Childhood Origins of Adulthood Noncognitive Skills: The Role of Chronic Health Problems and Exposure to Maltreatment

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A more recent version of this paper was published as Fletcher J M and Schurer S. (2017) Origins of Adulthood Personality: The Role of Adverse Childhood Experiences. The BE Journal of Economic Analysis & Policy, 17(2), 96-117

No. 2015-23
November 2015
Human capital is one of the most important determinants of an individual’s long-term economic productivity and health. Traditionally, human capital has been proxied by measures of achievement test scores, years of schooling, or the type of secondary qualification. In recent years economists are increasingly interested in the health- and productivity-boosting effects of the Big Five personality traits, a widely used domain of non-cognitive skills (NCS).

In this study we explore whether adverse childhood experiences - physical and mental health problems and exposure to parental maltreatment - predict age 30 NCS using longitudinal data from a large, representative cohort of young US Americans.

Exploiting differences across siblings to control for the confounding influences of shared environmental and genetic factors, we find significant and robust associations between childhood adversity and neuroticism, conscientiousness, and openness to experiences. Neuroticism is significantly associated with most childhood health problems and sexual abuse.

We show that the effect sizes are quantitatively meaningful and adverse childhood experiences partially account for the associations between conscientiousness and earnings and educational attainment.

Although our findings cannot be given a causal interpretation, they provide researchers with a set of possible explanations for why they may find a link between NCS and adulthood health and productivity.

Our findings are useful to applied researchers who seek to explore the meaning of the estimated associations between adulthood personality and labor market outcomes. We conclude that studies seeking to identify the causal effect of adulthood personality traits on adulthood health and productivity may need to control for adverse childhood experiences.
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ACKNOWLEDGEMENTS: The authors acknowledge financial support from an Australian Research Council Early Career Discovery Program Grant (DE140100463) and the Australian Research Council Centre of Excellence for Children and Families over the Life Course (project number CE140100027).

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Abstract

Economists are increasingly interested in the health- and productivity-boosting effects of the Big Five personality traits, a widely used domain of noncognitive skills (NCS). In this study we explore whether adverse childhood experiences - physical and mental health problems and exposure to parental maltreatment - predict age 30 NCS using longitudinal data from a large, representative cohort of young US Americans. Exploiting differences across siblings to control for the confounding influences of shared environmental and genetic factors, we find significant and robust associations between childhood adversity and neuroticism, conscientiousness, and openness to experiences. Neuroticism is significantly associated with most childhood health problems and sexual abuse. We show that the effect sizes are quantitatively meaningful and adverse childhood experiences partially account for the associations between conscientiousness and earnings and educational attainment. Although our findings cannot be given a causal interpretation, they provide researchers with a set of possible explanations for why they may find a link between NCS and adulthood health and productivity.

Keywords: noncognitive skills; personality traits; childhood health; maltreatment; siblings fixed effects; Add Health; United States
1. Introduction

Human capital is one of the most important determinants of an individual’s long-term economic productivity and health. Traditionally, human capital has been proxied by measures of achievement test scores, years of schooling, or the type of secondary qualification. In recent years, however, economists have suggested that non-cognitive skills (NCS), sometimes referred to as soft skills, character traits, or personality traits, are an important alternative form of human capital (Almlund et al., 2011). Although numerous proxies for adulthood NCS have been considered in the literature, the Big Five personality traits are one of the most widely used (e.g. Mueller & Plug, 2006; Heineck & Anger, 2010; Heckman and Kautz, 2012; Fletcher, 2013; Lundberg, 2013; Cameron et al., 2014; Gensowski, 2014).

In this study we explore the factors that shape the Big Five personality traits between early adolescence and young adulthood. We do so because little empirical evidence exists on the early-life determinants of these skills. Such knowledge would be useful for researchers to better interpret the health- or productivity-boosting effects of the Big Five personality traits documented in the literature. Some psychologists have suggested that personality differences may: 1) be behavioral manifestations of differences in underlying health (Caspi & Roberts, 2001), 2) emerge early in life (Caspi et al., 2005), and 3) be the result of parenting behavior (Eisenberg et al., 2014).

We therefore focus our attention on the childhood origins of adulthood personality traits, specifically on health-related adverse childhood experiences. We consider a broad range of chronic negative experiences - physical and emotional health problems and exposure to maltreatment – that have been shown to be important predictors of human capital accumulation over the lifecourse (Almond and Currie, 2011). Our analysis relies on the finding that personality traits are not exclusively influenced by genetic predisposition. Even though a strong genetic component has been shown, at least 50% of the variation in
personality traits can be attributed to unique personal experiences (Krueger et al., 2008; Turkheimer, 2000; Turkheimer et al., 2003; Borkenau et al., 2011).

To investigate the childhood determinants of NCS, we use longitudinal data from a US American cohort study (Add Health) that followed cohort members’ health trajectories from early adolescence into young adulthood. We estimate the relationship between these experiences and responses to an adulthood personality questionnaire that was measured many years after the exposure to adversity. The data has the advantage that it contains information on unique adverse life events and personality for siblings, which we exploit in our empirical framework to control for some of the confounding factors that may bias the treatment effects of interest (Moffit et al., 2011; Conley et al., 2007; Bound & Solon, 1999). Finally, we assess the extent to which the estimated relationship between adulthood personality and adulthood earnings (e.g. Fletcher, 2013) and educational attainment (e.g. Lundberg, 2013) is reduced when controlling for adverse childhood experiences.

2. Literature Review

A number of different personality inventories have been developed by psychologists, but the Five-Factor Model is broadly accepted as a meaningful and consistent construct for describing human differences by psychologists (McCrae and Costa, 2008). Personality psychologists have demonstrated strong links between the Big Five personality traits and occupational choice (Filer, 1986), job performance (e.g. Judge et al., 1999), academic achievement (Poropat, 2009), or healthy lifestyles (e.g. Hampson et al., 2006; Roberts et al., 2007). Various studies have established that low levels of neuroticism and high levels of

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2 The American Psychological Association Dictionary (2007) describes these as follows: 1. Openness to experience (Intellect)—The tendency to be open to new aesthetic, cultural, or intellectual experiences. 2. Conscientiousness—The tendency to be organized, responsible, and hardworking. 3. Extraversion—An orientation of one’s interests and energies toward the outer world of people and things rather than the inner world of subjective experience; characterized by positive affect and sociability. 4. Agreeableness—The tendency to act in a cooperative, unselfish manner. 5. Neuroticism (vs. Emotional stability)—A chronic level of emotional instability and proneness to psychological distress.
conscientiousness promote both physical and mental wellbeing (Goodwin & Friedman, 2006), and life expectancy is associated with youth conscientiousness (Kern & Friedman, 2008; Kern et al., 2009).

