ECONSTOR
Make Your Publications Visible.

A Service of
ZBW
Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Gensowski, Miriam; Gørtz, Mette; Schurer, Stefanie

Working Paper

Inequality in Personality over the Life Cycle

IZA Discussion Papers, No. 13378

Provided in Cooperation with:
IZA – Institute of Labor Economics

Suggested Citation: Gensowski, Miriam; Gørtz, Mette; Schurer, Stefanie (2020) : Inequality in Personality over the Life Cycle, IZA Discussion Papers, No. 13378, Institute of Labor Economics (IZA), Bonn

This Version is available at:
https://hdl.handle.net/10419/223820

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

I Z A Institute
of Labor Economics
Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 13378

Inequality in Personality over the Life Cycle

Miriam Gensowski
Mette Gørtz
Stefanie Schurer

JUNE 2020

I Z A Institute
of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 13378

Inequality in Personality over the Life Cycle

Miriam Gensowski
University of Copenhagen, CEBI and IZA

Mette Gørtz
University of Copenhagen, CEBI and IZA

Stefanie Schurer
University of Sydney and IZA

JUNE 2020

Any opinions expressed in this paper are those of the author(s) and not those of IZA. Research published in this series may include views on policy, but IZA takes no institutional policy positions. The IZA research network is committed to the IZA Guiding Principles of Research Integrity.

The IZA Institute of Labor Economics is an independent economic research institute that conducts research in labor economics and offers evidence-based policy advice on labor market issues. Supported by the Deutsche Post Foundation, IZA runs the world's largest network of economists, whose research aims to provide answers to the global labor market challenges of our time. Our key objective is to build bridges between academic research, policymakers and society.

IZA Discussion Papers often represent preliminary work and are circulated to encourage discussion. Citation of such a paper should account for its provisional character. A revised version may be available directly from the author.

ISSN: 2365-9793

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Inequality in Personality over the Life Cycle*

We describe gender and socioeconomic inequalities in the Big Five personality traits over the life cycle, using a facet-level inventory linked to administrative data. We estimate life-cycle profiles non-parametrically and test for cohort and sample-selection effects. We discuss the economic implications of the following findings: Women of all ages score more highly than men on all personality traits, including three that are positively associated with wages; Individuals with high own or parental education have more favorable traits except Conscientiousness; Over the life cycle, gender and socioeconomic gaps widen in Openness and shrink in Neuroticism, a trait associated with worse outcomes.

JEL Classification: J24, I24, J62, I31, J16

Keywords: inequality, socio-emotional skills, personality traits, Big Five facets, life cycle dynamics, gender gap, intergenerational transmission

Corresponding author:
Miriam Gensowski
Department of Economics
University of Copenhagen
Øster Farimagsgade 5
1353 Copenhagen K
Denmark

E-mail: Miriam.Gensowski@econ.ku.dk

* We appreciate generous funding from the Novo Nordisk Foundation (grant no. NNF17OC0026542) and from the Danish National Research Foundation through its grant (DNRF-134) to the Center for Economic Behavior and Inequality (CEBI) at the University of Copenhagen.

1 Introduction

Personality critically determines how individuals make decisions in their life – decisions about whether and how much to learn, whom to marry, in which occupation to work, how much to save for a rainy day and whether to exercise regularly and eat healthily. Personality traits are multi-dimensional manifestations of what economists often refer to as non-cognitive, socio-emotional, or soft skills. Today, these skills are widely accepted as an integral part of human capital and labor supply models (Almlund et al., 2011; Borghans et al., 2008; Bowles et al., 2001a; Lundberg, 2018). It has been suggested that socioeconomic inequalities in non-cognitive skills, which we observe at early ages (Attanasio et al., 2020), are implicated in the intergenerational transmission of inequality (Lundberg, 2018, p. 219). Recent research on the gender gap in education and labor market outcomes calls for more insight into the role of personality in explaining why women have such different outcomes in their lives than men (Bertrand, 2020; Petrongolo and Ronchi, 2020). In order to understand socioeconomic inequalities in lifetime outcomes, we must therefore understand inequalities in personality over the life cycle.

Surprisingly little evidence exists about inequalities in adulthood personality and their development. In this paper, we contribute to the literature by filling this gap. We explore life-cycle inequalities in the Big Five personality traits, one of the most widely used inventories to capture personality at the broadest level (Goldberg, 1992). A distinctive strength of our paper is that we provide detailed evidence on multiple dimensions of non-cognitive skill, captured in the Big Five and their lower-level facets.[1] Each of the five dimensions of personality relates to different domains of individual decision-making. Thus, each affects life-time educational, economic, health and social outcomes in different ways (Almlund et al., 2011; Lundberg, 2018). For instance, Extraversion and Conscientiousness, traits that are associated with sociability and high executive function, respectively, have high private returns in the labor market (Fletcher, 2013; Gensowski, 2018; Heineck and Anger, 2010; Mueller and Plug, 2006; Nyhus and Pons, 2005). Conscientiousness has been singled out in the literature as a super trait because of its predictive power in academic and job performance (Almlund et al., 2011),

[1] There are multiple behavioral domains and psychological inventories for measuring adulthood personality. Lundberg (2018) emphasizes that the literature lacks consensus on which are the right ones. In fact, the measurement situation beyond childhood and adolescence "becomes rather chaotic" (p. 220). We focus on the Big Five traits, because they capture multiple dimensions of non-cognitive ability and because of their widespread use and acceptability.

healthy living (Roberts et al., 2014), migration decisions (Bütikofer and Peri, 2020), and marriage-market sorting (Dupuy and Galichon, 2014; Lundberg, 2012). Agreeableness, a trait describing selfless and cooperative behavior, is associated with reciprocity, altruism, and pro- or anti-sociality (Becker et al., 2012; Engelmann et al., 2019; Hilbig et al., 2014), economic preferences which are at the basis of trust in strategic interactions (Engelmann et al., 2019), socioeconomic development (e.g. Bigoni et al., 2016) and wellbeing (Post, 2005). At the same time, Agreeableness is associated with *lower* wages (Gensowski, 2018; Heineck and Anger, 2010; Mueller and Plug, 2006). Openness to Experience, a trait describing intellectual curiosity, imagination and aesthetics, is a critical component in the human capital accumulation process of disadvantaged youth (Lundberg, 2013). Neuroticism, a trait that describes the disposition to experience and express negative affect, is associated with both poor emotional wellbeing (Widinger, 2011) and lower levels of education (Almlund et al., 2011; Lundberg, 2013, 2018).

We model inequalities in the age profiles of personality traits and facets by gender and socioeconomic status (SES). Establishing how these multi-faceted skills differ by age, gender, and socioeconomic status is essential for discussions of theory and empirical evidence related to, e.g., models of household production, optimal taxation, and the roots of gender pay gaps. To the best of our knowledge, we are the first to document age-related personality differences by both education and income. We collected a comprehensive survey in 2019 on a large Danish population (N=38,711), which included, among others, the Big Five Inventory-2 (BFI-2). The BFI-2 uses 60 items (30 in the abbreviated version) to hierarchically assess the Big Five personality domains, together with 15 more specific facet traits (Soto and John, 2017a,b). We linked the survey responses at the individual level to high-precision administrative register data, which allow us to classify individuals according to their own and parental SES. Thanks to this large sample, we can precisely estimate life-cycle profiles of personality by gender and SES. We model potential non-linearities in the age-personality relationships flexibly with bivariate kernel regression methods without imposing any specific functional form (Wand and Jones, 1995). This improves upon the previous literature – reviewed in detail in Section 2 – that could only test for linear or 2nd-order polynomial age-personality relationships, thus failing to detect more subtle developments (e.g. Anusic et al., 2012; Donnellan and Lucas, 2008; Srivastava et al., 2003).

Our findings produce a collection of stylized facts. First, we find large and significant

gender gaps[2] in all personality traits of the Big Five (and most facets)—with women scoring more highly on all of them. Thus, while women score more highly on Openness, Conscientiousness, Extraversion, and Agreeableness, they also score more highly in Neuroticism. Gender-personality gradients are observed at almost every stage of the life cycle. Second, we find large and significant SES gaps in personality over the entire life cycle—regardless of whether SES is measured with parental background or own education and income. Higher SES is associated with stronger non-cognitive skills (higher scores on Openness to Experience, Extraversion, and Agreeableness, lower scores on Neuroticism). Yet one dimension surprisingly shows no gap by either education or income: Conscientiousness. We discuss possible interpretations of this finding in Section 5. Third, most of the inequalities by gender and SES remain constant over the life cycle, with only two exceptions. For Openness to Experience, both gender and socioeconomic inequalities widen markedly over the life cycle. This is an important finding, because Openness to Experience is associated with intelligence, and therefore with cognitive functioning. To give an example, men and women do not differ in their Openness levels up until age 40. In mid-age, men's Openness levels drop while women's increase. A similar pattern emerges between individuals from high and low SES. Our findings suggest that both women and high SES individuals are better equipped to adapt to the aging process itself and the multitude of social and economic changes associated with approaching retirement. The gender gap in Neuroticism, a trait that is associated with worse education, labor market and health outcomes, significantly diminishes with age. This should reduce gender gaps in the related outcomes.

Finally, the estimated life-cycle profiles display remarkable non-linearities that were undetectable in previous research. The period before age 25 seems to be characterized by more substantial changes in personality traits than later periods in adulthood. Moreover, given our detailed investigation of facets that feed into the Big Five, we can paint a more nuanced picture about life-cycle inequalities in personality than the Big Five alone. To give an example, while overall Openness to Experience grows with age, its facet intellectual curiosity declines with age. The decline process starts earlier for men than for women and accelerates around retirement age. Another interesting example is that we find no gender inequalities in the facets Assertiveness and Creative Imagination,

[2]The administrative registers do not list gender, but biological sex. In what follows, we use the conventional term "gender" as it is used in the literature on gender gaps, for example, while pointing out that we are actually identifying sex gaps.

although they exist in their respective Big Five domains.

Using administrative register data on the full sample of people invited to participate in the survey, we can study the self-selection of respondents. Adjusting for sample selection on the basis of a wide array of important covariates (including demographics, health, and socioeconomic background) alters neither the life-cycle profiles of personality nor their gradients by gender, income, or education.

A critical limitation to our cross-sectional study design is that age-gradients in personality may not be evidence of changes in personality as people age but differences in personality by birth cohorts.[3] Initial conditions experienced in childhood and adolescence can have long-lasting effects on beliefs (see, e.g. Giuliano and Spilimbergo, 2013). The problem associated with identifying both age, period and cohort effects is well known in the literature on so-called apc models ("apc" for age, period and cohort, see Browning et al., 2012; Clark, 2007; Deaton and Paxson, 1994; Heckman and Roeb, 1985). Following this literature, we provide a practical solution by parameterizing some of the explanatory variables. This approach relies on finding suitable proxies for cohort specific factors, including rates on unemployment at age 18 (Schwandt and von Wachter, 2019), inflation (Dohmen et al., 2017), and GDP growth (Kapteyn et al., 2005). Proxying cohort effects with macroeconomic conditions results in a slightly less steep age gradient in middle age for some personality traits, but our conclusions about gender and socioeconomic inequalities over the life cycle remain the same.

The remainder of the manuscript is as follows. We review the main literature on adulthood personality development in Section 2. We describe our linked survey and administrative data in Section 3. The main results are presented in Section 4. We discuss the economic implications of our findings in Section 5.

2 Existing Evidence

2.1 Economics and Personality Traits

Although the study of personality psychology was traditionally not in the center of economists' attention, personality traits are increasingly perceived as a critical skill that shapes success in life (Almlund et al., 2011; Borghans et al., 2008; Bowles et al., 2001b;

[3]Personality may reflect different public policies, such as some birth cohorts are said to become neurotic in response to China's One-child-policy (Cameron et al., 2013) or because they grow up in times of low levels of social connectedness (Twenge, 2000).

Heckman, 2000; Lundberg, 2018). Early papers using personality measures as inputs into wage regressions used a multitude of measures for personality that were available in data sets. Possibly because of the lack of agreement on which personality measures are the right ones, Heckman (2000) summarized personality plainly as "non-cognitive skills". This simplification made it possible to compare the role of personality against standard cognitive ability measures, which were widely accepted as an (often unobserved) input into Mincer wage regressions (for reviews, see Card, 2001; Gronau, 2010). Various studies have emerged since then which conclude that personality is at least as important as cognitive skills in determining labor market outcomes (Heckman et al., 2006), especially for people at the bottom end of productivity (Lindqvist and Vestman, 2011). For people at the bottom end of cognitive ability and socioeconomic status, non-cognitive skills also predict migration decisions almost as well as cognitive ability (Bütikofer and Peri, 2020).

In recent years, interest in the role of personality has dramatically increased since the seminal work by Almlund et al. (2011) summarizing the economics of personality psychology. Some researchers would go as far as saying that inequalities in the crucial lifetime outcomes can only be understood if we better understand inequalities in other aspects of productivity, including personality (e.g. Cunha and Heckman, 2009; Heckman, 2000; Heckman et al., 2006). Recent research on the gender gap in education and labor market outcomes calls for more insight into the role of personality in explaining why women have such different outcomes in their lives than men (Bertrand, 2020; Petrongolo and Ronchi, 2020). The evidence base on whether inequalities in personality development exist is sparse. A small number of studies has focused on socioeconomic status (SES) gaps in children's behavioral patterns and styles, proxied either by a one-dimensional non-cognitive skill measure (Elkins and Schurer, 2020) or by multidimensional measures of behavioral problems (Attanasio et al., 2020) or economic preferences (Falk et al., 2020). For instance, Elkins and Schurer (2020) demonstrate that children from high SES backgrounds tend to have a more internal locus of control, a belief which is associated with better education, health, and labour market outcomes, and express positive control maturation processes over the life cycle. Attanasio et al. (2020) show that socioeconomic inequalities in socio-emotional skills – derived from the Strengths and Difficulties Questionnaire and sometimes likened to be a precursor to adulthood internal control beliefs – have increased in the past 30 years. Falk et al. (2020) document significant SES gaps in childhood economic preferences derived from incentivized labo-

ratory experiments, which are rooted in children from more advantaged families being more patient and altruistic, and less risk-seeking.

These studies provide a starting point to understand inequalities in personality at the early stages of the life cycle, but the previous literature does not directly help us to understand such inequalities throughout adulthood. For instance, do childhood inequalities in personality persist over the life cycle? Also, how can the many unidimensional results be integrated?

