. In print.

Schurer, S., Kassenboehmer, S.C., & Leung, S. (2015), Do universities shape their students' personality? IZA Discussion Paper No. 8874, Institute for the Study of Labor. IZA Bonn.

Seligman, M.E.P. (1975). Helplessness: On Depression, Development and Death, San Francisco, CA: W. H. Freeman.

Soto, C. J., John, O. P., Gosling, S. D. and Potter, J. (2011) Age differences in personality traits from 10 to 65: Big Five domains and facets in a large cross-sectional sample. *Journal of Personality and Social Psychology*, *100*(2), 330–348.

Specht, J., Egloff, B., & Schmukle, S. C. (2011). Stability and change of personality across the life course: The impact of age and major life events on mean-level and rank-order stability of the Big Five. *Journal of Personality and Social Psychology*, *101*(4), 862–882.

Specht, J., Egloff, B., & Schmukle, S.C. (2013). Everything under control? The effects of age, gender, and education on trajectories of perceived control in a nationally representative German sample. *Developmental Psychology,* 49(2), 353-364.

Stein, J., Newcomb, M., & Bentler, P. (1986). Stability and change in personality: A longitudinal study from early adolescence to young adulthood. *Journal of Research in Personality*, *20*(3), 276–291.

Summerfield, M., Freidin, S., Hahn, M., Ittak, P., Li, N., Macalalad, N., Watson, N., Wilkins, R., & Wooden, M. (2013). Hilda User Manual–Release 12.

Terracciano, A., McCrae, R. R. and Costa, P. T. (2010) Intra-individual change in personality stability and age. *Journal of Research in Personality*, *44*(1), 31–37.

Trapmann, S., Hell, B., Hirn, J.-O. W., & Schuler, H. (2007). Meta-analysis of the relationship between the Big five and academic success at university. *Zeitschrift Für Psychologie / Journal of Psychology*, *215*(2), 132–151.

Twenge, J. M. (2000). The age of anxiety? The birth cohort change in anxiety and neuroticism, 1952-1993. *Journal of Personality and Social Psychology*, *79*(6), 1007–1021.

Vaidya, J. G., Gray, E. K., Haig, J. and Watson, D. (2002) On the temporal stability of personality: Evidence for differential stability and the role of life experiences. *Journal of Personality and Social Psychology*, *83*(6), 1469–1484.

Vaidya, J. G., Gray, E. K., Haig, J. R., Mroczek, D. K. and Watson, D. (2008) Differential stability and individual growth trajectories of big five and affective traits during young adulthood. *Journal of Personality*, *76*(2), 267–304.

West, M. R., M.A. Kraft, A.S. Finn, R.E. Martin, A.L. Duckworth, C.F.O. Gabrieli, & Gabrieli, J.D.E. (2016). Promise and paradox: Measuring students' non-cognitive skills and the impact of schooling. *Educational Evaluation and Policy Analysis,* 38(1), 148-170.

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5. APPENDIX

Table A1: Probability of dropping out of the sample by wave 13

	Prob(Drop-out) Marginal effect Baseline: 0.29
Personality scale - Openness to experience	-0.0120 (0.0112)
Personality scale – Conscientiousness	0.0188^{+} (0.0110)
Personality scale – Extroversion	0.00870 (0.0102)
Personality scale - Agreeableness	-0.00787 (0.0120)
Personality scale - Emotional stability	-0.0154 (0.0108)
Age (Base 15)	0 (.)
16	-0.0379 (0.0453)
17	0.00900 (0.0471)
18	-0.0699 (0.0476)
19	-0.0355 (0.0511)
20	-0.106* (0.0489)
21	-0.125* (0.0497)
22	0.00421 (0.0544)
23	-0.0384 (0.0539)
24	-0.0608 (0.0543)
Female	-0.0351 (0.0220)
Labor force status (Base: Employed)	0 (.)
Unemployed	0.0181