Economists have added to this literature by showing that emotional stability and openness to experience are strongly associated with labor market earnings (e.g. Fletcher, 2013; Heineck & Anger, 2010; Muller & Plug, 2006), even for highly-talented people (Gensowski, 2014). Both high levels of youth conscientiousness and openness to experience increase the probability to obtain a university degree (Lundberg, 2013, Schurer et al., 2014), while conscientiousness and emotional stability are associated with performance on cognitive ability tests (Borghans et al., 2011).

What factors shape the Big Five personality traits beyond genetic endowment is less well researched. Earlier work contended that individuals are born with a fixed temperament and changes between childhood and adulthood occur deterministically, a process often referred to as maturation (for an overview, see McCrae and Costa, 2000). Many studies have demonstrated this strong path dependency between childhood temperament and adulthood personality (e.g. Caspi et al., 2003; Deal et al., 2005; Asendorpf et al., 2008; Moffitt et al., 2011; McAdams & Olson, 2010). The earlier work on the Five Factor Model also assumed that personality traits stabilize in young adulthood, but more recent evidence has shown that adulthood personality traits may even change beyond the age of 50 (Roberts et al., 2008; Fraley & Roberts, 2005, Roberts & DelVecchio, 2000, Roberts et al., 2006; Roberts & Mroczek, 2008). Some studies focus on the impact of social roles (Roberts et al., 2005), adulthood life events (Luhman et al., 2014; Specht et al., 2011; Cobb-Clark and Schurer, 2012), secondary schooling (Dahmann and Anger, 2014) or tertiary education (Schurer et al., 2014, Lüdtke et al., 2011).
To date, no empirical evidence exists on whether earlier life events shape adulthood personality traits. We model personality traits as a function of childhood temperament, cognitive ability, socioeconomic background, and adverse childhood experiences. There is little empirical guidance on which specific childhood experiences are relevant. Thus, we rely on a selection of standard measures that have been used in the literature to assess the health effects of maltreatment (e.g. Felitti et al., 1998; Hariharan and Schurer, 2016, and references therein) or the long-term effect of early-life health shocks or chronic conditions on human capital accumulation (see Almond and Currie, 2011). The reasons why adverse childhood experiences may affect NCS are multifold: they could directly affect childhood temperament, which matures into adulthood personality; they may alter the maturation process of temperament into personality; or they may just correlate with each other because they have the same underlying causes.

For instance, ADHD - a childhood psychiatric disorder of impaired impulse control3 – has similar characteristics to the temperament facets of low levels of inhibitory control and overly high levels of activity. A learning disability – the inadequate development of specific academic, language, and speech skills despite average intelligence – has been linked with process-information and task-persistence problems that are part of low levels of conscientiousness. The symptoms of depression - a sign of heightened levels of fearfulness - resemble the negative emotions described in neuroticism. Chronic health problems may lead to physiological, cognitive, and psychological impairments if their onset is during puberty, a critical period of socioemotional development and identity formation (Suris et al., 2004).

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3ADHD is one of the most prevalent and fastest growing mental health problems among children. Individuals with ADHD are characterized by lags in impulse control development of approximately 5 years (Shaw et al., 2007), which can cause impairment in a variety of domains including problem solving, planning ahead, and understanding the actions of others (AACAP, 2009). Research has documented the many short term consequences of ADHD on school-children, such as increased likelihood of pursuing risky behaviors or lower academic performance, many types of criminal activity (Fletcher & Wolfe, 2009), and can impact on future labor market performance (Fletcher, 2014).
Childhood medical trauma has been linked with post-traumatic stress disorder and the risk of psychiatric and physiological illness in later life (see Gerson & Rappaport, 2013 for an overview).

Parenting behaviors are also an important source of skill formation (see Eisenberg et al., 2014 on conscientiousness). We focus attention on maltreatment because its experience is likely to lead to an array of childhood temperament problems (Perry et al., 1999). Behavioral responses to abusive parenting may develop into a personality disorder (Putnam, 2006; Tyrka et al., 2009, Spila et al., 2008). While personality traits are distinct from personality disorders, some psychologists have alluded to the possibility that extreme- and mid-range manifestations of adulthood personality measures are a good proxy for the presence and absence, respectively, of a personality disorder (Krueger & Eaton, 2010, Widinger & Trull, 2007).

3. Data: National Longitudinal Study of Adolescent Health

The data in this study come from the confidential version of the National Longitudinal Study of Adolescent Health (Add Health). Add Health, one of the most comprehensive surveys of adolescents ever undertaken, is a school-based, longitudinal study of the health-related

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4 It is possible that parenting styles are the consequence of a child’s temperament, which means that parents adjust their parenting styles to the child’s needs and temperament (e.g. Deal et al., 2005). Because of this simultaneity of parenting, temperament, and health, modelling the effect of parenting behavior is empirically challenging. Some studies exploited birth-order – an exogenous variation in differential parental treatment - to test whether parenting behavior affects adulthood personality, but find little evidence in favor of it (e.g. Marini & Kurtz, 2011; Sulloway, 1996). Research on China’s One-Child Policy (OCP), a natural institutional experiment that led to concentrated attention on one child by all caretakers, found that children born just after the introduction of the OCP in 1979 tended to be less conscientious, more neurotic, and less optimistic than children born just before (Cameron et al. 2013).

5 Although we would like to compare the effect of abusive parenting styles with the effects of parental investments and more positive parenting styles such as warm and consistent parenting as in Del Bono et al (2014) or Attanasio et al. (2015), we do not have this data available.

6 Samuel & Widinger (2008) and Widinger et al. (2005) successfully mapped Axis II disorders into maladaptive variants of the 30 facets of the Five Factor Model. Their mapping exercise showed that dependent and avoidant personality disorders correlate strongly with depressive and self-conscious facets of neuroticism, and so does borderline syndrome disorders, while schizoid personalities correlate negatively with facets of extraversion.

Other sources of data include questionnaires for parents, siblings, fellow students, and school administrators. By design, the Add Health survey included a sample stratified by region, urbanicity, school type, ethnic mix, and size. Pre-existing databases (e.g. census data) have been linked with the individuals in the sample and provide information about neighborhoods and communities. Of the 20745 students surveyed during Wave I, nearly 15000 have been followed longitudinally in the Wave IV survey. Excluding people with missing data on all four maltreatment variables and personality measures, results in a sample of 10693 individuals which we use in our OLS analyses. There are 3428 siblings in the data, but eliminating those with missing data yields a sibling sample of 2152 individuals. The majority of families in the siblings sample have two siblings (92%).

[Insert Table 1 here]

3.1. Young adulthood personality traits

In Wave IV, data were collected on personality with the 20-item short-form version of the 50-item International Personality Item Pool-Five-Factor Model (IPIP-FFM) known as the Mini-IPIP (Donnellan et al. 2006). Baldasaro et al. (2013) suggest that the Mini-IPIP has a five-factor structure that represents extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience. Most of the scales have acceptable reliability, all the scales have
partial or full metric invariance, and the scales exhibit sufficient criterion validity.\(^7\) As is standard in the literature, we use factor analysis to extract the first principal factor for each domain and standardize it to mean 0 and standard deviation 1 (see Almlund et al. 2011, p. 32).\(^8\) Table A1 in the Online Appendix presents a summary of all 20 items.