2.2 Studies using the Big Five Traits

We focus in this study on inequalities in the Five Factor personality structure – Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. These five traits are generally accepted by psychologists as a meaningful and reliable instrument for describing and understanding human differences in adulthood (Goldberg, 1992; John and Srivastava, 1999; McCrae et al., 1999). Openness to Experience assesses the tolerance for and exploration of new ideas and the enjoyment of aesthetic, cultural, or intellectual experiences. Conscientiousness assesses the degree of organization, persistence and motivation during the fulfilment of goal-directed task behaviors. Extraversion assesses the extent to which a person actively engages with the world or avoids intense experience. Agreeableness assesses the interpersonal nature of the person and can range from warm and committed (e.g. friendly) to others versus antagonistic. Neuroticism measures the reverse of the regulation of emotions or the extent to which the person is worrying about unpleasant experiences and distressing emotions.

A rich body of literature has demonstrated the importance of the Big Five traits in the labor market (Fletcher, 2013; Heineck and Anger, 2010; Mueller and Plug, 2006; Nyhus and Pons, 2005), even for highly educated and high IQ men and women (Gensowski, 2018). An important insight from this literature is that some personality traits are more productive than others. Conscientiousness, for example, is frequently credited as a super-trait that should be studied in its own right (Roberts et al., 2014). The reason is that higher levels of Conscientiousness are associated with better academic performance in both high school (Noftle and Robins, 2007) and at university (Chamorro-Premuzic and Furnham, 2003; Edwards et al., 2020; Kappe and van der Flier, 2012; Trapmann et al., 2007). Some argue that Conscientiousness is considerably more powerful in predicting grade point averages than intelligence (Kappe and van der Flier, 2012). It has

also predictive power for task productivity (Cubel et al., 2016), in career success and longevity (Kern et al., 2009), and is associated with higher wages at both the beginning of young people's careers (Fletcher, 2013; Heineck and Anger, 2010; Mueller and Plug, 2006; Nyhus and Pons, 2005) and in later stages of the career (Gensowski, 2018). A facet of Conscientiousness, adaptability, has been shown to be a key predictor of migration decisions among Norwegian men, especially among men from economically disadvantaged backgrounds (Bütikofer and Peri, 2020). Other personality traits – e.g. Agreeableness – are positively related to economic preferences such as risk aversion (Borghans et al., 2009), reciprocity and altruism (Becker et al., 2012), trust (Dohmen et al., 2008), prosociality (Hilbig et al., 2014), and negatively related to antisociality (Engelmann et al., 2019). Trust and altruism are at the basis of socioeconomic development (e.g. Bigoni et al., 2016) and population wellbeing (Post, 2005).[4] Agreeableness has also been found to be productive for academic achievement and job performance (summarized in Almlund et al., 2011), but at the same time this trait is consistently associated with lower occupational attainment (Cobb-Clark and Tan, 2011) and lower wages (Gensowski, 2018; Heineck and Anger, 2010; Mueller and Plug, 2006). Openness to Experience is linked to intellectual curiosity, creativity and intelligence (Ackerman and Heggestad, 1997; Aitken Harris, 2004; Schretlen et al., 2010), and thus is a critical component in the human capital accumulation process (Almlund et al., 2011). Lundberg (2013) has proposed that this trait may be instrumental for helping young people from disadvantaged backgrounds to graduate. Neuroticism is a disposition to experience and express negative affects, and thus high values on the scale are linked to mental health problems, lack of emotional wellbeing and personality disorders (Widinger, 2011).

This large body of research demonstrates that some personality traits are more productive than others. So, what do we know about inequalities in personality development over the adult life cycle? In fact, very little has been written on this topic from within

[4]It should be noted that the literature in general assumes personality traits to be distinct from economic preferences – which are designed to capture risk tolerance, impatience, trust, prosociality, ability to tolerate ambiguity, and altruism. Some evidence based on adult samples suggest that overall they are not related to personality (Becker et al., 2012; Dohmen et al., 2010), but agreeableness has a relatively strong positive association with altruism (0.2), trust (0.17) and positive reciprocity (0.2) derived from experimental samples (Becker et al., 2012, see Table A.2). A recent study on university students suggests that the personality traits of antisociality and anger, both derived from the Five Factor Inventory, are significantly related to investor decisions to trust in a strategic game that allows for punishment (Engelmann et al., 2019). Antisociality is described as having high positive loadings on Machiavellianism, financial and ethical risk taking, and avoidance of relationships, as well as high negative loadings on trustworthiness, empathic concern, and agreeableness. Importantly, variations in antisocial personality are associated with effect sizes that are as large as strong variations in the strategic context of the trust game. Engelmann et al. (2019) conclude that the trust and punishment behavior of the antisocial personality is hard to reconcile with the rational choice approach to decision-making.

the economics discipline, while a large body of evidence has been accumulated in the personality psychology literature since the early 2000s. The personality psychology literature has approached this question mainly from a theoretical perspective. Different theories make different predictions about how mean levels of personality traits change in adulthood (see Roberts and Mroczek, 2008; Roberts et al., 2006, for reviews). According to the so-called plaster hypothesis laid out in the Five-factor theory, personality has a strong genetic component, is shaped in predictable ways through childhood, and stabilizes before the age of 30 (McCrae et al., 2000; McCrae and Costa Jr., 1996). The plaster hypothesis predicts few, if any, systematic mean-level changes in personality beyond the age of 30. This assumption has been challenged more recently by the contextualist, or social-investment, perspective, which assumes that personality is changing throughout the life course because of environmental factors. Social roles, life events, and social environments change during the life course, and such factors have been suggested as important influences on basic personality traits (Haan et al., 1986; Helson et al., 2002).[5]

Both perspectives have motivated a growing empirical literature. Most studies describe personality development in terms of mean-level differences across age groups.[6] The analyses are typically based on cross-sectional data (e.g. Allemand et al., 2008; Anusic et al., 2012; Branje et al., 2007; Donnellan and Lucas, 2008; McCrae and Costa, 1999; Soto et al., 2011; Srivastava et al., 2003; Wortman et al., 2012). A general insight from this literature is that middle-aged individuals tend to score more highly than young adults on Agreeableness and Conscientiousness and lower on Extraversion, Neuroticism, and Openness to Experiences (Roberts and Mroczek, 2008). Regarding gender inequalities in personality development, Roberts et al. (2006) suggest that "there is very little support for the idea that men and women change in distinct ways" over the life cycle

[5]This latter perspective argues that individual experiences must play a critical role in personality maturation as less than 50 percent of the variation in personality traits can be attributed to genetics while the remainder is attributed to personal experiences (Borkenau et al., 2001; Klimstra et al., 2009; Krueger et al., 2008; Turkheimer, 2000; Turkheimer et al., 2003)

[6]It should be noted that some studies explore personality development as rank-order consistency, which is about the relative position of individuals' personality scores over time (Roberts and DelVecchio, 2000). This literature requires at least two measurement periods of personality, to be able to construct Spearman Rank Order correlation coefficients. A third type of literature studies intra-individual personality changes. This literature focuses on how traits change within the same individual over time and to what degree these individual-specific changes depend on a range of events and uptake of social roles (Cobb-Clark and Schurer, 2012; Elkins et al., 2017; Schwaba and Bleidorn, 2018; Specht et al., 2011), exposure to malevolent parenting styles (Fletcher and Schurer, 2017), education (Bleidorn, 2012; Kassenboehmer et al., 2018; Schurer, 2017; West et al., 2016), retirement (Schwaba and Bleidorn, 2019), exposure to cultural events (Schwaba et al., 2018) or radical public policy changes (Cameron et al., 2013). The latter two literatures are substantially limited by the fact that life-cycle follow-up of people's personalities are not routinely collected. Most previous work studies intra-individual changes over four- to eight-year windows.

(p. 15). Indeed, none of the previous work finds strong evidence for gender inequalities (Branje et al., 2007; Donnellan and Lucas, 2008; Klimstra et al., 2009; Roberts et al., 2001; Soto et al., 2011; Srivastava et al., 2003), although some studies find outlier effects for one specific trait. For instance, Srivastava et al. (2003) find that Neuroticism declines for women over the life cycle, but male age-Neuroticism profiles remain flat.

Based on US online surveys, Soto et al. (2011) and Srivastava et al. (2003) stand out as the two studies most similar to our own. Both describe the age-personality gradient over the full life cycle separately for men and women—but not by socio-economic status. Srivastava et al. (2003) use a sample of web survey participants aged between 21 and 60, while Soto et al. (2011) extend their sample to include childhood participants (ages 10-65). Soto et al. (2011) furthermore disaggregate the personality-age gradients into ten facets of the Big Five. Both studies model non-linearities in the age-personality profiles with quadratic polynomials in the age variable, which means that they assume curvilinear age profiles.

From these two studies a number of stylized facts can be derived for an adult population: First, women score more highly on every personality trait at any point in the life cycle, with the exception of Openness to Experience, for which men score more highly. This means that women score more highly on Conscientiousness, Agreeableness and Extraversion, which are all considered positive traits, but they also score more highly on Neuroticism, a trait considered as negative because of its association with mental health problems (Widinger, 2011). This is a finding that has been replicated with data from a large Internet-based sample of young adults from 62 nations (Bleidorn et al., 2013). Second, both men and women increase substantially in their Conscientiousness and Agreeableness scores over the life cycle (from age 30 onward). Third, both men and women see declining scores in Neuroticism throughout the life cycle, although the reduction is particularly strong for women. Fourth, the age-personality profiles are relatively flat for Extraversion. Fifth, mixed results are obtained for Openness to Experience.

Soto et al. (2011) is currently the only study which estimates age-personality profiles separately for the facets of the Big Five. The main conclusion is that the age-personality profiles are very similar for each facet as for the overall domain, with the exception of Openness to Experience. For this trait, different life-cycle profiles are obtained when considering the Aesthetics facet, while the Ideas facet yields the same life-cycle profile as the domain.

Soto et al. (2011), Srivastava et al. (2003) and Bleidorn et al. (2013) unify the large evidence from previous studies, which explored age-personality changes separately for adolescents, young adults, adults, and older people, for various countries and smaller samples. Although comprehensive, this previous work does not provide sufficient evidence for understanding *inequalities* in personality over the life cycle. The literature does not produce evidence on whether socioeconomic inequalities in personality exist and vary over the life cycle. A notable exception is Donnellan and Lucas (2008), who test but cannot reject equal age profiles by education. Also, practically all existing work assumes linear or curvilinear personality developments, so that the specific growth path could disguise important inequalities in personality development as people age.

3 Data Description

3.1 Survey Collection

The data on personality traits for this project stems from a tailor-made online survey for which we invited a random sample of 121,390 individuals in Denmark.

Survey Design The largest component of the survey was the Big Five personality inventory. We used the BFI-2, of which we both implemented the full 60-item version (Soto and John, 2017a) and an abbreviated 30-item instrument (Soto and John, 2017b) for different groups.[7] These instruments hierarchically assess the traits of Openness to Experience (called Open-Mindedness by the authors of the BFI-2), Conscientiousness, Extraversion, Agreeableness, and Emotional Stability (Negative Emotionality), together with three sub-facets for each of these traits: Open-Mindedness facets of Intellectual Curiosity, Aesthetic Sensitivity, and Creative Imagination; Conscientiousness facets of Organization, Productiveness, and Responsibility; Extraversion facets of Sociability, Assertiveness, and Energy Level; Agreeableness facets of Compassion, Respectfulness, and Trust; and Negative Emotionality facets of Anxiety, Depression, and Emotional Volatility. The BFI-2 has a reasonably short response time, with repeated statements to agree/disagree with (for example, I am someone who ... "Is outgoing, sociable" or "Can be somewhat careless"). The availability of sub-facets addresses the bandwidth-fidelity

[7] See the full list of items in Table S.1 and Table S.2. There was no differential drop-out from the longer version. The survey also assessed health behaviors, economic preferences and beliefs about the health production function and satisfaction with the public health system. This data will not be used in the current paper, however.

tradeoff, in that broadly defined traits tend to predict a wider range of criteria, whereas narrowly defined traits tend to predict closely aligned criteria more accurately. Facets from a hierarchical model are not typically available in economics research, as surveys are kept too short to be able to break down traits. Another advantage from administering a longer instrument is that it can prevent the measurement problem of acquiescent responding, the tendency of some individuals to consistently agree (yea-saying) or disagree (nay-saying) with items regardless of their content. The BFI-2 contains an equal number of true-keyed and false-keyed items, in both the long and abbreviated form. The reliability is high. For the short version, for example, the alpha reliabilities are reported to have a range of 0.81 to 0.90 across samples in Soto and John (2017b).

For maximum comparability, the analyses presented here use the short version from all respondents (because the short version contains a sub-set of the items in the long version, it is easy to construct the short version for respondents to the long instrument). Section S.3 demonstrates that our conclusions are unaffected by this choice, from a comparison of age profiles by gender, education, and income for the full and abbreviated BFI-2 versions. Since this survey was administered in Denmark, we used the Danish translation suggested and validated by Vedel et al. (2019).

Survey Implementation We obtained a random sample of individuals in Denmark from Statistics Denmark, approximately representative of each cohort from 1944-2001. For the cohorts of 1956-1998, we also obtained the siblings of all non-singleton individuals.[8] The sample of 121,390 individuals aged 18 and older, living in Denmark, was then contacted in May and August 2019 via a secure messaging system,[9] which is linked to everyone's social security number and which is exclusively used for official communication (including pay slips etc.). Every secure letter contained an invitation to participate, which explained briefly the purpose of the study, and that there would be a lottery among all respondents with 200 prizes of 1,000 Danish Crowns each (approximately 130 Euro). The letter also contained information on privacy, such as GDPR laws being observed by our study. After 10 days, all non-respondents were sent reminders (79%), as were partial responders (1.4%, with a different text acknowledging their partial response). The response rate including partial responses was 33.7%, and complete responses 30%.

[8]Note that we can only identify siblings in the civil registration system when they are currently living in Denmark and have information on their biological mother. A few individuals could not be contacted because there was no name or address recorded with their social security number.

[9]This system is called "e-Boks"—see https://www.e-boks.com/danmark/en/what-is-e-boks/.

The completed survey data was anonymized and merged to the administrative registers on a secure server by Statistics Denmark.

3.2 Administrative Register Data

Having access to linked survey-register data allows us to obtain background information such as education, own income, income of parents, and health care use at the individual level for all respondents who participated in the survey. Survey and register data were linked by Statistics Denmark through the unique personal identifier for all individuals in Denmark. The linked survey-register data were anonymized by Statistics Denmark and made available for research through Statistics Denmark's secure research server.

Table S.3 shows descriptive statistics for personality traits and background information for the survey sample.