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	(0.0425)
Not in the labor force	0.00477 (0.0278)
Studying degree or above at university	0.0641+ (0.0332)
Currently studying (adv) diploma/certificate at TAFE	0.0874** (0.0337)
Still living at home	-0.144** (0.0346)
State of residence (Base: NSW)	0 (.)
[2] VIC	0.00966 (0.0279)
[3] QLD	0.0129 (0.0292)
[4] SA	0.0759+ (0.0398)
[5] WA	0.0768+ (0.0410)
[6] TAS	-0.0136 (0.0564)
[7] NT	-0.108 (0.114)
[8] ACT	-0.100+ (0.0526)
Country of birth (Base: Australia)	0 (.)
[2] Main English Speaking	0.100 (0.0642)
[3] Other	0.0456 (0.0455)
General health status (SF-36, 0-100)	-0.0000780 (0.000570)
Currently married or de facto	-0.107** (0.0285)
Log household income	0.0683** (0.0166)
Father's occupational prestige score (0-100)	-0.000245 (0.000504)

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Mother's highest level of education (Base: missing)	0 (.)
[1] None	0.224 (0.154)
[2] Primary school only	0.0261 (0.0966)
[3] Some secondary school, but no more than Year 10	-0.0332 (0.0576)
[4] Year 11 or equivalent (eg 5th form, Leaving Certificate)	-0.0714 (0.0621)
[5] Year 12 or equivalent (eg 6th form, Matriculation)	-0.0850 (0.0574)
Living in rural region	-0.0547* (0.0220)
Missing: Living at home	-0.205** (0.0569)
Missing: Household income	0.567** (0.156)
Missing: Father's occupational status	0.00223 (0.0379)
Life event: got married	0.0571 (0.0639)
Life event: got back together with spouse	0.0639 (0.0782)
Life event: pregnancy	0.0250 (0.0617)
Life event: birth of a baby	-0.0500 (0.0796)
Life event: major improvements in finances	-0.0998 (0.0676)
Life event: Promoted at work	-0.0403 (0.0341)
Life event: retired from work force	-0.0245 (0.140)
Life event: changed job	0.0474+ (0.0242)
Life event: moved house	0.0445+ (0.0258)
Life event: Serious illness or injury	0.0159 (0.0397)

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Life event: Serious illness or injury of family member	0.0126 (0.0297)
Life event: death of a spouse or child	0.0253 (0.129)
Life event: death of close family member	0.0103 (0.0319)
Life event: death of close friend	0.000196 (0.0400)
Life event: Victim of physical violence	-0.0694 (0.0541)
Life event: Victim of property crime	0.0682 (0.0429)
Life event: Detained in jail	-0.0456 (0.178)
Life event: Close family member detained in jail	0.0648 (0.0712)
Life event: Fired or made redundant	-0.0564 (0.0536)
Life event: Major worsening of finances	-0.00818 (0.0642)
Life event: separated from spouse	0.0456 (0.0396)
Observations	2000

Note: Logit model, dependent variable is whether the sample member of wave 5, when we measure the Big-Five personality traits, has dropped out of the sample by wave 13. Control variables are all reported at baseline. Reported are marginal probability effects. Standard errors in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

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Table A2: Within sample Cronbach's alpha for personality traits