### 3.2. Childhood Health

Add Health collected rich data on a variety of health conditions. We constructed measures of physical and mental health problems, where possible, from Wave I: self-assessed health status, low birth weight, chronic conditions (asthma, obesity, diabetes), various markers for sensory or motor skill problems, ADHD, learning disability, and depression.

#### Physical Health

- General health status: A general health status measure is constructed from a question asked in Wave I: “In general, how is your health?” The cohort members could respond with poor, fair, good, very good, or excellent.\(^9\)
- Asthma: We construct a binary measure of asthma from information collected in Wave III, when the young adult respondents were asked whether they have “ever been diagnosed with asthma”\(^10\).
- Diabetes: Information on self-reported diabetes status was not collected until wave IV. The key question posed to respondents was, “Has a doctor, nurse, or other health care provider ever told you that you have or had high blood sugar or diabetes?” Those answering yes for either condition were also asked for their age at diagnosis. We

\(^7\) In our full estimation sample Cronbach’s alpha for each dimension is: conscientiousness 0.64, openness to experience 0.61, extraversion 0.70, agreeableness 0.68, and neuroticism 0.85.

\(^8\) The same measures have been used in Fletcher (2013) and Lundberg (2013).

\(^9\) Despite the subjectivity of this variable, research has shown that it is a strong predictor of objective health measures such as mortality and health care utilization (Miilunpalo et al., 1997).

\(^10\) As this information could be interpreted as adulthood asthma, we tested the robustness of our results using data from Wave I, when parents were asked whether their child currently has asthma. These results are provided upon request. Each of these measures of asthma has strong predictive power of explaining adulthood labor market outcomes (Fletcher et al., 2010).
coded our childhood diabetes variable to take the value 1 if the individual reported that it was diagnosed before the age of 18.\textsuperscript{11}

- **Obesity**: A measure of obesity – an indicator of excessive body fat – is constructed from clinically-assessed height and weight information obtained in Wave II. BMI is defined as weight in kilograms divided by height in meters squared. Obesity is defined as a BMI greater than 30.

- **Birth weight**: Birth weight is retrospectively reported by the respondent's parent in Wave I, and we use a measure in grams.\textsuperscript{12}

- **Miscellaneous health measures**: We generate binary variables that indicate the childhood experience of blindness (by Wave III), problems with hands or feet (Wave I) which are likely to affect the development of fine and gross motor skills, and epilepsy (by Wave III).

**Mental Health**

- **ADHD**: We construct an indicator of childhood ADHD symptoms from eighteen questions collected during Wave III. The questions ask respondents to think back to when they were between 5 and 12 years of age and report how often they performed a set of behaviors (e.g. squirmed in their seat, had difficulty sustaining attention in tasks).\textsuperscript{13}

\textsuperscript{11} The same measure has been used in Fletcher and Richards (2010) to predict human capital accumulation. The disadvantage of this measure is that it does not allow us to distinguish between Type I and Type II diabetes.

\textsuperscript{12} While retrospective parental reports of children's birth weight may seem problematic because of the risk of measurement error, multiple studies have shown minimal recall bias 15 years or more following the birth (O'Sullivan et al., 2000; Yaw et al., 1998).

\textsuperscript{13} The same measure was used in Fletcher and Wolfe (2009). Retrospective ratings of previous health should be used with caution when examining adult outcomes. Yet, several reviews have concluded that childhood experiences are recalled with sufficient accuracy to provide useful information in retrospective studies (Babinski et al., 1999).
• Depression: We use 19 of the 20 items of the Center for Epidemiological Studies Depression Scale (CES-D) contained in Wave I. The scale ranges from 0 to 57, and we use a cut-off score of 22 for male adolescents and 24 for females to construct a binary measure of depression as recommended in Robert et al. (1991).  

• Learning disability: To construct an indicator variable for whether the child has a learning disability, we use the following question given to the parent respondent in Wave I: “Does (he/she) have a specific learning disability, such as difficulties with attention, dyslexia, or some other reading, spelling, writing, or math disability?”  

3.3. Maltreatment Indicators

In Wave III, respondents were asked four questions on how their parents (or adult caretakers) treated them before they were in sixth grade. Specifically, they were asked whether and how often:

1. Parents (or other adult caregivers) had not taken care of their basic needs, such as keeping them clean or providing food or clothing.
2. Parents (or other adult caregivers) slapped, hit, or kicked them.
3. Parents (or other adult caregivers) had touched them in a sexual way, forced them to touch him or her in a sexual way, or forced them to have sexual relations.
4. Parents (or other adult caregivers) left them home alone when an adult should have been with them.

To separately identify the effects and intensity of the four variants of maltreatment, we follow Currie & Tekin (2012) to construct for each event a binary indicator that takes the value 1 if the respondent reports that he or she experienced the respective maltreatment more than 10 times.

14 This scale has been used to examine adolescent depression and has been shown to have good measurement properties (see Fletcher (2009)).
15 The same indicator was used in Fletcher (2011).
times and 0 otherwise. One reason for considering only the higher frequency of traumatic events is the assumption that chronic abuse – in contrast to one-off events - will have a long-term impact on behavior. However, in a robustness check, we also consider a continuous measure of maltreatment, which is derived from factor analysis over all four intensity measures. This measure captures the intensity of maltreatment, without specifying the underlying causes of the maltreatment. Currie & Tekin (2012) and Fletcher (2009) provide further details that the information provided in the maltreatment report is reliable and that it was collected in an appropriate way.\(^{16}\)

In our data, 50% of all sample members reported the experience of some form of abuse during their childhood. Any sexual abuse was reported by 5% of the sample (535), but on a regular basis (> 10 times) less than 1% (75) of the sample reported sexual abuse. While almost one-third of the sample reports to have been ever spanked, hit, or kicked, over 6% (653) experienced physical abuse on a more regular basis (> 10 times). Regular neglect of basic needs or having been left alone (> 10 times) occurred for 3% (320) and 8% (856) of the sample, respectively. Important gender differences emerge only for the report of frequent sexual abuse (15 men versus 60 women).