Having access to socioeconomic background information for all respondents from the unique high-quality Danish register data has several important advantages. First, the register data allows us to link respondents to their parents. Secondly, socioeconomic characteristics such as education, income, marriage status, family structure, etc. are measured with precision, thus avoiding measurement error and bias due to self-reported measures which sometimes contaminate other surveys. Thirdly, the register data is a longitudinal panel, which potentially allows us to control for background characteristics in the past. Several socioeconomic characteristics are observed from 1980 and onwards. Fourthly, it is possible to link the entire sample of individuals that were initially drawn from the civil registration system for the survey to background information in the other administrative registers. Hence, we are able to compare the socioeconomic background of individuals who completed the questionnaire with that of the entire sample of randomly selected potential respondents. This allows us to assess potential biases in responses due to non-random selection into answering the survey. Moreover, having access to register information not only for the survey sample but also for the entire Danish population allows us to calculate sample weights for the respondents.

Our **income** measure contains both (gross) labor income and income transfers (latest observation, up to 2016). Labor income includes salary income and income for self-employed. Income transfers includes unemployment benefits, disability pension, pensions etc. We define "high" and "low" income as above/below the median income of each 5-year age group (for parents and children separately).

We divide the sample into two **education groups**, low and high education, with high education defined as upper secondary education ("short continuing education") and beyond (latest update to this register from 2017).

We are interested in the association between personality traits and socio-economic *background*—ideally measured with parental SES. Parents are observed well for the younger cohorts, but the match of "children" to their biological parents becomes less likely for cohorts born before the early 1960's. Therefore, we use overlapping SES measures, own SES and parental SES, as appropriate for the data quality. Table 1 shows the proportion of respondents in each 5-year age group for which the register data contains a parent identifier (column 1), for which there is income and education information for the parents, conditional on having identified the parent in the register data (column 2 and 3), and column 4-5 show proportion of the total sample for which we have parental income and education information available. We conclude that until the child's age of 60, data quality on parental SES is very high, so we use background SES until then.

Table 1: Data Availability Parent-Child Pairs

Age	(1) Parent	(2) Parent Income cond'l on Parent	(3) Parent Ed cond'l on Parent	(4) Parent Income	(5) Parent Ed
20	0.986	0.999	0.971	0.984	0.957
25	0.927	1.000	0.991	0.927	0.918
30	0.893	1.000	0.992	0.893	0.886
35	0.887	1.000	0.991	0.887	0.879
40	0.901	0.999	0.992	0.901	0.894
45	0.925	0.999	0.991	0.924	0.916
50	0.930	0.999	0.990	0.929	0.921
55	0.939	0.995	0.986	0.934	0.926
60	0.901	0.989	0.954	0.891	0.859
65	0.611	0.974	0.845	0.595	0.516
70	0.168	0.943	0.556	0.159	0.094
75	0.133	0.901	0.313	0.120	0.042

Note: Showing share of available data in our sample (columns 1,4,5) and conditional on observing parents (columns 2 and 3), for the 5-year groups around the age listed (e.g. age 40 groups those aged 38-42).

The register data on the full sample of individuals invited to the survey can also serve to compare main socioeconomic background characteristics of our survey sample with non-respondents. Respondents are more likely to be female, of Danish origin, and come from higher SES groups (although the differences are numerically small, see Tables S.9 to S.11). Section 4.6 will discuss the adjustment of our results to non-response.

4 Results

This section prepares the expanded discussion of the results and their implications in Section 5. We first pool all age groups to present average personality differences by gender, socioeconomic status, and age. We then illustrate inequalities in the life-cycle dynamics of personality by plotting mean personality scores for every age, plotted separately by gender, education and income.[10] Robustness checks are presented in a supplement. All age gradients are estimated non-parametrically with bivariate kernel density functions and their 95% confidence internals are constructed using the delta method.

4.1 Inequalities in Personality by Gender, SES, and Age

Table 2 shows how personality varies by gender, education, income and age for each of the Big Five Inventory (BFI) personality traits and their three facets. We report the estimated coefficients of gender, education, income, or age from a regression model in which personality is the outcome variable and the respective column variable is the predictor. We confirm significant age gradients in personality that are expected from the literature. Individuals become more open, conscientious, agreeable, and extraverted over the life course, and less neurotic. The magnitudes of the age effects are generally small. For every additional year of age personality changes by around 0.01 SD or less. The largest association is observed for Conscientiousness, which implies an increase in Conscientiousness of 0.14 SD for every additional decade of age.

There are also significant gender gaps: Women score significantly more highly than men on each of the five higher-level personality traits and on most of the facets. The only exceptions are that we find no gender gap in Creative Imagination, a facet of Openness to Experience, and Assertiveness, a facet of Extraversion. In terms of magnitude, gender inequalities are largest for Agreeableness (0.56 standard deviations (SD)), a gap driven by the facet Compassion (0.60 SD), Neuroticism (0.38 SD, mainly driven by the facet Anxiety) and Conscientiousness (0.30 SD, mainly driven by the facet Responsibility).

Secondly, we find significant education inequalities in personality: Openness to Experience, Extraversion and Agreeableness are increasing, while Conscientiousness and Neuroticism are decreasing in education. The differences are particularly large for Openness

[10] Our estimation models on the pooled sample control for age and female in all regressions, but not for background information such as socioeconomic status or proxies for early-life family and schooling environments. In future work, we will study the mechanisms through which inequalities in personality emerge, taking advantage of the availability of historic administrative data on every sample member.

to Experience (0.4 SD, mainly driven by the facet Intellectual Curiosity) and Extraversion (0.18 SD, mainly driven by the facet Assertiveness), and relatively smaller for the other traits (around 0.10 SD). Regarding the facets, we find no education gradient in Responsibility (facet of Conscientiousness).

Thirdly, the income gradient works in the same direction as the education gradient for Openness to Experience, Extraversion, Agreeableness, and Neuroticism, but not for Conscientiousness. Thus, people with higher income report higher levels of Conscientiousness than people with lower levels of income. Furthermore, we observe important differences in magnitude as well. While the education-Openness gap is 0.4 SD, it is only 0.11 SD for the income-Openness gap. A similar difference in magnitude, but in opposite direction, is observed for Neuroticism, for which we find a four times larger gap across income than across education. In terms of facets, we find no income gradient in Compassion (a facet of Agreeableness).

4.2 Gender Inequalities in Personality over the Life Cycle

As we will show next, gender inequalities in personality are observed over the full life cycle—see Fig. 1. They are roughly in line with Soto et al. (2011) and Srivastava et al. (2003), except for Openness to Experience, as we will discuss in Section 5.

For Conscientiousness, Extraversion and Agreeableness, we observe a gender gap already in late adolescence, which remains constant over the life cycle. Gender inequalities in Conscientiousness are driven by the facets of Responsibility and Organization. The facet Productivity is similar for men and women, although significantly in favor of women. Gender inequalities in Extraversion are driven by a significant female surplus in Sociability and Energy Levels in older age. In contrast, differences in Assertiveness and Energy Level between men and women are small for most parts of the life cycle, although women have significantly higher Energy levels in old age than men. Gender inequalities in Agreeableness are observed for all three facets (Compassion, Respectfulness and Trust).

We find remarkable changes in gender inequalities over the life cycle for Openness to Experience and Neuroticism. Fig. 1a shows that men and women do not differ significantly in their Openness to Experience scores until age 35. Starting already at age 30, women increase in their Openness scores almost linearly, up until age 65, when the profile declines. For men, the Openness profile is flat until age 30, weekly U-shaped

Table 2: Coefficients of Age, Gender, Education, and Income on Personality

	(1) Age	(2) Female	(3) High Education	(4) High Income
Openness	0.002***	0.154***	0.399***	0.114***
	(0.000)	(0.010)	(0.010)	(0.010)
Openness, Intellectual Curiosity	-0.004***	0.160***	0.446***	0.141***
	(0.000)	(0.010)	(0.010)	(0.010)
Openness, Aesthetic Sensitivity	0.003***	0.183***	0.324***	0.074***
	(0.000)	(0.010)	(0.010)	(0.010)
Openness, Creative Imagination	0.004***	0.006	0.153***	0.051***
	(0.000)	(0.010)	(0.010)	(0.010)
Conscientiousness	0.014***	0.301***	-0.085***	0.102***
	(0.000)	(0.010)	(0.010)	(0.010)
Conscientiousness, Organization	0.011***	0.284***	-0.138***	0.015
	(0.000)	(0.010)	(0.010)	(0.010)
Conscientiousness, Productiveness	0.012***	0.112***	-0.032**	0.157***
	(0.000)	(0.010)	(0.010)	(0.010)
Conscientiousness, Responsibility	0.010***	0.315***	-0.008	0.084***
	(0.000)	(0.010)	(0.010)	(0.010)
Extraversion	0.006***	0.117***	0.187***	0.286***
	(0.000)	(0.010)	(0.010)	(0.010)
Extraversion, Sociability	0.002***	0.203***	0.091***	0.140***
	(0.000)	(0.010)	(0.010)	(0.010)
Extraversion, Assertiveness	0.006***	0.012	0.196***	0.242***
	(0.000)	(0.010)	(0.010)	(0.010)
Extraversion, Energy Level	0.006***	0.032**	0.141***	0.271***
	(0.000)	(0.010)	(0.010)	(0.010)
Agreeableness	0.006***	0.559***	0.112***	0.020
	(0.000)	(0.010)	(0.010)	(0.010)
Agreeableness, Compassion	0.005***	0.594***	0.088***	-0.026*
	(0.000)	(0.010)	(0.010)	(0.010)
Agreeableness, Respectfulness	0.003***	0.407***	0.127***	0.041***
	(0.000)	(0.010)	(0.010)	(0.010)
Agreeableness, Trust	0.007***	0.320***	0.051***	0.033**
	(0.000)	(0.010)	(0.010)	(0.010)
Neuroticism	-0.011***	0.373***	-0.118***	-0.312***
	(0.000)	(0.010)	(0.010)	(0.010)
Neuroticism, Anxiety	-0.008***	0.487***	-0.106***	-0.283***
	(0.000)	(0.010)	(0.010)	(0.010)
Neuroticism, Depression	-0.012***	0.145***	-0.060***	-0.259***
	(0.000)	(0.010)	(0.010)	(0.010)
Neuroticism, Emotional Volatility	-0.007***	0.300***	-0.126***	-0.231***
	(0.000)	(0.010)	(0.010)	(0.010)

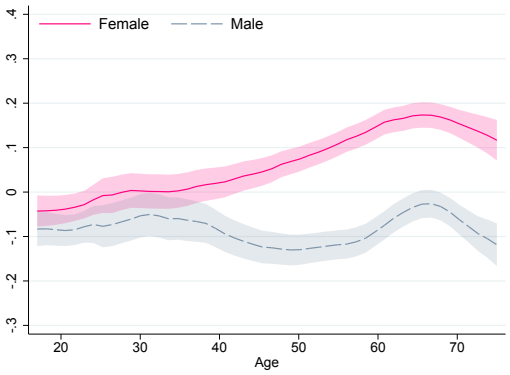
Note: Each column and row reports the coefficient (standard error in parentheses) from a separate regression of personality on the variable indicated in the column header. Personality is standardized to mean 0 and standard deviation 1. The sample pools all observations across all ages. Income and education variables refer to socioeconomic background of parents for sample members aged 40 or young, and to individual's own socioeconomic background for sample members older than 40. The regressors for columns (2)-(4) are binary indicators, while age in column (1) is continuous. Significance levels: $^{*}(p < 0.05)$,$^{**}(p < 0.01)$,$^{***}(p < 0.001)$. See Tables S.4 to S.8 for multivariate regression models.

between age 30 and 65, and declining thereafter. Thus, the gender gap in Openness is mainly driven by the middle- to older-age groups in our sample. A closer look at the facets of Openness shows that the gender gap is mainly driven by gaps in Intellectual Curiosity and Aesthetic Sensitivity. Creative Imagination is not statistically different for any age group except in adolescence, where the gap is in favor of men. In contrast, gender inequalities in Neuroticism are extremely large in late adolescence, but these inequalities eases over the life cycle. Women score almost 0.75 SD higher in Neuroticism than men in late adolescence, but the gap is no more than 0.2 SD from age 60 onward. Moreover, we see that for two of the facets of Neuroticism, namely Depression and Emotional Volatility, the gender gap narrows significantly around the age of 30 and 50, respectively.

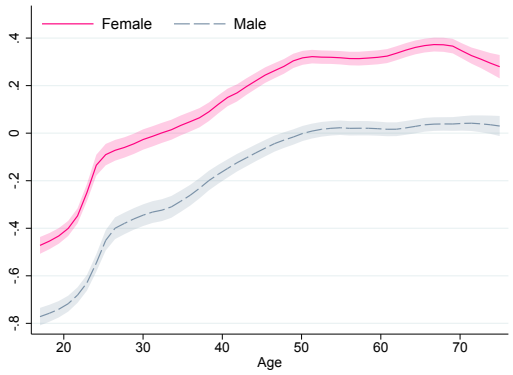
Last but not least, it should be noted that allowing for non-parametric estimation of life-cycle dynamics in personality is critical, if interest lies in capturing the large degree of nonlinearity in the data. Imposing linear age profiles would not capture the fact that Openness profiles remain constant up until age 40 for both men and women. Linear age profiles would also significantly underestimate the steep growth in Conscientiousness that we observe between late adolescence and mid-20s for both men and women, and overestimate the flattening of the curve that we observe for both men and women from age 30 onwards. Linear age profiles do not capture the fact that Extraversion scores stay constant or decline from late adolescence until the mid-20s, then increase steeply from age 30 to age 50, before they flatten out. At best, linear age profiles are only appropriate when modeling the life-cycle dynamics of Agreeableness (up until age 60) and Neuroticism for men.