	N*T	Sign	item-test corr	item-rest corr	avg interim covar	alpha if drop item
External locus of control						
I have little control over the things that happen	1,068	+	0.716	0.594	0.957	0.826
There is really no way I can solve some of the problems	1,068	+	0.791	0.696	0.906	0.811
There is little I can do to change many of the	1,068	+	0.769	0.672	0.936	0.815
I often feel helpless in dealing with the problems	1,068	+	0.800	0.703	0.886	0.809
Sometimes I feel that I'm being pushed around	1,068	+	0.767	0.652	0.903	0.817
What happens to me in the future mostly	1,068	-	0.553	0.399	1.086	0.854
I can do just about anything I really set my	1,068	-	0.641	0.511	1.029	0.838
Test scale					*0.958*	***0.846***
Extraversion						
Talkative	1,161	-	0.733	0.587	0.827	0.713
Quiet	1,161	+	0.825	0.703	0.702	0.677
Extroverted	1,161	-	0.622	0.424	0.928	0.756
Shy	1,161	+	0.809	0.678	0.720	0.684
Lively	1,161	-	0.577	0.416	1.000	0.755
Bashful	1,161	+	0.483	0.274	1.073	0.788
Test scale					*0.875*	***0.767***
Emotionally stable (reverse of neuroticism)						
Envious	1,161	+	0.668	0.516	0.928	0.770
Moody	1,161	+	0.746	0.594	0.823	0.751
Jealous	1,161	+	0.725	0.579	0.862	0.755
Temperamental	1,161	+	0.747	0.610	0.841	0.747
Fretful	1,161	+	0.660	0.496	0.926	0.774
Touchy	1,161	+	0.665	0.488	0.909	0.777
Test scale					*0.882*	***0.794***
Conscientiousness						
Orderly	1,161	-	0.750	0.608	0.762	0.735
Systematic	1,161	-	0.598	0.388	0.896	0.791
Inefficient	1,161	+	0.690	0.539	0.830	0.752
Sloppy	1,161	+	0.624	0.459	0.892	0.770
Organised	1,161	+	0.785	0.644	0.709	0.724
Efficient	1,161	-	0.728	0.598	0.809	0.740
Test scale					*0.816*	***0.786***
Openness to experience						
Deep	1,161	+	0.692	0.528	0.796	0.705
Philosophical	1,161	+	0.719	0.541	0.748	0.700
Creative	1,161	+	0.645	0.452	0.833	0.726
Imaginative	1,161	+	0.690	0.528	0.801	0.705
Complex	1,161	+	0.650	0.452	0.825	0.726
Intellectual	1,161	+	0.610	0.445	0.891	0.727

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Test scale					*0.816*	***0.751***
Agreeable						
Sympathetic	1,161	+	0.768	0.535	0.568	0.727
Kind	1,161	+	0.800	0.647	0.566	0.669
Cooperative	1,161	+	0.700	0.472	0.673	0.753
Warm	1,161	+	0.801	0.616	0.532	0.677
Test scale					*0.585*	***0.763***

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Table A3: Description of one-off and aggregated self-reported life events experienced after the baseline measurement of personality traits

One-off Life Events
Positive
Got married
Got back together with spouse
Birth or adoption of new child
Promoted at work
Major improvement of finances
Negative
Retired from the workforce
Serious personal illness or injury
Serious personal illness to family member
Death of spouse or child
Death of close family member or relative
Victim of physical violence
Victim of property crime
Detained in jail
Family member detained in jail
Fired or made redundant
Major worsening of finances
High-frequency Life Events (in three or more of eight years)
Experience of unemployment for three years or more
Experience of being fired three or more times
Experience of chronic pain for three years or more
Experience of a medical condition that restricted the individual for three years or more
Experience of an illness or injury for at least three years
Experience of any long-term health condition for three or more years
Experience of 3 or more death of a family member
Experience of family member detained in jail in three or more years
Experience of being victim of a property crime in three or more years

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Table A4a: Summary statistics of Big Five estimation sample