3.4. Childhood Temperament and Cognitive Ability

In Wave I cohort members were asked to answer 21 questions regarding their temperament that can be mapped into three of the Five Factors - neuroticism, extraversion, and

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\(^{16}\) Self-reported measures of maltreatment are error prone. Currie & Tekin (2012) discuss the potential pitfalls of these measures, but refer to methodological papers that have shown that, “if collected properly, these data are valid” (p. 515). The participants of the AddHealth study were asked to listen to pre-recorded questions on sensitive topics through earphones and to enter their answers directly on laptops. This process ensured confidentiality and minimized the potential for interviewer or other third-party influence. In order to obtain accurate responses about the timing of events, the study members were prompted with a calendar that gave the dates of many important events. While recall bias is an important consideration for these measures, the bias could be small because the respondents were young adults when asked about childhood maltreatment. This has the advantage that young adults are mature enough to understand and report on such events (see Perkonigg et al., 2000). Another advantage is that the time window over which the respondents recall past events is relatively short (10 years on average).
conscientiousness - using the IPIP/NEO-PI-R as guidelines (Young & Beaujean, 2011). These questions are listed in Table A2 in the Online Appendix. Young and Beaujean (2011) compared these questions with items from the IPIP (Goldberg et al., 2006) version of the NEO-PI-R (Costa & McCrae, 1992). They subjected all available items to an item-level factor analysis to determine what items to keep, as well as the dimensionality of the domains the items were measured. They concluded that 13 of the original 21 items can be reliably used to generate measures of childhood neuroticism (6 items), extraversion (3 items), and conscientiousness (4 items). To construct an index for each childhood personality trait, we use factor analysis.

To measure cognitive ability, we follow Fletcher (2013) and Lundberg (2013) and use from Wave I answers to the Peabody Picture Vocabulary Test (PVT) and self-reported school math grades. A short description of all variables - including measures of childhood socioeconomic status and other demographic information – are reported in Table 1 and summary statistics are presented separately by sex in Table A3 (Online Appendix).

4. Empirical Framework

To test whether childhood health problems and exposure to maltreatment are important predictors of adulthood personality, we use linear regression (OLS) and siblings fixed effects (S-FE) models. In Eq. (1), personality trait \( k (PT_i^k) \) is a linear function of past experiences:

\[
PT_i^k = \alpha^k + X_i \beta^k + \epsilon_i^k, \tag{1}
\]

17 The factor structure of the items indicates that each measures only one construct and the three factor scores have internal consistency estimates ranging between 0.76 and 0.86, which are similar to the reliability coefficients for the adulthood NEO personality instruments measured with 3 to 10 times as many items (Young & Beaujean, 2011, Table 5).
where $\epsilon_{ik}^k$ captures all unobservable shocks that affect personality trait $k$, but are independent of variables $X_i'$, and $\alpha^k$ and $\beta^k$ are parameters to be estimated. The vector $X_i'$ includes measures of (1) being female, ethnicity, parental marital status, rural area, and birth-order (2) childhood physical health conditions, (3) childhood mental health conditions, (4) experience of maltreatment, (5) childhood temperament, (6) childhood socioeconomic status, (7) childhood cognitive ability (see Table 1 for definitions). In a separate analysis we include into this specification adulthood socioeconomic status (education, earnings) and general health status, both measured in Wave IV, to test the potential pathways via which childhood experiences can affect adulthood personality. To be able to compare effect sizes, we standardize all continuous right-hand-side variables so that a one-unit change in the relevant variable reflects a move from the bottom to the top of the distribution. This standardization allows us to compare the effect sizes of a binary variable (e.g. frequent sexual abuse) to the effect size of a continuous variable (e.g. childhood neuroticism).

The above outlined model considers only variation between families and does not control for unobserved family factors that may potentially confound the treatment effects of interest. To control for some of these confounding factors, we complement our analysis with a S-FE model, which takes differences in the outcome and treatment variables between siblings. In Eq. (2) each individual has now subscript $f$, which represents the family, and subscript $i$ which represents sibling $i$ within family $f$. On the right-hand side of Eq. (2), we include only variables that vary between siblings ($Z_{if}$).

$$PT_{if}^k = \alpha^k + Z_{if}'\beta^k + \mu_{if}^k + \eta_{if}^k.$$ (2)

The error term is now broken down into two components: $\mu_{if}^k$ is a family fixed effect and $\eta_{if}^k$ the error specific to each sibling $i$ in family $f$. The family fixed effect could represent, for instance, general parenting styles, level of familial conflict, or a genetic proneness to disease.
To eliminate this family-fixed effect, we difference across the siblings (e.g. 1, 2) in each family (Eq. (3)).

\[ PT_{1f}^k - PT_{2f}^k = (Z_{1f} - Z_{2f})' \beta + (\mu_f^k - \mu_f^k) + (\eta_1^k - \eta_2^k). \]  

(3)

The S-FE approach improves upon the OLS model because it controls for difficult-to-measure shared background components. However, as with most empirical models used to analyze observational data, it has its limitations. On the one hand, the S-FE approach exploits only variation within families, and therefore is an inefficient estimator (e.g. Conley et al., 2007, p. 1095). More important is that the estimated coefficients may still be biased if the differences of unobservable factors between sibling 1 and 2 \((\eta_1^k - \eta_2^k)\) are correlated with differences in maltreatment or health problems and with differences in personality. Therefore, the S-FE results do not warrant a causal interpretation.

We have sufficient variation in our data between siblings on most variables, which is the main requirement for this approach to yield efficient estimates (Bound and Solon, 1999). In Table 2 we report the number of siblings who differ in outcomes and treatments. Almost 90% of the sibling-pairs differ in their personality scores. The numbers of sibling pairs who report differences in adversity differ for the various measures. The smallest numbers of sibling pairs with differences in treatment are in ascending order: 23 for blindness (1.1%), 37 for sexual abuse (1.7%), 72 for epilepsy (3.4%), and 94 for diabetes (4.4%). All other conditions have substantially larger sibling pairs, ranging between 140 for ADHD and 2056 for PVT.

[Insert Table 2 here]
5. Estimation Results

In this section we interpret the effect sizes of childhood adversity on young-adulthood personality for both OLS (10693 individuals) and S-FE models (2152 individuals). To reduce the high dimensionality of our results, we summarize graphically the effects of interest in Figures 1 (neuroticism), 2 (conscientiousness), 3 (openness to experience), 4 (agreeableness), and 5 (extraversion). The effects of interest are the estimated coefficients on physical health, mental health, and parental maltreatment, compared against the effect sizes of childhood temperament and cognitive ability. Full estimation results are reported in Table A4 in the Online Appendix. The effect sizes are represented by a black dot, while their 90% confidence intervals are drawn as light-gray (S-FE) and dark-gray spikes (OLS). We have chosen a more generous confidence level because of the smaller sample sizes that identify the effects in the S-FE models. All effect sizes are interpreted as a standard-deviation (SD) change in personality trait \( k \) when moving from the bottom to the top in the distribution of the treatment variable.