Figure 1: Gender Inequalities in Personality over the Life Cycle (in Standard Deviations)

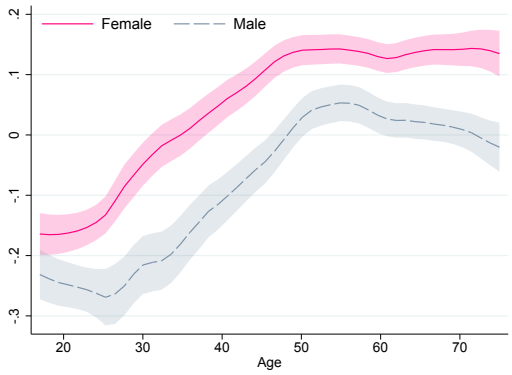
(a) Openness



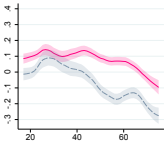
(b) Conscientiousness



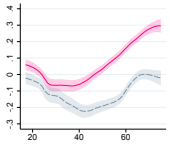
(c) Extraversion



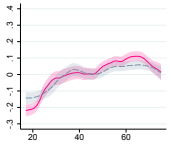
Intellectual Curiosity



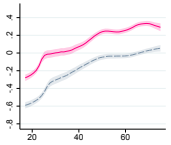
Aesthetic Sensitivity



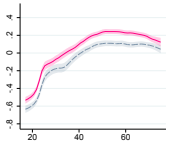
Creative Imagination



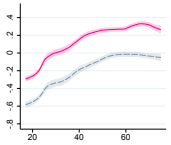
Organization



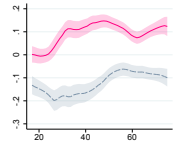
Productiveness



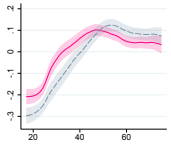
Responsibility



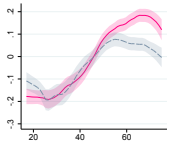
Sociability



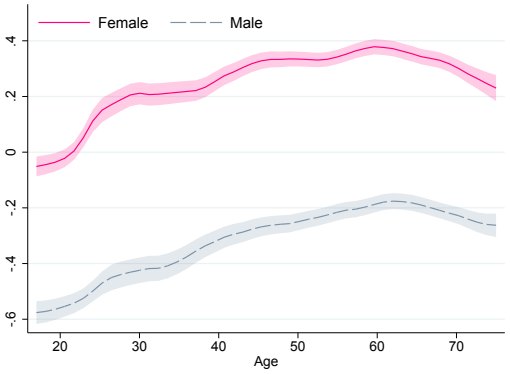
Assertiveness



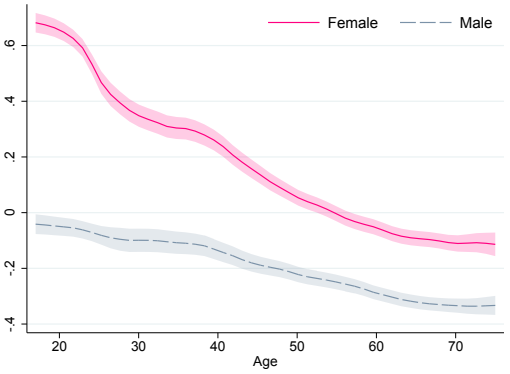
Energy Level



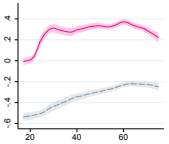
(d) Agreeableness



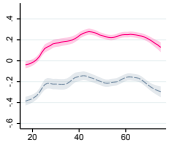
(e) Neuroticism



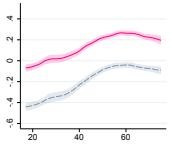
Compassion



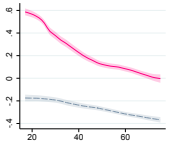
Respectfulness



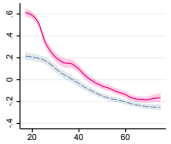
Trust



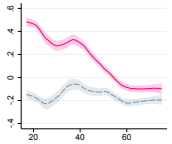
Anxiety



Depression



Emotional Volatility



4.3 Education Inequalities in Personality over the Life Cycle

We next describe the education gradient in personality over the life cycle. Figure 2 shows average personality traits by age, separately for high/low own or parental education. Education is classified as high for all with more than upper secondary education ("short continuing education").[11] We show results for parental education for individuals until the age of 50 because 93% or more of parents could be identified in the register data for this age range (see Table 1). In terms of own human capital, we allow individuals to complete their education until age 35, so the graphs show associations of own education with traits only starting at that age. We will demonstrate that for most personality traits, the education gradients in parental and own education are closely aligned.

Once considering the full life cycle of personality dynamics, we find remarkable education inequalities in four of the five traits over the life cycle, namely Openness to Experience, Extraversion, Agreeableness, and Neuroticism. With the exception of Openness to Experience, these inequalities remain relatively constant over the life cycle. However, we find no significant education gap in Conscientiousness or its facets, once considering the full life cycle (Fig. 2b). Both education groups experience a steep increase in Conscientiousness from late adolescence until age 30, a linear but less steep increase until age 50, and a full flattening of the curve afterwards. If anything, low education groups tend to score higher in Organization than high education groups. We will discuss possible explanations for the lack of education inequalities in personality in Section 5.

The single most interesting finding is the growing education inequality in Openness to Experience over the life cycle (Fig. 2a). While Openness is increasing steadily with age for the highly educated, it is fairly stable for those with low own/parental education, thus leading to a widening gap over time. Most remarkable is the widening gap Intellectual Curiosity, the biggest contributor to the gap, between the high and low educated groups over the life cycle. High educated groups keep their Intellectual Curiosity constant over the life cycle, while low education groups drop in Intellectual Curiosity from age 40 onward. While the gap was 0.3 SD in late adolescence, it widens to 0.6 SD in old age.

Another notable finding is that the education gradient in Extraversion over the life cycle is driven by differences in Assertiveness and Energy level that emerge strongly between age 30 and 40 (Fig. 2c), while there is only a small difference in Sociability over

[11] According to this classification, 38.3% of our respondents had high education, vs 25.8% in the Danish population.

the life cycle. The gap tends to be larger when considering own education rather than parental background as proxy for socioeconomic status. The socioeconomic gradient in Agreeableness is present in adolescence, especially for the facets of Compassion and Respectfulness (Fig. 2d). Yet, low education groups appear to be "catching up" until the mid-20s. The gap widens significantly in mid-age, especially when considering own education as proxy for socioeconomic status. There are no significant socioeconomic gradients in Trust between late adolescence and mid-age, but significant gaps emerge in mid-age that remain relatively constant. Finally, the education gap in Neuroticism (Fig. 2e) is constant across the life cycle and this holds equally for all of its facets (Anxiety, Depression, and Emotional Volatility).

4.4 Income Inequalities in Personality over the Life Cycle

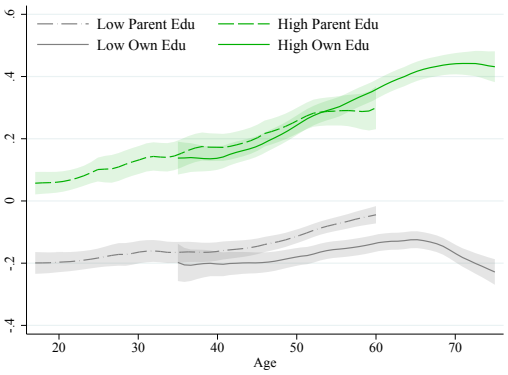
Figure 3 shows average traits by age of the respondent, classified into above/below median own income or parental income.[12] Generally, Fig. 3 replicates education inequalities in personality as shown in Fig. 2. Interestingly, while we find larger education gaps than income gaps for two traits - Openness and Agreeableness - we find that income gaps are larger than education gaps for the three remaining traits - Conscientiousness, Neuroticism, and Extraversion. Openness to Experience (Fig. 3a) thus shows much less difference by income than education, but the gap is still widening over time, especially in the first two facets. This widening gap is comparable to the widening education gap. Again, there are no income gradients in Conscientiousness (Fig. 3b), with the exception of Productiveness. In contrast to the education gradient, we find no income gradient in Agreeableness anywhere in the life cycle (Fig. 3d), with the exception of the facet Compassion, for which a gap emerges from 45. This difference is unsurprising, given that the literature has found a positive association of Agreeableness with academic performance and attainment, and a negative association with wages.

The income gaps for Extraversion are similar to the gaps by education (Fig. 3c); they mirror a large and persistent gap with high-income earners scoring much higher on Extraversion. At high ages, past age 60, we observe a narrowing of this gap (especially in Energy Level). Age trends by income are similar to those by education (Fig. 3e), but the gap between income groups is more sizable than between education groups.

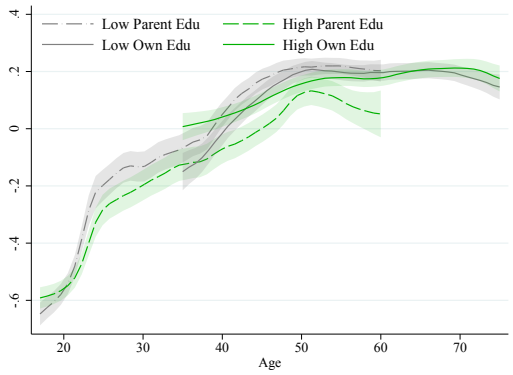
[12] Own income is defined as total personal income including transfers, in Danish crowns (DKK). Parental income represents the sum of the biological parents' total personal incomes including transfers. If a parent is not identified in the data (or income data is not available), this income is simply counted as zero.

Figure 2: Education Inequalities in Personality over the Life Cycle (in Standard Deviations)

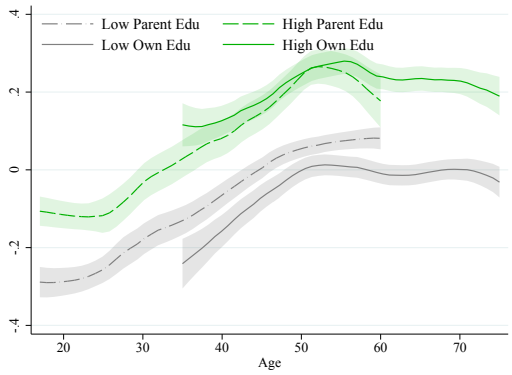
(a) Openness



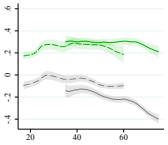
(b) Conscientiousness



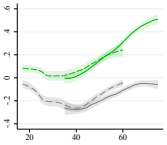
(c) Extraversion



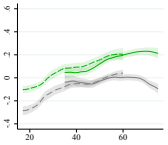
Intellectual Curiosity



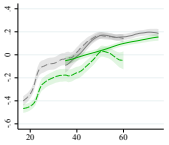
Aesthetic Sensitivity



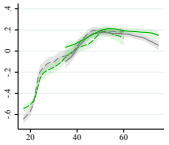
Creative Imagination



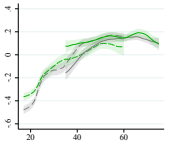
Organization



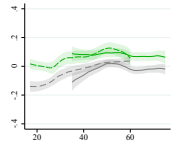
Productiveness



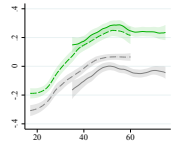
Responsibility



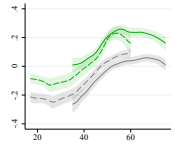
Sociability



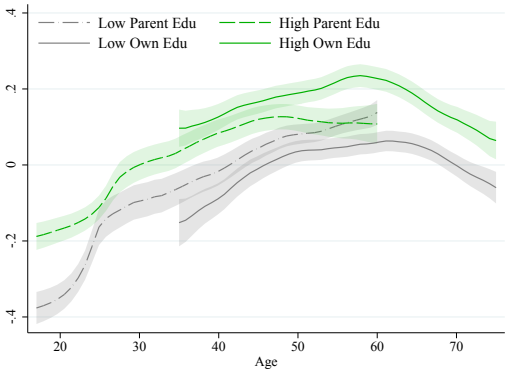
Assertiveness



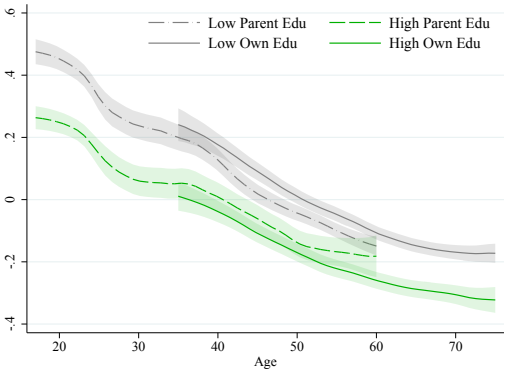
Energy Level



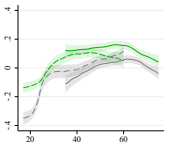
(d) Agreeableness



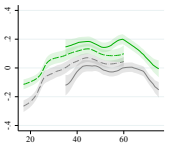
(e) Neuroticism



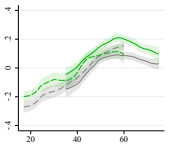
Compassion



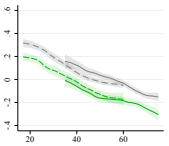
Respectfulness



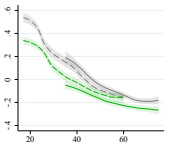
Trust



Anxiety



Depression



Emotional Volatility

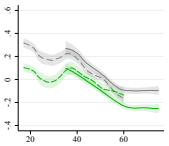
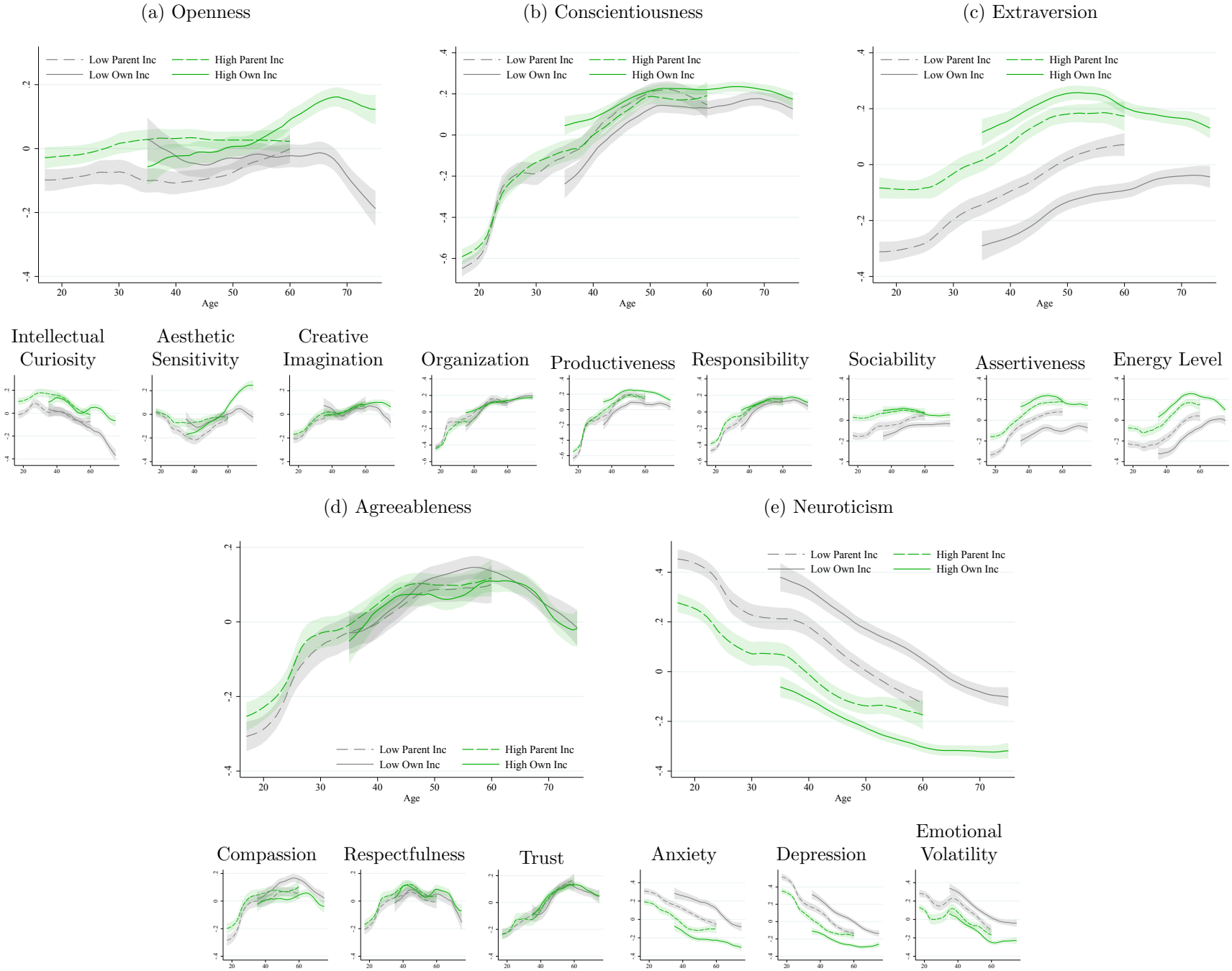