Dependent variable: Changes 2013-2005	N	Mean	Std. Dev.	Min.	Max.
Openness to Experience	1,161	-0.032	1.021	-4.33	3.67
Conscientiousness	1,161	0.384	0.987	-2.50	5.00
Extraversion	1,161	-0.104	0.925	-3.50	3.50
Agreeableness	1,161	0.157	0.963	-3.25	5.00
Emotional stability	1,161	0.135	1.098	-3.50	4.33
One-off life events (2006-2013)					
Got married	1,161	0.248	0.432	0	1
Got back together with spouse	1,161	0.062	0.241	0	1
Birth/adoption of new child	1,161	0.289	0.454	0	1
Major improvement in finances	1,161	0.127	0.334	0	1
Promoted at work	1,161	0.441	0.497	0	1
Retired from the workforce	1,161	0.016	0.127	0	1
Serious personal injury/illness	1,161	0.246	0.431	0	1
Serious injury/illness to family member	1,161	0.457	0.498	0	1
Death of spouse or child	1,161	0.016	0.127	0	1
Death of close relative/family member	1,161	0.469	0.499	0	1
Victim of physical violence	1,161	0.121	0.326	0	1
Victim of a property crime	1,161	0.283	0.451	0	1
Detained in jail	1,161	0.022	0.145	0	1
Close family member detained in jail	1,161	0.059	0.237	0	1
Fired or made redundant	1,161	0.239	0.427	0	1
Major worsening in finances	1,161	0.110	0.313	0	1
High frequency life events (2006-2013)					
Unemployed 3 or more times	1,161	0.038	0.191	0	1
Recurring pain in 3 + years	1,161	0.015	0.120	0	1
Long-term health condition in 3 + years	1,161	0.018	0.133	0	1
Serious illness or injury in 3 + years	1,161	0.023	0.151	0	1
Long-term health condition in 3 + years	1,161	0.139	0.346	0	1
Death of at least 3 close family members	1,161	0.047	0.211	0	1
Baseline characteristics (2005)					
Age	1,161	19.214	2.887	15	24
Female	1,161	0.557	0.497	0	1
Living at home	1,161	0.611	0.488	0	1
General health status	1,161	72.764	19.193	0	100
Married or de facto	1,161	0.189	0.392	0	1
Number of children	1,161	0.094	0.397	0	5
Log household income	1,161	10.857	1.083	0	13.229
Father occupation prestige scale	1,161	42.213	28.208	0	100
Highest level of education of mother					
Missing	1,161	0.034	0.182	0	1
None	1,161	0.003	0.051	0	1
Primary School	1,161	0.015	0.120	0	1
Some secondary school	1,161	0.345	0.476	0	1

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Year 11 or equivalent	1,161	0.118	0.323	0	1
Year 12 or equivalent	1,161	0.485	0.500	0	1
Own labor force status					
Employed	1,161	0.691	0.462	0	1
Unemployed	1,161	0.071	0.256	0	1
Not in the labor force	1,161	0.239	0.426	0	1
Highest level of education					
Year 11 and below	1,161	0.443	0.497	0	1
Year 12	1,161	0.327	0.469	0	1
Certificate III/IV	1,161	0.112	0.315	0	1
Advanced diploma	1,161	0.034	0.180	0	1
Bachelor	1,161	0.078	0.268	0	1
Graduate degree	1,161	0.007	0.083	0	1
State of residence					
New South Wales	1,161	0.285	0.452	0	1
Victoria	1,161	0.239	0.426	0	1
Queensland	1,161	0.220	0.415	0	1
South Australia	1,161	0.085	0.279	0	1
Western Australia	1,161	0.086	0.281	0	1
Tasmania	1,161	0.040	0.195	0	1
Northern Territory	1,161	0.007	0.083	0	1
Australian Capital Territory	1,161	0.038	0.191	0	1
Country of birth					
Australia	1,161	0.913	0.282	0	1
English-speaking country[a]	1,161	0.027	0.161	0	1
Non-English speaking country	1,161	0.060	0.238	0	1
Not living in metropolitan area	1,161	0.370	0.483	0	1
Missing data flag					
Missing: Living at Home	1,161	0.015	0.120	0	1
Missing: Household income	1,161	0.005	0.072	0	1
Missing: Father occupation	1,161	0.140	0.347	0	1
Missing: Mother education	1,161	0.034	0.182	0	1
Missing: Mother education	1,161	0.015	0.120	0	1

Note: [a]Main English speaking countries include United Kingdom, New Zealand, Canada, USA, Ireland and South Africa (HILDA codebook).

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Table A4b: Summary statistics of locus of control estimation sample