We limit the discussion to the effect sizes that emerge significantly (\( p < 0.10 \) or better) across both OLS and S-FE specifications, and highlight the interesting cases that hold only in one of the two specifications. Significant effects that disappear in the S-FE model are likely to be driven by unobserved family-effects. Effects that are only significant in the S-FE model are more difficult to interpret. It could be the case that they emerge because families with multiple siblings have very specialized family characteristics and dynamics.

\[ \text{OLS model that includes all control variables yields an adjusted R-squared in order of magnitudes: (1) neuroticism (14.8%), (2) agreeableness (13.1%), (3) openness to experience (12.7%), (4) conscientiousness (7.1%), and (5) extraversion (4.5%). Each block of variables adds significantly to the explained variation of the respective personality traits (p-value < 0.01).} \]
Neuroticism. Figure 1 shows that adulthood neuroticism is significantly associated with the experience of asthma, diabetes, epilepsy, blindness, ADHD, and frequent sexual abuse. Suffering from diabetes is associated with a significant 0.3 (OLS) to 0.45 (S-FE) SD increase in adulthood neuroticism. Equally, individuals who report that they were frequently sexually abused by a care-taker score 0.20 (OLS) SD to 0.41 (S-FE) SD higher on neuroticism. The remaining significant effect sizes are: ADHD 0.36 (OLS) to 0.22 (S-FE) SD, epilepsy 0.35 (OLS) to 0.29 (S-FE) SD, blindness 0.37 (OLS) to 0.25 (S-FE) SD, asthma 0.08 (OLS) to 0.09 (S-FE) SD. The significant effect of early-life depression on neuroticism found in the OLS model (0.34 SD) is fully explained by unobserved family fixed effects. In contrast, the effect size of parental neglect is only significant when comparing siblings within the same family (0.27 SD).

To put the significant effect sizes into perspective, we compare them against the effect size of childhood neuroticism, the largest we find across all models. A move from bottom to the top on the childhood neuroticism scale is significantly associated with a 0.86 (OLS) to 1.5 (S-FE) SD increase in adulthood neuroticism. All significant S-FE effect sizes of interest lie within 6% (asthma) and 30% (diabetes) of the S-FE effect size of childhood neuroticism.

[Insert Figure 1 here]

Conscientiousness. Figure 2 shows that diabetes, ADHD, learning disability, and obesity are each negatively associated with conscientiousness. The effect sizes are, in descending order: ADHD: 0.38 (OLS) to 0.23 (S-FE) SD; obesity: 0.19 SD (OLS, S-FE); learning disability:

19 In a robustness check, we replaced the four maltreatment indicators with a continuous measure of maltreatment. Moving from the bottom (no maltreatment experience) to the top on this maltreatment index (highest degree of maltreatment) is associated with almost 0.4 SD higher levels of neuroticism in both OLS and S-FE models (significant at the 1% level).
20 We also find a very strong negative correlation between neuroticism and verbal intelligence (-1 SD (OLS), -0.75 SD (S-FE)).
0.17 (OLS) to 0.26 (S-FE) SD; and diabetes: 0.14 (OLS) to 0.17 (S-FE) SD. The experience of frequent neglect is associated with a 0.2 SD lower conscientiousness score, but this effect – similar as for its positive effect on neuroticism – is only significant when exploiting within-family variations.²¹

Again, childhood neuroticism is the strongest, significant determinant of adulthood conscientiousness in both the OLS (- 0.96 SD) and S-FE (- 0.95 SD) models against which we benchmark all other significant effects. The significant S-FE effects of these treatments lie within 15% (diabetes) and 27% (learning disability) of the S-FE effect size of childhood neuroticism.

[Insert Figure 2 here]

**Openness to Experience.** Figure 3 shows that openness to experience is negatively associated with learning disability and diabetes. The effect sizes range between 0.13 (OLS) and 0.19 (S-FE) SD for learning disability and between 0.11 (OLS) and 0.34 (S-FE) SD for diabetes. The largest association we find is between openness to experience and verbal intelligence, a standard result in the literature (Goff & Ackermann, 1992). Individuals at the bottom of the PVT score distribution score 2.4 (OLS) to 1.3 (S-FE) SD lower on openness than individuals at the top. Therefore, the S-FE effects of a learning disability and diabetes lie within 15% and 30% of the S-FE effects of verbal intelligence.

Individuals who suffered from ADHD and physical abuse also score lower on openness to experience, but these associations are not significant in the S-FE model. Similar

²¹In robustness check, we replaced the four maltreatment indicators with a continuous measure of maltreatment. Moving from the bottom (no maltreatment experience) to the top on this maltreatment index (highest degree of maltreatment) is associated with 0.28 (OLS) SD to 0.4 (S-FE) SD lower levels of conscientiousness, and both effects are statistically significant at the 1% level.
to its effects on neuroticism and conscientiousness, experience of neglect is only significantly associated with openness in the sibling sample (-0.21 SD).

[Insert Figure 3 here]

**Agreeableness.** Agreeableness is associated with various childhood physical and mental health conditions and exposure to maltreatment (Figure 4), but the associations are almost entirely explained by unobserved factors that siblings share. The effect sizes of six treatments - PVT score, asthma, obesity, depression, learning disability, regular physical abuse - are substantially reduced in magnitude and insignificant when controlling for unobserved shared factors.

[Insert Figure 4 here]

**Extraversion.** Similar to agreeableness, the significant effects of diabetes, depression, ADHD, and physical abuse on extraversion are fully explained by unobserved factors that siblings share (Figure 5). Except for general health, we cannot find robust effects of any of the health and maltreatment variables on extraversion.

[Insert Figure 5 here]

**Pathways** We have explored the possible pathways via which childhood trauma may affect adulthood personality traits. It is likely that the experience of childhood trauma limits human capital accumulation and adulthood health, and that it is these contemporaneous outcomes that affect adulthood personality. Overall, the effects are robust to the inclusion of adulthood
outcomes; at maximum the estimated coefficients are reduced by less than 20% (Table A5, Online Appendix). We further explored whether the effects differ by sex (OLS model only), but there is little evidence of gender heterogeneity (Table A6, Online Appendix).

6. Do Adverse Childhood Experiences Moderate the Relationship between Adult Outcomes and Personality?

In this section we test whether the relationship between some of the Big Five personality traits and labor market or education outcomes documented in e.g. Fletcher (2013, Table 4) and Lundberg (2013, Table 1) for Add Health could be explained by adverse childhood experiences. For this purpose, we estimate a model of log earnings as a function of the Big Five personality traits, both measured in Wave IV. In version (1a) we only control for family SES, ethnicity, education, number of siblings, and geographic region. In version (1b) we control additionally for adverse childhood experiences. We also estimate a binary logit model in which the dependent variable is a binary indicator of whether the individual holds a college degree by Wave IV controlling for the same set of background variables as in (1a) and (1b). Table 3 reports the estimation results.