Figure 3: Income Inequalities in Personality over the Life Cycle (in Standard Deviations)



4.5 Controlling for Age, Cohorts and Time Effects

Although we interpret personality profiles over age groups in the survey as evidence of changes in personality as people age, these patterns can reflect, at least partially, differences in personality by birth cohorts. The problem of identifying age, period and cohort effects is well known in the literature discussing the so-called apc model ("apc" for age, period and cohort) (Browning et al., 2012; Clark, 2007; Deaton and Paxson, 1994; Dohmen et al., 2017; Heckman and Roeb, 1985; Kapteyn et al., 2005). The interest in this literature lies in separating, for some outcome of interest, the influences of aging processes, the period of observation, and the cohort (date of birth) of the individual in question. As our data contains only one wave so far, we cannot follow individuals over time, and there is only one period of observation. As age is by definition a perfect linear combination of birth year and survey year, even with panel data, it is impossible to identify age profiles (Heckman and Roeb, 1985).

Given that our period is fixed (one wave of the survey), our challenge is to identify variation in personality traits that is due to the ageing process, separately from variation that is due to effects attributable to one's birth cohort. In dealing with cohort effects, the previous literature has suggested different approaches to achieve identification of the other effects. One solution may be to place restrictions on some of the parameters to achieve identification. As explained by Browning et al. (2012), we only need one restriction to achieve identification. In fact, one may be able to achieve identification with rather weak assumptions, for example assuming that the effects of two adjacent cohorts are the same, which is a strong assumption. A more practical solution is to abandon the nonparametric model and parameterize some of the explanatory variables. This approach relies on finding suitable proxies for cohort-specific factors. For example, it has been established in the literature that initial conditions experienced in childhood and adolescence can have long-lasting effects on beliefs (see e.g. Giuliano and Spilimbergo (2013). Proxies for cohort effects that have previously been used in the literature include unemployment rates when the subject was 18 (Schwandt and von Wachter, 2019), inflation rates (Dohmen et al., 2017) for the identification of age-dependency in risk attitudes, and GDP growth rates (Kapteyn et al., 2005).

In order to disentangle age from cohort effects, we investigate to which extent cohort characteristics may explain the variation we find over age groups, by controlling for some of the cohort proxies that have been used in previous papers. Specifically, we regress the

five higher-order personality traits on two specific cohort controls: average unemployment rate and average GDP growth rate, both measured in the year the person turned 18. As Fig. S.1 shows, there is sufficient variation in these macroeconomic conditions across the birth cohorts. We then plot the standardized residuals against age.[13]

Figure 4 and Fig. 5 contrast the age profiles with and without cohort controls. Controlling for each of these two cohort measures in turn, changes to a small degree the age-personality profiles in three out of five personality traits. While age-gradients in Openness to Experience and Neuroticism remain unaffected by cohort controls, age gradients in Conscientiousness, Extraversion, and Agreeableness controlled for cohort effects increase somewhat less steeply in middle age. Yet our broad conclusions on the age profiles by gender and socioeconomic status remain the same. Thus, under the strong assumption that macroeconomic conditions are a reliable and sufficient proxy for cohort effects, we could argue that the age-personality profiles that we observe represent true life-cycle maturation process.

Obviously, it is possible that other cohort proxies than macroeconomic conditions may lead to a different outcome. Our approach does not deliver bullet-proof evidence that the variation in personality traits that we observe over age is entirely an age effect. As the apc model explains, due to the linear relationship between age, period and cohorts, we may essentially be capturing a combination of an age and cohort effect (Heckman and Roeb, 1985). Yet, even if we had access to panel data, we would experience an identification problem as we would then have to control for period effects as well. But when we control for factors that should influence cohorts' initial levels of traits when entering adulthood, there is still a clear age profile to be observed. This additional variation over cohorts is consistent with e.g. Donnellan and Lucas (2008).

[13] Available upon request are the regression results of this first-stage regression. We find significant but modest effects of these business-cycle-related proxies measured at age 18 for all five traits. For Conscientiousness, Extroversion, Agreeableness and Neuroticism, unemployment and GDP growth rates recorded at age 18 have the same signs, being positively associated with Conscientiousness, Extroversion and Agreeableness, and negatively related with Neuroticism. Openness is negatively related to unemployment rates and positively related to GDP growth rates. Numerically, the effects of unemployment and GDP growth rates at 18 are very small compared to the effects of being one year older. We tested for different measures of the unemployment rate; e.g. including a gender specific unemployment rate instead of the average unemployment rate. And we tested different functional forms, e.g. including a quadratic term of the unemployment rate. Neither of these variations changed the overall picture.

Figure 4: Gender Inequalities in Personality over the Life Cycle (in Standard Deviations), Controlling for Cohort Effects with Macroeconomic Proxies

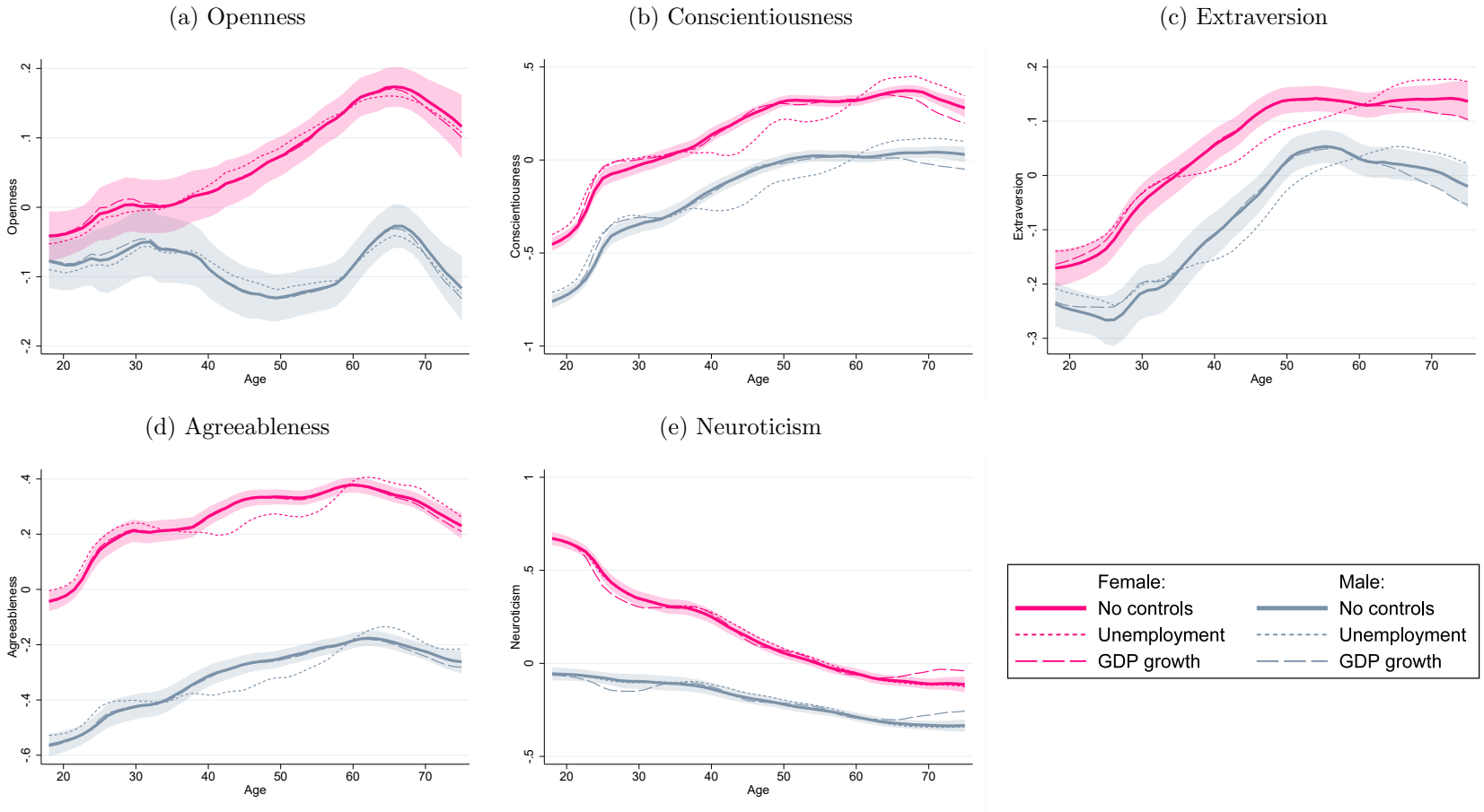
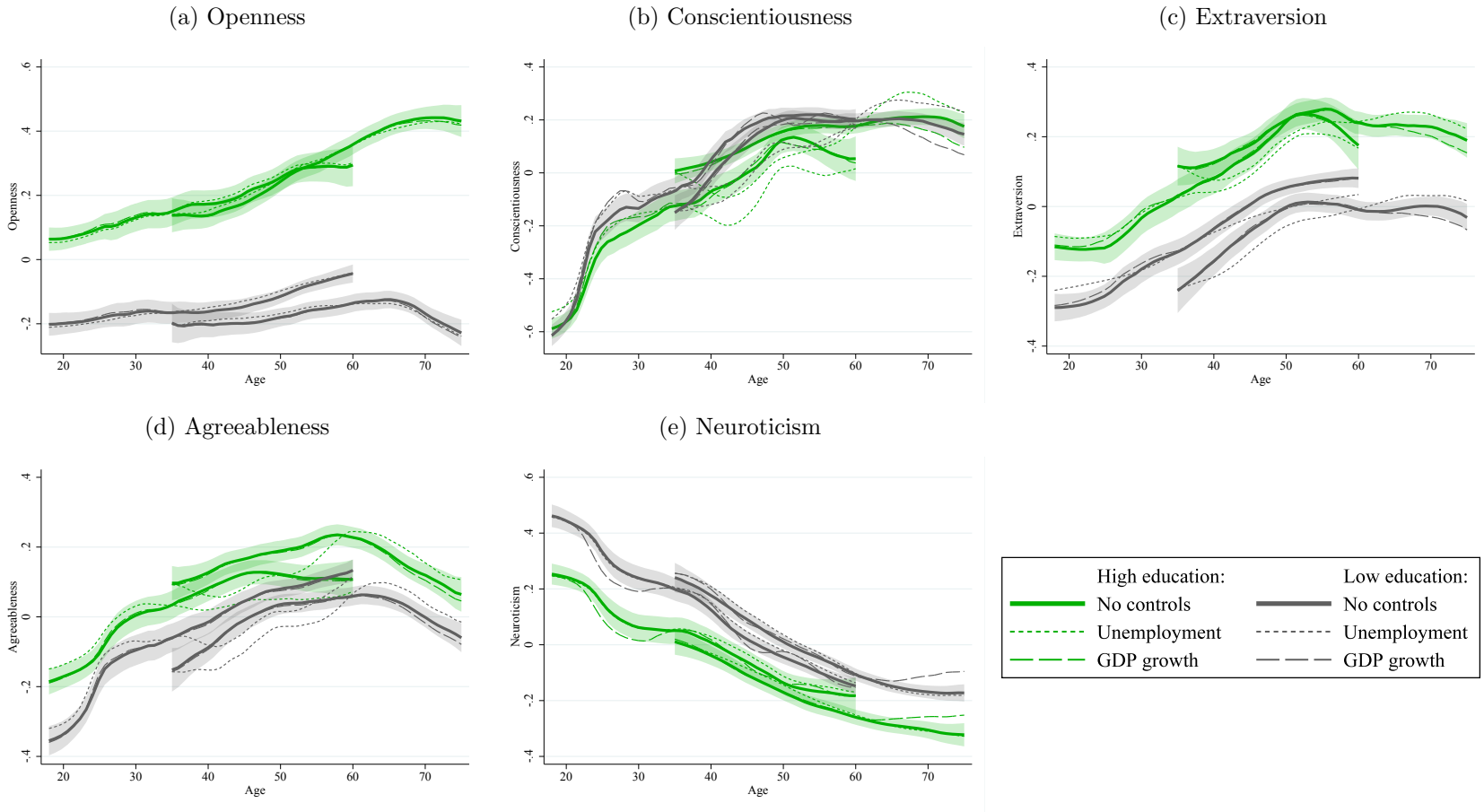


Figure 5: Education Inequalities in Personality over the Life Cycle (in Standard Deviations), Controlling for Cohort Effects with Macroeconomic Proxies



4.6 Controlling for Sample Selection

Even though our baseline sample that was invited to participate in the survey was extraordinarily large and truly representative of the population, our estimates can only represent population-wide age patterns to the extent that they are not biased because of self-selection into our voluntary survey. Yet we can provide evidence that the age-and-SES gradients we observe are not driven by selection into the sample.