Dependent variable: Changes 2011-2003	N	Mean	Std. Dev.	Min.	Max.
External locus of control	1,068	-0.147	1.184	-4	4
One-off life events (2004-2011)					
Got married	1,068	0.274	0.446	0	1
Got back together with spouse	1,068	0.077	0.266	0	1
Birth/adoption of new child	1,068	0.300	0.458	0	1
Major improvement in finances	1,068	0.160	0.367	0	1
Promoted at work	1,068	0.487	0.500	0	1
Retired from the workforce	1,068	0.020	0.139	0	1
Serious personal injury/illness	1,068	0.266	0.442	0	1
Serious injury/illness to family member	1,068	0.486	0.500	0	1
Death of spouse or child	1,068	0.019	0.136	0	1
Death of close relative/family member	1,068	0.476	0.500	0	1
Victim of physical violence	1,068	0.133	0.340	0	1
Victim of a property crime	1,068	0.294	0.456	0	1
Detained in jail	1,068	0.019	0.136	0	1
Close family member detained in jail	1,068	0.072	0.259	0	1
Fired or made redundant	1,068	0.223	0.416	0	1
Major worsening in finances	1,068	0.113	0.317	0	1
High frequency life events (2003-2011)					
Unemployed 3 or more times	1,068	0.030	0.171	0	1
Recurring pain in 3 or more years	1,068	0.013	0.114	0	1
Long-term health condition in 3 or more years	1,068	0.028	0.165	0	1
Serious illness or injury in 3 or more years	1,068	0.022	0.145	0	1
Long-term health condition in 3 or more years	1,068	0.146	0.353	0	1
Death of at least 3 close family members	1,068	0.046	0.209	0	1
Baseline characteristics (2003)					
Age	1,068	19.238	2.916	15	24
Female	1,068	0.512	0.500	0	1
Living at home	1,068	0.578	0.494	0	1
General health status	1,068	72.922	19.726	0	100
Married or de facto	1,068	0.199	0.400	0	1
Log household income	1,068	10.779	0.867	0	13.044
Number of children	1,068	0.087	0.391	0	4
Father's occupation prestige score	1,068	41.667	28.513	0	100
Mother's occupation prestige score	1,068	37.095	30.866	0	100
Not living in metropolitan area	1,068	0.360	0.480	0	1
Highest level of education					
Year 11 and below	1,068	0.453	0.498	0	1
Year 12	1,068	0.325	0.469	0	1
Certificate III/IV	1,068	0.113	0.317	0	1
Advanced diploma	1,068	0.023	0.151	0	1
Bachelor	1,068	0.080	0.271	0	1
Graduate degree	1,068	0.006	0.075	0	1

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Labor force status					
Employed	1,068	0.685	0.465	0	1
Unemployed	1,068	0.077	0.266	0	1
Not in the labor force	1,068	0.238	0.426	0	1
State of residence					
New South Wales	1,068	0.278	0.448	0	1
Victoria	1,068	0.246	0.431	0	1
Queensland	1,068	0.219	0.414	0	1
South Australia	1,068	0.106	0.308	0	1
Western Australia	1,068	0.083	0.277	0	1
Tasmania	1,068	0.043	0.203	0	1
Australian Capital Territory	1,068	0.024	0.154	0	1
Country of birth					
Australia	1,068	0.899	0.302	0	1
English-speaking country[a]	1,068	0.030	0.171	0	1
Non-English speaking country	1,068	0.071	0.257	0	1
Missing information flag					
Missing: General health	1,068	0.005	0.068	0	1
Missing: Household income	1,068	0.002	0.043	0	1
Missing: Father occupation	1,068	0.156	0.363	0	1
Missing: Mother occupation	1,068	0.269	0.444	0	1
Missing: Living at home	1,068	0.006	0.075	0	1

Note: [a]Main English speaking countries include United Kingdom, New Zealand, Canada, USA, Ireland and South Africa (HILDA codebook).

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Table A5: Robustness of Multiple Hypothesis Testing to Different Methods