Overall, the estimates of the effect of personality on earnings or the probability to obtain a college degree do not change when controlling for adverse childhood experiences. One important exception is that the estimated coefficient of the effect of conscientiousness on both earnings and educational attainment is significantly reduced when moving from models a) to b). In the base model for log earnings (1a), a 1 SD increase in conscientiousness is associated with a 4.2 percent increase in earnings. In the full model (1b), this effect drops significantly by 45 percent to 2.3 percent, which is not statistically different from zero. A similar result is obtained for educational attainment. In the base model for educational attainment (2a), a 1 SD increase in conscientiousness is associated with a 2.2 percentage
point increase in the probability of obtaining a college degree. When also controlling for childhood health and maltreatment (2b), this association drops significantly by 38 percent to 1.3 percentage points. The effect of neuroticism on educational attainment is also significantly reduced by 26%. This suggests that the productivity and human capital boosting effects of conscientiousness are fully and partially, respectively, explained by adverse childhood experiences.

[Insert Table 3 here]

7. Discussion
The present study explored the idea that noncognitive skills which we proxy with the Five Factor Model may have their origins in adverse childhood experiences. We used a large, nationally-representative sample of young US Americans and exploited siblings-fixed-effects models to control for the potentially confounding effects of shared environments and genes. Some adverse childhood experiences predict significantly and robustly neuroticism, conscientiousness and openness to experience, but they have no consistent impact on agreeableness and extraversion. Neuroticism is the trait significantly associated with most childhood health problems and the experience of sexual abuse. Overall, diabetes, ADHD, and learning disabilities stand out as the strongest predictors of neuroticism, conscientiousness and openness to experience. Parental neglect affects all three traits, but its effect emerges only when comparing sibling outcomes.

Our findings must be considered in light of some important limitations. The amount of variation in sexual abuse and some of the health indicators (epilepsy, blindness) between siblings may be too small to detect statistically-significant effects, which is a general limitation of siblings-fixed effects models (Conley et al., 2007, Bound & Solon, 1999). For instance, the effect sizes of sexual abuse on both conscientiousness and openness are
meaningful (-0.10 SD and -0.17 SD), but both have large standard errors (0.22 and 0.21, respectively).

We are also not able to fully control for reporting differences that are linked to personality. This leaves open the possibility that some of the estimated effects are driven by differences in the willingness to report, for instance, maltreatment, that also correlate with personality. It is impossible to say for certain that the treatment effect of parental neglect on neuroticism, conscientiousness, and openness are true differences in exposure between siblings. More neurotic personalities may be more likely to inflate negative experiences such as neglect - leading to false positives - while more extraverted personalities may be more likely to share harmful experiences. In both cases, we would overestimate the effect of maltreatment on personality. Frequent sexual abuse is likely to be underreported because of its stigma and criminal nature. Due to these false negatives we are likely to underestimate the true effect of sexual abuse on neuroticism.

Although our results cannot be given a causal interpretation, they provide a clearer picture of what adulthood personality traits may capture. Importantly, the strong associations observed between conscientiousness and adulthood productivity and educational attainment are partially explained by these adverse childhood experiences. Our findings are useful to applied researchers who seek to explore the meaning of the estimated associations between adulthood personality and labor market outcomes. These findings complement the knowledge we have already about the correlates of openness to experience with intelligence (see Almlund et al., 2011 for an overview). We conclude that studies seeking to identify the causal effect of adulthood personality traits on adulthood health and productivity may need to control for adverse childhood experiences.
References


Cameron, A. C., and P. K. Trivedi. 2010. Microeconometrics Using Stata. Rev. ed. College Station, TX: Stata Press.


Fletcher, J.M., Richards, M.R. (2012). Lower Wages And Employment In Young Adults Diabetes's 'Health Shock' To Schooling And Earnings: Increased Dropout Rates And Lower Wages And Employment In Young Adults. Health Affairs 31(1), 27-34.


Table 1: Control variables for regression models

1) Baseline
- Wave I: Being female, ethnicity, parental marital status, rural area, birth-order, birth-weight
- Wave IV: Age

2) Physical health conditions
- Wave I: General health, Difficulties with hands, Difficulties with feet
- Wave II: Measured obesity (BMI > 30)
- Wave I and III: Asthma, Epilepsy, Blind
- Wave IV: Diabetes (coded = 1 if occurred before 18 years),

3) Mental Health conditions
- Wave I: Depression, Learning disability
- Wave III: ADHD in childhood

4) Maltreatment indicators
- Wave III: Sexually abused more than 10 times
- Wave III: Slapped more than 10 times
- Wave III: Left alone when shouldn’t have more than 10 times
- Wave III: Neglected basic needs more than 10 times
- Wave III data on maltreatment refers to experiences that happened before grade 6

5) Childhood temperament
- Wave I: Neuroticism, extraversion, conscientiousness

6) Childhood SES:
- Wave I: Parental education and household income

7) Cognitive ability
- Wave I: Peabody Vocabulary Test, Self-reported math grade

8) Adult SES
- Wave IV: Years of education, Weekly earnings

9) Adult health conditions
- Wave IV: General health status ratings: 1 (poor) to 5 (excellent)

Note: The baseline model and its extensions will be estimated with OLS on the full sample available across all family members (N full sample=10,693).
Table 2: Number of sibling-pairs in the siblings fixed effects model for whom outcomes and treatments differ

<table>
<thead>
<tr>
<th></th>
<th>$\Delta \neq 0$</th>
<th>SS</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraversion</td>
<td>1911</td>
<td>2152</td>
<td>88.80</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>1901</td>
<td>2152</td>
<td>88.34</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>1850</td>
<td>2152</td>
<td>85.97</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>1899</td>
<td>2152</td>
<td>88.24</td>
</tr>
<tr>
<td>Openness to experience</td>
<td>1879</td>
<td>2152</td>
<td>87.31</td>
</tr>
<tr>
<td>Peabody Vocabulary Test</td>
<td>2056</td>
<td>2152</td>
<td>95.54</td>
</tr>
<tr>
<td>Math grade</td>
<td>1582</td>
<td>2152</td>
<td>73.51</td>
</tr>
<tr>
<td>Birth weight</td>
<td>1782</td>
<td>2152</td>
<td>82.81</td>
</tr>
<tr>
<td>General health wave 1</td>
<td>1422</td>
<td>2152</td>
<td>66.08</td>
</tr>
<tr>
<td>Asthma</td>
<td>522</td>
<td>2152</td>
<td>24.26</td>
</tr>
<tr>
<td>Diabetes</td>
<td>94</td>
<td>2152</td>
<td>4.37</td>
</tr>
<tr>
<td>Difficulty with hands</td>
<td>165</td>
<td>2152</td>
<td>7.67</td>
</tr>
<tr>
<td>Difficulty with feet</td>
<td>201</td>
<td>2152</td>
<td>9.34</td>
</tr>
<tr>
<td>Obesity</td>
<td>314</td>
<td>2152</td>
<td>14.59</td>
</tr>
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<td>Epilepsy</td>
<td>72</td>
<td>2152</td>
<td>3.35</td>
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<td>Blindness</td>
<td>23</td>
<td>2152</td>
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<tr>
<td>Depressed</td>
<td>359</td>
<td>2152</td>
<td>16.68</td>
</tr>
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<td>ADHD</td>
<td>140</td>
<td>2152</td>
<td>6.51</td>
</tr>
<tr>
<td>Learning disability</td>
<td>468</td>
<td>2152</td>
<td>21.75</td>
</tr>
<tr>
<td>Frequent sexual abuse</td>
<td>37</td>
<td>2152</td>
<td>1.72</td>
</tr>
<tr>
<td>Frequent slapped/beaten</td>
<td>221</td>
<td>2152</td>
<td>10.27</td>
</tr>
<tr>
<td>Frequent left alone</td>
<td>318</td>
<td>2152</td>
<td>14.78</td>
</tr>
<tr>
<td>Frequent neglect of basic needs</td>
<td>152</td>
<td>2152</td>
<td>7.06</td>
</tr>
</tbody>
</table>