Our data allows us to easily estimate selection into participation on the basis of observable covariates, because we have administrative records on all individuals who were invited to participate, regardless of survey completion status. We thus construct inverse probability weights for participation by age, using information on: own/parents income and education, number of siblings, whether an individual is married or cohabiting, the number of days admitted to a hospital in the past year, and the number of times individuals visited their general practitioner.

Section S.2 shows that selection into our survey sample is standard, and as is observed in other surveys: individuals are more likely to participate if they are female, of Danish origin, more highly educated, live more stable lives (as proxied here with cohabiting), and have a greater interest in health, but not if they are in bad health.

While it is inherently impossible to control for the role of personality traits in the selection into the survey, one would expect personality traits to be correlated with the covariates we have controlled for. Therefore, the role of personality can only indirectly be taken into account, yet given the breadth of types of background characteristics that are observed, a large component of this should be incorporated already.

We thus adjust for non-response by re-weighting our respondent sample to reflect the representative population in terms of a wide array of important covariates. Adjusting the average traits by age for selection into the sample does *not* alter the life-cycle profile of these traits. The gradients by gender, income, or education are all virtually unchanged. These results are reported in Figs. S.2 to S.4 and Tables S.12 to S.15.

5 Discussion and Conclusion

In this study, we provide a comprehensive analysis of the dynamics of personality over the life course. We document inequalities in personality traits across gender and socioeconomic groups. Our findings produce a collection of stylized facts. First, we find large

and significant gender gaps in all personality traits of the Big Five (and most facets)—with women scoring more highly on all of them. Thus, while women score more highly on Conscientiousness, Extraversion, and Openness, – traits that are usually considered to be positively correlated with SES – they also score more highly in Agreeableness and Neuroticism, traits negatively associated with wages. Gender-personality gradients are observed at almost every stage of the life cycle. Second, we find large and significant SES gaps in personality over the entire life cycle—regardless of whether SES is measured with parental background or own education and income. Higher SES is associated with stronger non-cognitive skills (higher scores on Openness to Experience, Extraversion, and Agreeableness, lower scores on Neuroticism). Yet one dimension shows no gap by either education or income: Conscientiousness. Third, most of the inequalities by gender and SES remain constant over the life cycle, with only two exceptions, Openness to Experience and Neuroticism.

Socioeconomic inequalities in personality traits have important economic implications, as there are significant education and labor market returns to many of these skills. Observing how skills are unevenly distributed in the population, and differentially so by age, enhances our understanding of the sources of inequality. These findings also relate to social immobility, because of the aforementioned returns. Personality gaps by parental and own SES tell us different stories. Observed gaps by *parental* education and income demonstrate the long shadow that parental disadvantage can cast over a child's skill development, under the reasonable assumption that child personality does not cause parental SES. Personality gaps by *own* SES inform us about the degree of association between adulthood personality and SES, as a function of the past. The gaps by own and parental SES combined inform us about intergenerational transmission of disadvantage. Demonstrating inequalities in these traits in both late adolescence, when they are largely the result of parental background, and at later stages of the life course, when they are associated with own circumstances, may explain why economic inequalities persist over the life course and across generations. Our study cannot comment on why we find socioeconomic inequalities in personality by late adolescence and why they remain present or widen over the life cycle. However, previous research suggests that late-adolescence inequalities in personality result from socioeconomic inequalities in parenting styles and behaviors rooted in childhood (Elkins and Schurer, 2020; Falk et al., 2020).

Consider Openness to Experience, which is linked to intelligence (Ackerman and

Heggestad, 1997; Aitken Harris, 2004; Schretlen et al., 2010) and greater propensities to graduate from college for disadvantaged populations (Lundberg, 2013). Openness to Experience displays a significant widening of inequalities by both gender and socioeconomic markers over the life cycle. Because of its associations with intelligence and therefore cognitive functioning, our findings suggest that both women in general and individuals with higher levels of education or income are better equipped to adapt to the aging process itself and the multitude of social and economic changes associated with approaching retirement.

Finding no SES gap in Conscientiousness or any of its facets is surprising. Often termed a super-trait, it is the one trait most strongly associated with academic and job performance, earnings, and favorable health outcomes (Roberts et al., 2014)—outcomes that have strong socioeconomic gradients. A recent study from Norway suggested that adaptability – a facet of Conscientiousness – strongly predicts migration decisions, especially among men from disadvantaged backgrounds (Bütikofer and Peri, 2020). However, we can think of some explanations for us finding no significant SES gap in Conscientiousness: A first potential explanation is measurement error occurring e.g. if individuals from different socioeconomic backgrounds simply use different anchors against which they compare themselves when asked about their dependability. For instance, it is possible that individuals from better education backgrounds rate themselves more humbly, while individuals from poorer education backgrounds may exaggerate their self-assessments (West et al., 2016). Yet, Conscientiousness is not the only socially desirable trait that would be subject to biased reporting. Thus, we would expect the same mechanism of under-reporting of more humble individuals in advantaged settings for other personality traits. A second explanation is that, even if socioeconomic gradients in Conscientiousness emerge early in life, public education institutions may compensate for such gradients by training school students in facets of Conscientiousness. Although our study cannot answer these questions, our findings illustrate the complexity of assessing personality and identifying its predictors.

Many of the **life-cycle patterns** we find are closely aligned with evidence produced in the personality psychology literature. As individuals age, they tend to become more agreeable and conscientious, and less neurotic (Allemand et al., 2008; Denissen et al., 2008; Donnellan and Lucas, 2008; Hopwood et al., 2011; McCrae et al., 1999, 2000; McGue et al., 1993; Roberts et al., 2006; Soto et al., 2011; Srivastava et al., 2003;

Terracciano et al., 2005; Vaidya et al., 2008). We also replicate the finding that Conscientiousness, Agreeableness and Neuroticism have their steepest growth or decline rates before the age of 30 (Hopwood et al., 2011; Pullmann et al., 2006; Roberts and DelVecchio, 2000; Terracciano et al., 2005). Other findings differ. In our setting, Openness to Experience follows an unusual path of lifelong growth for women and individuals with high socioeconomic status (SES). The same is found for Extraversion, even though the literature reports a flat or a declining age profile in Extraversion over the life course (e.g. Donnellan and Lucas, 2008; Soto et al., 2011; Srivastava et al., 2003).

When considering **life-cycle patterns by gender** separately, we also contribute relative to the previous literature. We find gender differences in the maturation process of two personality traits, although much of the literature does not (Branje et al., 2007; Donnellan and Lucas, 2008; Klimstra et al., 2009; Roberts et al., 2001; Soto et al., 2011; Srivastava et al., 2003). Roberts et al. (2006) suggested that "there is very little support for the idea that men and women change in distinct ways" over the life course (p. 15). Yet, we find that gender moderates the age-personality profile for Neuroticism and Openness to Experience. Our gender differences in the age profiles of personality are similar to Soto et al. (2011), and Srivastava et al. (2003), who find that Neuroticism declines strongly for women over the life cycle and is flat for men, but they not comment on this finding. In fact, women appear to be heavily disadvantaged early in life, as their Neuroticism scores are almost 0.75 standard deviations higher than for men in late adolescence, a time where important human capital decisions are being made. Over the life course, gender inequality in Neuroticism shrinks continuously until it stabilizes at 0.2 standard deviations. Although true for all facets of Neuroticism, the converging age profiles are most remarkable for Emotional Volatility. Another intriguing finding is that while men and women start out with the same levels of Openness to Experience in late adolescence, women grow in their Openness to Experience over the life course, whereas men remain more or less on the same level. Men and women do not differ in their Creative Imagination, but in their Aesthetic Sensitivity and their Intellectual Curiosity, all facets of Openness. Women are protected against the steep declines in Intellectual Curiosity over the life course, which we observe for men.

Although our findings must be understood as description of what is, they allow some speculation on their economic implications. We focus in this discussion on gender wage gaps, household production models, and optimal taxation.

Gender gaps in earnings are thought to reflect, among others, gaps in skills. But as we demonstrate, women score more highly on three traits that the literature considers as productive—raising the question of why there is still a gender gap in earnings. Extraversion, for instance, has high labor market returns (e.g. Gensowski, 2018; Heineck and Anger, 2010; Mueller and Plug, 2006). Considering the emergence of automation and artificial intelligence (Deming, 2017), the importance of the female advantage in the "soft skills" of Conscientiousness, Extraversion, and Openness should only grow in importance in today's labor markets, which should close the gender gap in earnings. Two factors may counteract this trend: First, women also score more highly in Neuroticism and Agreeableness, which are negatively associated with wages. There is evidence for men and women reaping differential returns of personality traits (Mueller and Plug, 2006), which would prevent a gender gap from closing. Bertrand (2020) argues that gender norms and stereotypes may explain differential behavior of men and women. Not only is it likely that men and women adjust their self-view to what seems appropriate for their gender group, thus internalizing gender norms into their preferences and thereby indirectly affecting behaviors. Stereotypes may also directly affect behaviors and choices because of the social and reputational costs of deviating from group norms. This is consistent with Akerlof and Kranton's influential model of identity influencing economic outcomes to avoid costly deviations from the prescribed behavior (Akerlof and Kranton, 2000). Gender norms and stereotypes may even explain why women consistently avoid selecting into high-wage STEM education, despite a general rise in educational levels.

Household production naturally follows as a discussion from the observation on gender gaps in wages. Observing that women score more highly on productive traits should, all else equal, result in relatively higher wages for women in the labor market, thus making her time spent in home production relatively more expensive. Of course, the division of labor in the household in classical models (following Becker, 1973) will reflect *relative* price/productivity differences. Thus, if on average women still have a comparative advantage in home production, changes in the returns to soft skills may not be enough to reverse the well-known patterns. But recall that the division of labor is the result of specialization in the two sectors (home and market) on the basis of potentially very small initial productivity differences. These only lead to larger productivity differences and a stark sexual division of labor through subsequent investments in market- or household-specific human capital. Now we have demonstrated very large differences in

Neuroticism and its facets *at the start* of productive life. These differences could lead women to under-invest in education and market-specific human capital, and over time translate to a lower likelihood of having a comparative advantage in the market relative to men, who did not suffer from these early challenges. The division of labor later in life will reflect the large, early gaps to a greater extent than the actual smaller gaps in Neuroticism during prime earning years. On the other hand, women's wage potential increases over the life cycle with decreasing Neuroticism and increasing Openness to Experience levels. As home and outside labor markets are interconnected, an increase in the value of women's time could lead to a renegotiation of the marital contract or ultimately to divorce (Grossbard-Shechtman, 1984).

Optimal taxation and transfer systems could incorporate knowledge of gender inequalities in innate abilities, such as personality, over the life cycle. Women experience high psychic costs in late adolescence due to excessively high levels of Emotional Volatility, Depression, and Anxiety, all facets of Neuroticism, which are likely to reduce their investment in human capital and participation in the labor market. Public policy should create incentives for young women in their sensitive years when making important educational and career choices. Understanding the role of socio-emotional traits and how these interact with gender roles and norms may be crucial in explaining the gender wage gap (Bertrand, 2020). Men, on the other hand, face high ability inequalities in late adulthood due to hefty declines in Intellectual Curiosity, a facet of Openness to Experience. Under the assumption that Intellectual Curiosity is critical in learning and training, men are less likely to adjust to changing labor markets in older age and the sensitive period of retirement.

The policy maker could use the tax and transfer system to create such incentives. A standard utilitarian framework for tax analysis suggests that personal attributes correlated with wages should be considered more widely for determining taxes (see Mankiw et al., 2009). What is referred to in the literature as "tagging", means that all information on innate ability should be used to identify "groups of persons who are on the average needy" (Akerlof, 1978, p. 8). A system of tagging permits tax credits for needy persons, and tax surcharges for less needy persons. Previous literature on optimal taxation models propose discrimination in marginal tax rates by gender (Alesina et al., 2011), age (Weinzierl, 2011), or other exogenous characteristics such as height (Mankiw and Weinzierl, 2010). Personality traits are a critical component of people's innate abilities

and they are associated with wages. Our results are thus consistent with the idea of providing tax credits for women early in their career and for men late in their career, and tax surcharges for women later and for men early in their career.

References

Ackerman, P. and E. Heggestad (1997). Intelligence, Personality, and Interests: Evidence for Overlapping Traits. *Psychological Bulletin 121*(2), 219–245.

Aitken Harris, J. (2004). Measured intelligence, achievement, openness to experience, and creativity. *Personality and Individual Differences 36*(4), 913 – 929.

Akerlof, G. (1978). The Economics of 'Tagging' as Applied to the Optimal Income Tax, Welfare Programs, and Manpower Planning. *The American Economic Review 68*(1), 8–19.

Akerlof, G. and R. Kranton (2000). Economics and Identity. *The Quarterly Journal of Economics 115*(3), 715–53.

Alesina, A., A. Ichino, and L. Karabarbounis (2011). Gender-Based Taxation and the Division of Family Chores. *American Economic Journal: Economic Policy 3*(2), 1–40.

Allemand, M., D. Zimprich, and A. A. J. Hendriks (2008). Age Differences in the Big Five Across the Life Span: Evidence from Two National Samples. *Developmental Psychology 44*, 758–770.

Almlund, M., A. L. Duckworth, J. J. Heckman, and T. Kautz (2011). Personality Psychology and Economics. In E. A. Hanushek, S. Machin, and L. Woessmann (Eds.), *Handbook of the Economics of Education, Vol. 4*, Volume 4, Chapter 1, pp. 1–181. Elsevier B.V.

Anusic, I., R. E. Lucas, and M. B. Donnellan (2012). Cross-sectional age differences in personality: Evidence from nationally representative samples from Switzerland and the United States. *Journal of Research in Personality 46*, 116–120.

Attanasio, O., R. Blundell, G. Conti, and G. Mason (2020). Inequality in socio-emotional skills: A cross-cohort comparison. *Journal of Public Economics 96*(4), 898–912.

Becker, A., T. Deckers, T. Dohmen, A. Falk, and F. Kosse (2012). The Relationship Between Economic Preferences and Psychological Personality Measures. *Annual Review of Economics 4*, 453–478.

Becker, G. S. (1973). A Theory of Marriage: Part I. *Journal of Political Economy 81*(4), 813–846.

Bertrand, M. (2020). Gender in the Twenty-First Century. *American Economic Review: Papers & Proceedings 110*, 1–24.

Bigoni, M., S. Bortolotti, M. Cesari, D. Gembetta, and F. Pancotto (2016). Amoral Familism, Social Capital, or Trust? The Behavioural Foundations of the Italian North-South Divide. *The Economic Journal 126*, 1318–1341.

Bleidorn, W. (2012). Hitting the Road to Adulthood: Short-Term Personality Development During a Major Life Transition. *Personality and Social Psychology Bulletin 38*(12), 1594–1608.