	Openness to Exp.		Conscientiousness		Extraversion		Agreeableness		Emotional Stability		External LOC	
	# Reject	p-value	# Reject	p-value	# Reject	p-value	# Reject	p-value	# Reject	p-value	# Reject	p-value
Individual Life events (16)												
Simes	1	0.00625	1	0.00625	0	0.00625	1	0.00625	0	0.00625	0	0.00625
Holm	1	0.00667	1	0.00667	0	0.00625	1	0.00667	0	0.00625	0	0.00625
Krieger	1	0.00606	1	0.00606	0	0.00568	1	0.00606	0	0.00568	0	0.00568
Liu 1	1	0.00749	1	0.00749	0	0.00656	1	0.00749	0	0.00656	0	0.00656
Liu 2	1	0.00711	1	0.00711	0	0.00625	1	0.00711	0	0.00625	0	0.00625
Yekutieli	0	0.00185	1	0.00185	0	0.00185	0	0.00185	0	0.00185	0	0.00185
Bonferroni	1	0.00625	1	0.00625	0	0.00625	1	0.00625	0	0.00625	0	0.00625
High-frequency shocks (9)												
Simes	0	0.01111	0	0.01111	0	0.01111	0	0.01111	1	0.01250	2	0.01429
Holm	0	0.01010	0	0.01010	0	0.01010	0	0.01010	1	0.01136	3	0.04545
Krieger	0	0.01164	0	0.01164	0	0.01164	0	0.01164	1	0.01481	2	0.01947
Liu 1	0	0.01111	0	0.01111	0	0.01111	0	0.01111	1	0.01406	2	0.01837
Liu 2	0	0.00393	0	0.00393	0	0.00393	0	0.00393	1	0.00393	2	0.00786
Yekutieli	0	0.01111	0	0.01111	0	0.01111	0	0.01111	1	0.01111	3	0.03333
Bonferroni	0	0.01111	0	0.01111	0	0.01111	0	0.01111	1	0.01111	2	0.01111

Note: Column (1) describes the different step-up and step-down procedures implemented in STATA – multproc – described in Newson (2003). # Reject: Number of rejected null hypotheses. p-value adjusted for multiple hypothesis testing for a False Discovery Rate of 0.10, or a Family Wise Error Rate of 0.10.

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Table A6: Wage effects of personality traits underlying Table 5 calculations

	Wage Effects Own calculations[a] (%) (1)	Wage Effects M&P (2006)[b] (%) (2)	Wage Effects H&A (2010)[c] (%) (3)
External LOC	-2.8+	--	-6.8**
Agreeableness	-4.2**	-2.05+	-2.4+
Conscientiousness	3.2**	1.40	-0.1
Emotional stab.	0.6	2.0+	0.5
Extraversion	-1.2	-0.5	0.2
Openness to exp.	0.7	3.8**	1.9
N	1629	5025	1580

Note: [a] Wage effects own calculations are based on estimation results presented in Table A7. OLS regression. [b] Wage effect of a 1 St. Dev. increase in personality trait as reported by Mueller and Plug (2006) based on 1992 data from the Wisconsin Longitudinal Study. Both personality and wages were assessed in the same year when the cohort members were in their early 50s. Males and Female effects from Mueller and Plug (2006) were averaged. OLS regressions. Controls include: cognitive ability, years of schooling, work experience, tenure, region, married, number of children. [c] Wage effect of a 1 St. Dev. increase external locus of control as reported by Heineck and Anger (2010) based on a sample of 20 to 60 year old individuals. Personality traits were measured in 2005, while wage data was collected between 1991 and 2006. Males and Female effects from Heineck and Anger (2010) were averaged. Hausman-Taylor IV estimator. Controls include: cognitive ability, living in East Germany, married, German citizenship, years of education, age and age squared, tenure and tenure squared, public employer, working in a firm with 2000 employees or more, a temporary job, a part-time job, and white collar worker. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

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Table A7: Determinants of hourly wages in Wave 13