Note: Siblings sample (SS) with non-missing sibling information is 2152 observations.
Table 3: Estimated relationship between earnings or education and personality with and without controlling for childhood health and maltreatment indicators (Reported: marginal effects)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Log Earnings (1a)</th>
<th>Log Earnings (1b)</th>
<th>% Diff</th>
<th>College degree (2a)</th>
<th>College degree (2b)</th>
<th>% Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extraversion</strong></td>
<td>0.050***</td>
<td>0.048***</td>
<td>-4</td>
<td>-0.018***</td>
<td>-0.020***</td>
<td>8.7</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td>(0.014)</td>
<td></td>
<td>(0.004)</td>
<td>(0.004)</td>
<td></td>
</tr>
<tr>
<td><strong>Neuroticism</strong></td>
<td>-0.086***</td>
<td>-0.074***</td>
<td>-14</td>
<td>-0.042***</td>
<td>-0.031***</td>
<td>26**</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.016)</td>
<td></td>
<td>(0.004)</td>
<td>(0.004)</td>
<td></td>
</tr>
<tr>
<td><strong>Agreeableness</strong></td>
<td>0.014</td>
<td>0.009</td>
<td>-35.7</td>
<td>0.042***</td>
<td>0.042***</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.018)</td>
<td></td>
<td>(0.005)</td>
<td>(0.005)</td>
<td></td>
</tr>
<tr>
<td><strong>Conscientious</strong></td>
<td>0.042***</td>
<td>0.023</td>
<td>-45.2**</td>
<td>0.022***</td>
<td>0.013***</td>
<td>38.4**</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.015)</td>
<td></td>
<td>(0.004)</td>
<td>(0.004)</td>
<td></td>
</tr>
<tr>
<td><strong>Openness</strong></td>
<td>-0.026</td>
<td>-0.029*</td>
<td>11.5</td>
<td>0.030***</td>
<td>0.031***</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.016)</td>
<td></td>
<td>(0.004)</td>
<td>(0.004)</td>
<td></td>
</tr>
</tbody>
</table>

Family Background: Yes Yes
Childhood health and maltreatment: No Yes No Yes
Observations: 8,195 8,195 10,693 10,693
R-squared: 0.106 0.134 0.2174 0.2404

Note: All models control for the full set of family background variables as in Fletcher (2013) for earnings and in Lundberg (2013) for the probability to obtain a college degree. Outcomes and personality are measured in Wave IV. Models (1a) and (1b) are estimated with ordinary least squares. Models (2a) and (b) are estimated with a linear probability model.
Figure 1: Neuroticism (Estimated effects and 90% confidence intervals)

Spike plots report coefficients and 90% confidence intervals obtained from OLS (R-Sq: .118, N=10693) and Sibl. Fixed Effects (R-Sq: .084, N = 2152). A unit change in each treatment variable reflects a move from bottom to top of the distribution (0 to 1).
Figure 2: Conscientiousness (Estimated effects and 90% confidence intervals)

Spike plots report coefficients and 90% confidence intervals obtained from OLS (R-Sq: .052, N=10683) and Sibl. Fixed Effects (R-Sq: .053, N = 2152). A unit change in each treatment variable reflects a move from bottom to top of the distribution (0 to 1).
Figure 3: Openness to Experience (Estimated effects and 90% confidence intervals)
Figure 4: Agreeableness (Estimated effects and 90% confidence intervals)

Spike plots report coefficients and 90% confidence intervals obtained from OLS (R-Sq: .115, N=10693) and Sibl. Fixed Effects (R-Sq: .129, N = 2152). A unit change in each treatment variable reflects a move from bottom to top of the distribution (0 to 1).
Figure 5: Extraversion (Estimated effects and 90% confidence intervals)

Spike plots report coefficients and 90% confidence intervals obtained from OLS (R-Sq: .041, N=10693) and Sibl. Fixed Effects (R-Sq: .039, N = 2152). A unit change in each treatment variable reflects a move from bottom to top of the distribution (0 to 1).
**Technical Appendix**