Bleidorn, W., T. A. Klimstra, J. J. A. Denissen, P. J. Rentfrow, J. Potter, and S. D. Gosling (2013). Personality Maturation Around the World: A Cross-Cultural Examination of Social-Investment Theory. *Psychological Science 24*(12), 2530–2540.

Borghans, L., A. L. Duckworth, H. J. J., and B. ter Weel (2008). The Economics and Psychology of Personality Traits. *The Journal of Human Resources 3*(4), 972–1059.

Borghans, L., B. H. Golsteyn, J. J. Heckman, and H. Meijers (2009). Gender differences in risk aversion and ambiguity aversion. *Journal of the European Economic Association 7*(2-3), 649–658.

Borkenau, P., R. Riemann, F. Spinath, and A. Angleitner (2001). Genetic and environmental influences on observed personality: Evidence from the German Observational Study of Adult Twins. *Journal of Personality and Social Psychology 80*, 655–668.

Bowles, S., H. Gintis, and M. Osborne (2001a). Incentive-Enhancing Preferences: Personality, Behavior, and Earnings. *The American Economic Review 91*(2), 155–158.

Bowles, S., H. Gintis, and M. Osborne (2001b). The Determinants of Earnings: A Behavioral Approach. *Journal of Economic Literature 39*(4), 1137–1176.

Branje, S., C. Vam Lieshout, and R. Gerris (2007). Big Five Personality Development in Adolescence and Adulthood. *European Journal of Personality 21*(1).

Browning, M., I. Crawford, and M. Knoef (2012). The age-period cohort problem: set identification and point identification. *cemmap working paper* (02).

Bütikofer, A. and G. Peri (2020). How Cognitive Ability and Personality Traits Affect Geographic Mobility. *Journal of Labor Economics* (forthcoming).

Cameron, L., N. Erkal, L. Gangadharan, and X. Meng (2013). Little Emperors: Behavioral Impacts of China's One-Child Policy. *Science 339*(6122), 953–957.

Card, D. (2001). Estimating the Return to Schooling: Progress on Some Persistent Econometric Problems. *Econometrica 69*(5), 1127–1160.

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

Clark, A. (2007). Born To Be Mild? Cohort Effects Don't (Fully) Explain Why Well-Being is U-Shaped in Age. *IZA Discussion Paper* (3170).

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

Cobb-Clark, D. A. and M. Tan (2011). Noncognitive skills, occupational attainment, and relative wages. *Labour Economics 18*(1), 1–13.

Cubel, M., A. Nuevo-Chiquero, S. Sanchez-Pages, and M. Vidal-Fernandez (2016). Do Personality Traits Affect Productivity? Evidence from the Lab. *The Economic Journal 126*(May), 654–681.

Cunha, F. and J. J. Heckman (2009). The Economics and Psychology of Inequality and Human Development. *Journal of the European Economics Association 7*(2-3), 320–364.

Deaton, A. S. and C. H. Paxson (1994). Saving, Growth, and Aging in Taiwan. In D. A. Wise (Ed.), *Studies in the Economics of Aging*, Number January, Chapter 9, pp. 331–362. University of Chicago Press.

Deming, D. J. (2017). The Growing Importance of Social Skills in the Labor Market. *Quarterly Journal of Economics 132*(4), 1593–1640.

Denissen, J. J. A., R. Geenen, M. A. G. van Aken, S. D. Gosling, and J. Potter (2008). Development and Validation of a Dutch Translation of the Big Five Inventory (BFI). *Journal of Personality Assessment 90*, 152–157.

Dohmen, T., A. Falk, B. Golsteyn, D. Huffman, and U. Sunde (2017). Risk Attitudes Across The Life Course. *Economic Journal 127*(605), F95–F116.

Dohmen, T., A. Falk, D. Huffman, and U. Sunde (2008). Representative trust and reciprocity: Prevalence and determinants. *Economic Inquiry 46*(1), 84–90.

Dohmen, T., A. Falk, D. Huffman, and U. Sunde (2010). Are Risk Aversion and Impatience Related to Cognitive Ability? *The American Economic Review 100*(3), 1238–1260.

Donnellan, M. B. and R. E. Lucas (2008). Age Differences in the Big Five Across the Life Span: Evidence From Two National Samples. *Psychology and Aging 23*, 558–566.

Dupuy, A. and A. Galichon (2014). Personality Traits and the Marriage Market. *Journal of Political Economy 122*(6), 1271–1319.

Edwards, R., R. Gibson, C. Harmon, and S. Schurer (2020). First in their families at university: Can skills compensate for social origin? unpublished manuscript, University of Sydney.

Elkins, R., S. Kassenboehmer, and S. Schurer (2017). The stability of personality traits in adolescence and young adulthood. *Journal of Economic Psychology 60*, 37–52.

Elkins, R. and S. Schurer (2020). Exploring the role of parental engagement in non-cognitive skill development over the lifecourse. *Journal of Population Economics 33*, 957–1004.

Engelmann, J. B., B. Schmid, C. K. W. De Dreu, J. Chumbley, and E. Fehr (2019). On the psychology and economics of antisocial personality. *Proceedings of the National Academy of Sciences 116*(26), 12781–12786.

Falk, A., F. Kosse, P. Pinger, H. Schildberg-Hörisch, and T. Deckers (2020). Socio-economic status and inequalities in children's IQ and economic preferences. *Journal of Political Economy Forthcoming.*

Fletcher, J. and S. Schurer (2017). Origins of adulthood personality: The role of adverse childhood experiences. *B.E. Journal of Economic Analsys & Policy 17*(2).

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

Gensowski, M. (2018). Personality, IQ, and Lifetime Earnings. *Labour Economics 51*, 170–183.

Giuliano, P. and A. Spilimbergo (2013). Growing up in a Recession. *The Review of Economic Studies 81*(2), 787–817.

Goldberg, L. R. (1992). The Development of Markers for the Big-Five Factor Structure. *Psychological Assessment 4*(1), 26.

Gronau, R. (2010). Zvi Griliches's contributions to the economics of technology and growth. In *Contributions in Memory of Zvi Griliches*, pp. 275–297. National Bureau of Economic Research.

Grossbard-Shechtman, A. (1984). A Theory of Allocation of Time in Markets for Labour and Marriage. *The Economic Journal 94*(376), 863–882.

Haan, N., R. Millsap, and E. Hartka (1986). As time goes by: Change and stability in personality over fifty years. *1*, 220–232.

Heckman, J. J. (2000). Policies to foster human capital. *Research in Economics 54*(1), 3–56.

Heckman, J. J. and R. Roeb (1985). *Cohort Analysis in Social Research: Beyond the Identification Problem.* New York: Springer Verlag.

Heckman, J. J., J. Stixrud, and S. Urzua (2006). The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior. *Journal of Labor Economics 24*(3), 411–482.

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

Helson, R., C. Jones, and V. S. Y. Kwan (2002). Stability and change in personality: A longitudinal study from early adolescence to young adulthood. *Journal of Personality and Social Psychology 83*, 752–766.

Hilbig, B. E., A. Gloeckner, and I. Zettler (2014). Personality and prosocial behavior: Linking basic traits and social value orientations. *Journal of Personality and Social Psychology 107*(3), 529–539.

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

John, O. P. and S. Srivastava (1999). The Big Five Trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin and O. P. John (Eds.), *Handbook of personality: Theory and research*, pp. 102–139. New York: Guilford Press.

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

Kapteyn, A., R. Alessie, and A. Lusardi (2005). Explaining the wealth holdings of different cohorts: Productivity and Social Security. *European Economic Review* (49), 1361–1391.

Kassenboehmer, S., F. Leung, and S. Schurer (2018). University education and noncognitive skill development. *Oxford Economic Papers 70*(2), 538–562.

Kern, M., H. Friedman, L. Martin, C. Reynolds, and G. Luong (2009). Conscientiousness, Career Success, and Longevity: A Lifespan Analysis. *Annals of Behavioral Medicine 37*, 154–163.

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

Krueger, R., S. South, W. Johnson, and W. Iacono (2008). The Heritability of Personality is not Always 50%: Gene-Environment Interactions and Correlations between Personality and Parenting. *Journal of Personality 76*(6), 1485–1521.

Lindqvist, E. and R. Vestman (2011). The Labor Market Returns to Cognitive and Noncognitive Ability: Evidence from the Swedish Enlistment. *American Economic Journal: Applied Economics 3*, 101–128.

Lundberg, S. (2012). Personality and Marital Surplus. *IZA Journal of Labor Economics 1*(3).

Lundberg, S. (2013). The College Type: Personality and Educational Inequality. *Journal of Labour Economics 31*(3), 421–441.

Lundberg, S. (2018). Non-Cognitive Skills as Human Capital. In C. R. Hulten and V. A. Ramey (Eds.), *Education, Skills, and Technical Change: Implications for Future US GDP Growth*, pp. 219–243. NBER/CRIW: University of Chicago Press.

Mankiw, N. G. and M. Weinzierl (2010). The Optimal Taxation of Height: A Case Study of Utilitarian Income Redistribution. *American Economic Journal: Economic Policy 2*(1), 155–176.

Mankiw, N. G., M. Weinzierl, and D. Yagan (2009, December). Optimal Taxation in Theory and Practice. *Journal of Economic Perspectives 23*(4), 147–74.

McCrae, R. R., P. T. Costa, M. P. de Lima, A. Simoes, F. Ostendorf, and A. Angleitner (1999). Age differences in personality across the adult life span: Parallels in five cultures. *Developmental Psychology 35*, 466–477.

McCrae, R. R., P. T. Costa, F. Ostendorf, A. Angleitner, M. Hrebickova, and M. D. Avia (2000). Nature over nurture: Temperament, personality, and life span development. *Journal of Personality and Social Psychology 78*, 173–186.

McCrae, R. R. and P. T. J. Costa (1999). A Five-Factor theory of personality. In A. Pervin and O. P. John (Eds.), *Handbook of personality: Theory and research*, pp. 139–153. New York: Guilford.

McCrae, R. R. and P. T. Costa Jr. (1996). Toward a new generation of personality theories: Theoretical contexts for the five-factor model. In J. S. Wiggins (Ed.), *The five-factor model of personality: Theoretical perspectives*, pp. 51–87. New York: Guilford Press.

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

Mueller, G. and E. Plug (2006). Estimating the Effect of Personality on Male and Female Earnings. *Industrial and Labor Relations Review 60*(1), 3–22.

Noftle, E. E. and R. W. Robins (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. and E. Pons (2005). The effects of personality on earnings. *Journal of Economic Psychology 26*, 363–384.

Petrongolo, B. and M. Ronchi (2020). Gender Gaps and the Structure of Local Labor Markets. IZA Discussion Paper 13143, Institute of Labor Economics.

Post, S. G. (2005). Altuism, Happiness, and Health: It's Good to Be Good. *International Journal of Behavioural Medicine 12*, 66–77.

Pullmann, H., L. Raudsepp, and J. Allik (2006). Stability and Change in Adolescents' Personality: A Longitudinal Study. *European Journal of Personality 20*(6), 447–459.

Roberts, B. W., A. Caspi, and T. E. Moffitt (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. and W. F. DelVecchio (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., C. Lejuez, R. F. Krueger, J. M. Richards, and P. L. Hill (2014). What is conscientiousness and how can it be assessed? *Developmental Psycholgy 50*(5), 1315–1330.

Roberts, B. W. and D. Mroczek (2008). Personality Trait Change in Adulthood. *Current Directions in Psychological Science* (17), 31–35.

Roberts, B. W., K. E. Walton, and W. Viechtenbauer (2006). Patterns of Mean-Level Change in Personality Traits Across the Life Course: A Meta-Analysis of Longitudinal Studies. *Psychological Bulletin 126*(1), 3–25.

Schretlen, D., E. van der Hulst, G. Pearlson, and B. Gordon (2010). A Neuropsychological Study of Personality: Trait Openness in Relation to Intelligence, Fluency, and Executive Functioning. *Journal of Clinical and Experimental Neuropsychology 32*, 1068–1073.

Schurer, S. (2017). Does education strengthen life skills of adolescents? *IZA World of Labor 366*(June).

Schwaba, T. and W. Bleidorn (2018). Individual Differences in Personality Change Across the Adult Life Span. *Journal of Personality 86*, 450–464.

Schwaba, T. and W. Bleidorn (2019). Personality Trait Development Across the Transition to Retirement. *Journal of Personality and Social Psychology 116*(4), 651–665.

Schwaba, T., J. J. A. Denissen, J. M. Chung, M. Luhmann, and W. Bleidorn (2018). Openness to Experience and Culture-Openness Transactions Across the Lifespan. *Journal of Personality and Social Psychology 115*(1), 118–136.

Schwandt, H. and T. von Wachter (2019). Unlucky Cohorts: Estimating the Long-Term Effects of Entering the Labor Market in a Recession in Large Cross-Sectional Data Sets. *Journal of Labor Economics 37*(S1), S161–S198.

Soto, C. J. and O. P. John (2017a). Short and extra-short forms of the Big Five Inventory–2: The BFI-2-S and BFI-2-XS. *Journal of Research in Personality 68*, 69–81.

Soto, C. J. and O. P. John (2017b). The Next Big Five Inventory (BFI-2): Developing and Assessing a Hierarchical Model With 15 Facets to Enhance Bandwidth , Fidelity , and Predictive Power. *Journal of Personality and Social Psychology 113*(1), 117–143.

Soto, C. J., O. P. John, S. D. Gosling, and J. Potter (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., B. Egloff, and S. C. Schmukle (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.

Srivastava, S., O. P. John, S. D. Gosling, and J. Potter (2003). Development of personality in early and middle age: Set like plaster or persistent change? *Journal of Personality and Social Psychology 84*, 1041–1053.

Terracciano, A., R. R. McCrae, L. J. Brant, and P. T. J. Costa (2005). Hierarchical Linear Modeling Analyses of the NEO-PI-R Scales in the Baltimore Longitudinal Study of Aging. *Psychology and Aging 20*, 1–25.

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

Turkheimer, E. (2000). Three Laws of Behavior Genetics and What They Mean. *Current Directions in Psychological Science 9*, 160–164.

Turkheimer, E., A. Haley, M. Waldron, B. D'Onofrio, and I. Gottesman (2003). Socioeconomic Status Modifies Heritability of IQ in Young Children. *Psychological Science 14*(6), 623–628.

Twenge, J. M. (2000). The Age of Anxiety? Birth Cohort Change in Anxiety and Neuroticism, 1952-1993. *Journal of Personality and Social Psychology 79*(6), 1007–1021.