	(1) POOLED	(2) FEMALE	(3) MALE
External locus of control (Wave 3, Std)	-0.0282*	-0.0184	-0.0423*
	(0.0115)	(0.0142)	(0.0186)
Agreeableness (Wave 5, Std)	-0.0422**	-0.0362*	-0.0467**
	(0.0107)	(0.0146)	(0.0164)
Conscientiousness (Wave 5, Std)	0.0324**	0.0259*	0.0413*
	(0.0107)	(0.0130)	(0.0184)
Emotional Stability (Wave 5, Std)	0.00571	0.0365**	-0.0297
	(0.0108)	(0.0132)	(0.0181)
Extraversion (Wave 5, Std)	-0.0115	-0.0133	-0.00808
	(0.0104)	(0.0125)	(0.0178)
Openness to experience (Wave 5, Std)	0.00735	0.0129	0.00162
	(0.0111)	(0.0135)	(0.0184)
Cognitive ability (Wave 12, Std)	0.0547**	-0.0171	0.124**
	(0.0210)	(0.0280)	(0.0327)
Wage information imputed	-0.0258	-0.0235	-0.0371
	(0.0360)	(0.0409)	(0.0692)
Casual employment contract	-0.0768*	-0.142**	0.0244
	(0.0329)	(0.0410)	(0.0575)
Age	-0.0478	-0.0644	-0.0529
	(0.0463)	(0.0553)	(0.0785)
Age Squared	0.000568	0.000683	0.000686
	(0.000541)	(0.000642)	(0.000919)
Female	-0.179**		
	(0.0231)		
Education (Base: Year 11 or less)			
Year 12	0.141**	0.0859+	0.208**
	(0.0380)	(0.0473)	(0.0615)
Certificate III/IV	0.0908**	-0.0284	0.179**
	(0.0305)	(0.0387)	(0.0477)
Adv diploma, diploma	0.219**	0.205**	0.229**
	(0.0403)	(0.0493)	(0.0680)
Bachelor or honours	0.387**	0.343**	0.424**
	(0.0351)	(0.0426)	(0.0602)
Grad diploma/certificate, postgrad	0.487**	0.420**	0.553**

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	(0.0385)	(0.0468)	(0.0641)
Living at home in Wave 13	-0.231**	-0.287*	-0.192+
	(0.0807)	(0.123)	(0.113)
Rural area	-0.0728**	-0.0516+	-0.0786*
	(0.0214)	(0.0270)	(0.0340)
State of residence (Base: NSW)			
[2] VIC	-0.0666*	-0.0841*	-0.0379
	(0.0281)	(0.0366)	(0.0431)
[3] QLD	-0.103**	-0.117**	-0.107*
	(0.0270)	(0.0338)	(0.0432)
[4] SA	-0.131**	-0.162**	-0.110
	(0.0488)	(0.0570)	(0.0809)
[5] WA	0.0231	-0.0387	0.0871
	(0.0381)	(0.0440)	(0.0629)
[6] TAS	-0.0476	-0.0184	-0.0612
	(0.0380)	(0.0452)	(0.0613)
[8] ACT	0.0627	0.0147	0.112
	(0.0593)	(0.0835)	(0.0826)
Country of birth (Base: Australia)			
[2] Main English Speaking	0.0117	0.0630	-0.0327
	(0.0357)	(0.0482)	(0.0511)
[3] Other	-0.107**	-0.0770+	-0.148+
	(0.0394)	(0.0444)	(0.0760)
General health status (Sf 36, 0-100)	0.000280	0.000580	-0.0000339
	(0.000416)	(0.000574)	(0.000593)
Married or de facto	0.0597*	0.0360	0.0956+
	(0.0260)	(0.0300)	(0.0512)
Number of children (Base: 0)			
1	0.00941	0.0194	-0.0132
	(0.0290)	(0.0367)	(0.0494)
2	0.0413	0.0230	0.0605
	(0.0278)	(0.0327)	(0.0502)
3	0.0350	-0.0538	0.127*
	(0.0351)	(0.0453)	(0.0561)

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4	0.0394	-0.0992	0.129
	(0.0658)	(0.0829)	(0.0990)
5	0.0175	0.171	-0.0285
	(0.161)	(0.259)	(0.185)
7	0.430^{+}	0.647**	0.146^{+}
	(0.252)	(0.0729)	(0.0760)
8	0.131*		0.206*
	(0.0536)		(0.0855)
Cognitive ability score missing	0.114^{+}	-0.0770	0.294**
	(0.0689)	(0.0928)	(0.104)
Constant	3.230**	2.949**	3.332**
	(0.0712)	(0.0840)	(0.120)
Observations	1629	857	772

Note: HILDA sample of 25 to 40 year old men and women in 2003. Hourly wages are measured at ages 35 and 50. Dependent variable is log of hourly wages in main job in Wave 13. Personality traits are measured in Wave 3 and 5, Cognitive ability was assessed through interviewers in Wave 12 (Symbol Digits Modalities Test). All other control variables are measured in Wave 13. Standard errors in parentheses, $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

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