**Table A1: The Big Five Personality Traits Measured in Wave IV**

<table>
<thead>
<tr>
<th>Conscientiousness (C)</th>
<th>Characteristics are related to being reliable, responsible, and having self-control versus impulsivity and casualness</th>
</tr>
</thead>
<tbody>
<tr>
<td>H4PE3 3. I get chores done right away</td>
<td></td>
</tr>
<tr>
<td>H4PE11 11. I often forget to put things back in their proper place</td>
<td></td>
</tr>
<tr>
<td>H4PE19 19. I like order</td>
<td></td>
</tr>
<tr>
<td>H4PE27 27. I make a mess of things</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Openness to experience (O)</th>
<th>Characteristics are associated with the willingness to have new experiences, engage new ideas, and be open to one’s own feelings versus being cynical and tough-minded</th>
</tr>
</thead>
<tbody>
<tr>
<td>H4PE5 5. I have a vivid imagination</td>
<td></td>
</tr>
<tr>
<td>H4PE13 13. I am not interested in abstract ideas</td>
<td></td>
</tr>
<tr>
<td>H4PE21 21. I have difficulty understanding abstract ideas</td>
<td></td>
</tr>
<tr>
<td>H4PE29 29. I do not have a good imagination</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neuroticism (N)</th>
<th>Characteristics are related to anxiety and emotional liability versus being placid and emotionally stable</th>
</tr>
</thead>
<tbody>
<tr>
<td>H4PE4 4. I have frequent mood swings</td>
<td></td>
</tr>
<tr>
<td>H4PE6 6. I worry about things</td>
<td></td>
</tr>
<tr>
<td>H4PE8 8. I get angry easily</td>
<td></td>
</tr>
<tr>
<td>H4PE12 12. I am relaxed most of the time</td>
<td></td>
</tr>
<tr>
<td>H4PE14 14. I am not easily bothered by things</td>
<td></td>
</tr>
<tr>
<td>H4PE16 16. I rarely get irritated</td>
<td></td>
</tr>
<tr>
<td>H4PE20 20. I get upset easily</td>
<td></td>
</tr>
<tr>
<td>H4PE22 22. I get stressed out easily</td>
<td></td>
</tr>
<tr>
<td>H4PE24 24. I lose my temper</td>
<td></td>
</tr>
<tr>
<td>H4PE28 28. I seldom feel blue</td>
<td></td>
</tr>
<tr>
<td>H4PE32 32. I keep my cool</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Extraversion (E)</th>
<th>Characteristics are associated with enthusiasm toward life’s circumstances, outgoing, and surgency versus introversion gravity; encounter with oneself and one’s life circumstances</th>
</tr>
</thead>
<tbody>
<tr>
<td>H4PE1 1. I am the life of the party</td>
<td></td>
</tr>
<tr>
<td>H4PE9 9. I don't talk a lot</td>
<td></td>
</tr>
<tr>
<td>H4PE17 17. I talk to a lot of different people at parties</td>
<td></td>
</tr>
<tr>
<td>H4PE25 25. I keep in the background</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Agreeableness (A)</th>
<th>Characteristics are related to an inclination toward submission to others, passivity, and subduedness versus being independent and having a strong will</th>
</tr>
</thead>
<tbody>
<tr>
<td>H4PE2 2. I sympathize with others' feelings</td>
<td></td>
</tr>
<tr>
<td>H4PE10 10. I am not interested in other people's problems</td>
<td></td>
</tr>
<tr>
<td>H4PE18 18. I feel others' emotions</td>
<td></td>
</tr>
<tr>
<td>H4PE26 26. I am not really interested in others</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Factor analysis is used to predict the first principal factor from the four questions each. Scores are standardised to mean 0 and standard deviation 1.*
| Table A2. Personality Questionnaire Wave I (as suggested by Young and Beaujean, 2011) |
|-------------------------------|----------------------------------------------------------------------------------|
| **Neuroticism**               | You have a lot of good qualities* H1PF 30                                       |
|                               | You have a lot to be proud of* H1PF 32                                          |
|                               | You like yourself just the way you are* H1PF33                                    |
|                               | You feel like you are doing everything just about right* H1PF34                  |
|                               | You feel socially accepted* H1PF35                                                |
|                               | You feel wanted and loved* H1PF36                                                 |
| **Extraversion**              | I feel close to people at school** S62B                                           |
|                               | I feel like I am a part of this school** S62E                                      |
|                               | I feel socially accepted** S62O                                                   |
| **Conscientiousness**         | When you have a problem to solve, one of the first things you do is get as many facts about the problem as possible* H1PF18 |
|                               | When you are attempting to find a solution to a problem, you usually try to think of as many different ways to approach the problem as possible* H1PF19 |
|                               | When making decisions, you generally use a systematic method for judging and comparing alternatives* H1PF20 |
|                               | After carrying out a solution to a problem, you usually try to analyze what went right and what went wrong* H1PF21 |

Note: Child hood temperament was part of Wave I; Young and Beaujean (2011) demonstrate the construct validity of the each facet. Cronbach’s alpha for Neuroticism, Extraversion and Conscientiousness is 0.86, 0.76, and 0.76, respectively.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Female (N=5966)</th>
<th>Male (N=4727)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Wave 4</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>Extraversion (4 items)</td>
<td>13.335</td>
<td>13.174</td>
</tr>
<tr>
<td>Neuroticism (4 items)</td>
<td>10.872</td>
<td>9.810</td>
</tr>
<tr>
<td>Agreeableness (4 items)</td>
<td>15.891</td>
<td>14.660</td>
</tr>
<tr>
<td>Conscientiousness (4 items)</td>
<td>14.902</td>
<td>14.448</td>
</tr>
<tr>
<td>Openness to Experience</td>
<td>14.248</td>
<td>14.890</td>
</tr>
<tr>
<td>Birth order (position)</td>
<td>1.813</td>
<td>1.860</td>
</tr>
<tr>
<td>Parents were married in Wave 1</td>
<td>0.721</td>
<td>0.733</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.142</td>
<td>0.162</td>
</tr>
<tr>
<td>Black</td>
<td>0.228</td>
<td>0.188</td>
</tr>
<tr>
<td>Lived in a rural area in Wave 1</td>
<td>0.266</td>
<td>0.260</td>
</tr>
<tr>
<td>Mother years of education</td>
<td>13.222</td>
<td>13.321</td>
</tr>
<tr>
<td>Annual family income (in 1000$)</td>
<td>4.763</td>
<td>4.652</td>
</tr>
<tr>
<td>Childhood Neuroticism (4 items)</td>
<td>8.763</td>
<td>8.713</td>
</tr>
<tr>
<td>Childhood Extraversion (3 items)</td>
<td>11.824</td>
<td>10.795</td>
</tr>
<tr>
<td>Peabody Vocabulary Testing Score</td>
<td>7.226</td>
<td>7.013</td>
</tr>
<tr>
<td>Math grade</td>
<td>0.072</td>
<td>0.187</td>
</tr>
<tr>
<td>Birth weight in pound</td>
<td>2.512</td>
<td>2.433</td>
</tr>
<tr>
<td>General health Wave 1</td>
<td>7.023</td>
<td>7.198</td>
</tr>
<tr>
<td>Asthma by Wave 3</td>
<td>3.805</td>
<td>3.991</td>
</tr>
<tr>
<td>Diabetes Wave 4 (before Age 18)</td>
<td>0.168</td>
<td>0.129</td>
</tr>
<tr>
<td>Difficulty with hands Wave 1</td>
<td>0.009</td>
<td>0.009</td>
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Note: Sample refers to maximum available sample used in the OLS model (Combined N=10,693).
Table A4: Full estimation results for OLS and Siblings-Fixed Effects models: Standardized effect sizes on all personality traits

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Table A4: Full estimation results for OLS and Siblings-Fixed Effects models: Standardized effect sizes on all personality traits, continued.

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<th>Openness to Exp.</th>
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Observations: 10,693, 2,152
R-squared: 0.041, 0.039

Note: Not shown are the estimated coefficients on the dummy variables indicating a missing value (math score, learning disability, birth weight)

Difficulties with hands, difficulties with feet and obesity, and for the OLS models, family background variables. All models are estimated with OLS (Seemingly-Unrelated Regression) to allow for correlation of the error terms across equations. Each equation controls for the same set of control variables. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
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Note: All models control for the full set of control variables. *** p<0.01, ** p<0.05, * p<0.1.
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Table A6: Determinants of Adulthood Big-Five personality traits, by sex (OLS)
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Note: All models are estimated with OLS (Seemingly-Unrelated Regression) to allow for correlation of the error terms across equations. Each equation controls for the same set of control variables. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.