Vaidya, J. G., E. K. Gray, J. R. Haig, D. K. Mroczek, and D. Watson (2008). Differential Stability and Individual Growth Trajectories of Big Five and Affective Traits During Young Adulthood. *Journal of Personality 76*(2), 267–304.

Vedel, A., K. B. Wellnitz, S. Ludeke, C. Soto, O. John, and S. C. Andersen (2019). Development and validation of the Danish Big Five Inventory-2: Domain- and facet-level structure, construct validity, and reliability. *European Journal of Psychological Assessment 00*.

Wand, M. and M. Jones (1995). *Kernel Smoothing*. Monographs on Statistics and Applied Probability. Chapman & Hall.

Weinzierl, M. (2011, 04). The Surprising Power of Age-Dependent Taxes. *The Review of Economic Studies 78*(4), 1490–1518.

West, M., M. Kraft, A. S. Finn, R. Martin, A. Duckworth, C. Gabrieli, and J. Gabrieli (2016). Promise and Paradox: Measuring Students' Non-Cognitive Skills and the Impact of Schooling. *Educational Evaluation and Policy Analysis 38*(1), 148–170.

Widinger, T. A. (2011). Personality and psychopathology. *World Psychiatry 10*, 103–106.

Wortman, J., R. E. Lucas, and M. B. Donnellan (2012). Stability and change in the Big Five personality domains: Evidence from a longitudinal study of Australians. *Psychology and Aging 27*(4), 867–874.

S Appendix

S.1 Descriptive Statistics

Table S.1: List of Short BFI-2 Instrument, see Soto and John (2017a)

Extraversion	Sociability	Tends to be quiet Is outgoing, sociable
	Assertiveness	Is dominant, acts as a leader Prefers to have others take charge
	Energy Level	Is full of energy Is less active than other people
Agreeableness	Compassion	Is compassionate, has a soft heart Can be cold and uncaring
	Respectfulness	Is respectful, treats others with respect Is sometimes rude to others
	Trust	Assumes the best about people Tends to find fault with others
Conscientiousness	Organization	Tends to be disorganized Keeps things neat and tidy
	Productiveness	Is persistent, works until the task is finished Has difficulty getting started on tasks
	Responsibility	Can be somewhat careless Is reliable, can always be counted on
Negative Emotionality	Anxiety	Is relaxed, handles stress well Worries a lot
	Depression	Tends to feel depressed, blue Feels secure, comfortable with self
	Emotional Volatility	Is emotionally stable, not easily upset Is temperamental, gets emotional easily
Open-Mindedness	Intellectual Curiosity	Has little interest in abstract ideas Is complex, a deep thinker
	Aesthetic Sensitivity	Is fascinated by art, music, or literature Has few artistic interests
	Creative Imagination	Has little creativity Is original, comes up with new ideas

Table S.2: Full List of BFI-2 Items, see Soto and John (2017b)

Extraversion	Sociability	Tends to be quiet Is talkative Is outgoing, sociable Is sometimes shy, introverted
	Assertiveness	Is dominant, acts as a leader Has an assertive personality Prefers to have others take charge Finds it hard to influence people
	Energy Level	Is full of energy Shows a lot of Enthusiasm Rarely feels excited or eager Is less active than other people
Agreeableness	Compassion	Is compassionate, has a soft heart Can be cold and uncaring Is helpful and unselfish with others Feels little sympathy for others
	Respectfulness	Is respectful, treats others with respect Is polite, courteous to others Is sometimes rude to others Starts arguments with others
	Trust	Assumes the best about people Has a forgiving nature Tends to find fault with others Is suspicious of others' intentions
Conscientiousness	Organization	Tends to be disorganized Is systematic, likes to keep things in order Keeps things neat and tidy Leaves a mess, doesn't clean up
	Productiveness	Is efficient, gets things done Is persistent, works until the task is finished Tends to be lazy Has difficulty getting started on tasks
	Responsibility	Can be somewhat careless Sometimes behaves irresponsibly Is reliable, can always be counted on Is dependable, steady
Negative Emotionality	Anxiety	Is relaxed, handles stress well Worries a lot Rarely feels anxious or afraid Can be tense
	Depression	Often feels sad Tends to feel depressed, blue Feels secure, comfortable with self Stays optimistic after experiencing a setback
	Emotional Volatility	Is emotionally stable, not easily upset Is temperamental, gets emotional easily Keeps their emotions under control Is moody, has up and down mood swings
Open-Mindedness	Intellectual Curiosity	Has little interest in abstract Ideas Is complex, a deep thinker Avoids intellectual, philosophical discussions Is curious about many different things
	Aesthetic Sensitivity	Is fascinated by art, music, or literature Has few artistic interests Values art and beauty Thinks poetry and plays are boring
	Creative Imagination	Has little creativity Is inventive, finds clever ways to do things Is original, comes up with new Ideas Has difficulty imagining things

Table S.3: Descriptive Statistics for Full Sample

	mean	sd
Openness	0.00	0.99
Openness, Intellectual Curiosity	0.00	1.00
Openness, Aesthetic Sensitivity	0.00	1.00
Openness, Creative Imagination	0.00	1.00
Conscientiousness	0.01	0.99
Conscientiousness, Organization	0.00	1.00
Conscientiousness, Productiveness	0.01	0.99
Conscientiousness, Responsibility	0.01	0.99
Extraversion	0.00	1.00
Extraversion, Sociability	0.00	1.00
Extraversion, Assertiveness	0.00	1.00
Extraversion, Energy Level	0.00	1.00
Agreeableness	0.00	0.99
Agreeableness, Compassion	0.00	1.00
Agreeableness, Respectfulness	0.00	0.99
Agreeableness, Trust	0.00	1.00
Neuroticism	-0.00	1.00
Neuroticism, Anxiety	0.00	1.00
Neuroticism, Depression	-0.00	1.00
Neuroticism, Emotional Volatility	-0.00	1.00
Total Parental Income	451,126.92	709,289.54
Income	330,486.84	396,990.32
Age on May 1 2020	47.37	17.59
Female	0.55	0.50
Observations	38,711	

Table S.4: Multiple Regression of Traits on Characteristics, Full Sample

	(1) Openness	(2) Intellectual Curiosity	(3) Aesthetic Sensitivity	(4) Creative Imagination
Age on May 1 2020	0.004***	-0.002***	0.005***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)
Female	0.138***	0.140***	0.169***	0.003
	(0.010)	(0.010)	(0.010)	(0.010)
Higher education	0.409***	0.417***	0.341***	0.182***
	(0.011)	(0.011)	(0.011)	(0.011)
Above-Median Income	-0.000	0.037***	-0.017	-0.015
	(0.011)	(0.011)	(0.011)	(0.011)
Constant	-0.431***	-0.191***	-0.431***	-0.309***
	(0.022)	(0.022)	(0.022)	(0.023)
Observations	38214	37956	38153	38163

Note: Multivariate regressions on personality trait and facet (standard errors in parentheses). All traits and facets are standardized to mean 0 and standard deviation 1. The sample pools all observations across all ages. Income and education variables refer to socioeconomic background of parents for sample members aged 40 or young, and to individual's own socioeconomic background for sample members older than 40. Significance levels: $^{*}(p < 0.05)$,$^{**}(p < 0.01)$,$^{***}(p < 0.001)$.

Table S.5: Multiple Regression of Traits on Characteristics, Full Sample

	(1) Conscientiousness	(2) Organization	(3) Productiveness	(4) Responsibility
Age on May 1 2020	0.014***	0.011***	0.012***	0.010***
	(0.000)	(0.000)	(0.000)	(0.000)
Female	0.340***	0.314***	0.147***	0.342***
	(0.010)	(0.010)	(0.010)	(0.010)
Higher education	-0.077***	-0.124***	-0.030**	-0.007
	(0.010)	(0.011)	(0.011)	(0.011)
Above-Median Income	0.128***	0.064***	0.151***	0.096***
	(0.010)	(0.011)	(0.011)	(0.011)
Constant	-1.023***	-0.730***	-0.880***	-0.821***
	(0.022)	(0.022)	(0.022)	(0.022)
Observations	38221	38207	38178	38176

Note: See note to Table S.4.

Table S.6: Multiple Regression of Traits on Characteristics, Full Sample

	(1) Extraversion	(2) Sociability	(3) Assertiveness	(4) Energy Level
Age on May 1 2020	0.006***	0.002***	0.006***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)
Female	0.149***	0.224***	0.032**	0.065***
	(0.010)	(0.010)	(0.010)	(0.010)
Higher education	0.132***	0.042***	0.168***	0.097***
	(0.011)	(0.011)	(0.011)	(0.011)
Above-Median Income	0.248***	0.148***	0.181***	0.234***
	(0.011)	(0.011)	(0.011)	(0.011)
Constant	-0.800***	-0.441***	-0.656***	-0.730***
	(0.022)	(0.022)	(0.022)	(0.022)
Observations	38223	38191	38164	38181

Note: See note to Table S.4.

Table S.7: Multiple Regression of Traits on Characteristics, Full Sample

	(1) Agreeableness	(2) Compassion	(3) Respectfulness	(4) Trust
Age on May 1 2020	0.007***	0.006***	0.003***	0.007***
	(0.000)	(0.000)	(0.000)	(0.000)
Female	0.570***	0.602***	0.409***	0.336***
	(0.010)	(0.010)	(0.010)	(0.010)
Higher education	0.103***	0.082***	0.108***	0.055***
	(0.010)	(0.010)	(0.011)	(0.011)
Above-Median Income	0.037***	0.003	0.048***	0.040***
	(0.010)	(0.010)	(0.011)	(0.011)
Constant	-0.740***	-0.637***	-0.503***	-0.609***
	(0.021)	(0.021)	(0.022)	(0.022)
Observations	38224	38202	38193	38194

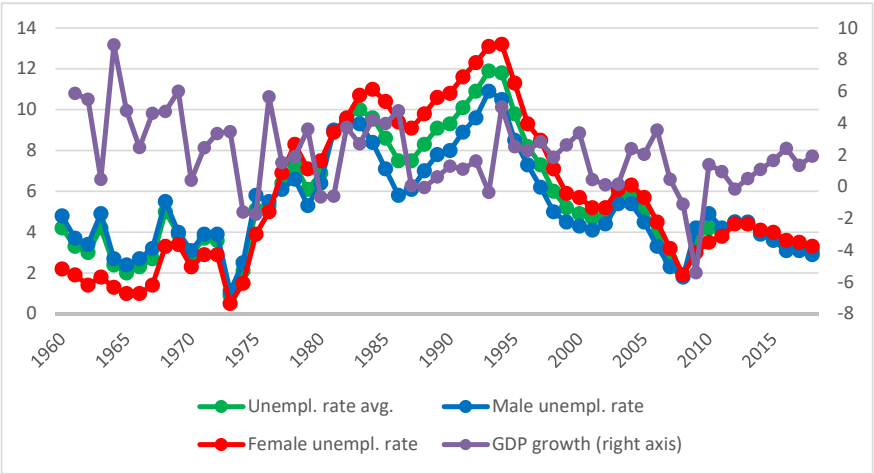
Note: See note to Table S.4.

Table S.8: Multiple Regression of Traits on Characteristics, Full Sample

	(1) Neuroticism	(2) Anxiety	(3) Depression	(4) Emotional Volatility
Age on May 1 2020	-0.011***	-0.008***	-0.012***	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)
Female	0.344***	0.464***	0.110***	0.286***
	(0.010)	(0.010)	(0.010)	(0.010)
Higher education	-0.124***	-0.112***	-0.062***	-0.132***
	(0.011)	(0.011)	(0.011)	(0.011)
Above-Median Income	-0.207***	-0.177***	-0.196***	-0.139***
	(0.010)	(0.010)	(0.011)	(0.011)
Constant	0.706***	0.442***	0.843***	0.449***
	(0.022)	(0.022)	(0.022)	(0.022)
Observations	38216	38186	38187	38167

Note: See note to Table S.4.

Figure S.1: Variation in Macro-Economic Conditions in Denmark, 1960-2018



S.2 Adjusting for Non-Response with Inverse-Probability Weighting

We first define an indicator for whether an individual who was invited to our study responded to any of the BFI-2-S traits (higher level, not facets).[14] Since we observe the full population from administrative registers (and can identify everyone who was invited to participate in our survey), and the registers contain information on background characteristics, we can compare respondents and non-respondents characteristics—see Tables S.9 to S.11. These tables show that the selection in our survey sample is standard, as is observed in other surveys: individuals are more likely to participate if they more highly educated, live more stable lives (as proxied here with cohabiting), if they have a greater interest in health (as indicated by number of visits to general practitioners, GPs), but not if they are in bad health (number of days admitted to a hospital).

Table S.9: Comparison Respondents' and Non-Respondents' Characteristics, Age 18-27

	Mean Non-Resp.	Mean Respondents	Difference	Observations
Male	0.55	0.44	0.11***	27,978
Father years of education	13.90	14.40	-0.50***	25,740
Mother years of education	13.85	14.37	-0.52***	26,214
Father personal income	481.90	533.95	-52.05***	26,609
Mother personal income	362.71	383.70	-20.99***	27,020
Years of education	9.73	9.87	-0.14***	10,570
Personal income	69.81	58.83	10.97***	27,685
Days spent in hospital	1.22	1.12	0.10	27,978
GP visits	0.68	0.63	0.06**	27,978
Biological siblings	1.77	1.63	0.14***	26,833
Married/Cohabiting	0.61	0.65	-0.04***	27,472
Non-Dane	0.16	0.10	0.07***	27,978

Note: All income measures are in 1,000 Danish Crowns of 2019.

Table S.10: Comparison Respondents' and Non-Respondents' Characteristics, Age 28-47

	Mean Non-Resp.	Mean Respondents	Difference	Observations
Male	0.54	0.42	0.12***	35,096
Father years of education	12.98	13.25	-0.27***	30,202
Mother years of education	12.60	13.00	-0.40***	30,898
Father personal income	316.53	320.79	-4.25	30,977
Mother personal income	260.28	272.38	-12.10**	31,539
Years of education	13.69	14.43	-0.74***	32,409
Personal income	347.35	380.76	-33.40***	34,854
Days spent in hospital	1.92	2.18	-0.26**	35,096
GP visits	0.86	0.88	-0.02	35,096
Biological siblings	1.88	1.79	0.09***	31,417
Married/Cohabiting	0.65	0.71	-0.06***	34,542
Non-Dane	0.19	0.10	0.09***	35,096

Note: All income measures are in 1,000 Danish Crowns of 2019.

We next perform an inverse-probability weighting (IPW) adjustment for attrition

[14] There are only 49 individuals who responded partially to the 5 traits if they responded to any of them. 39,158 individuals responded to all 5 factors.

Table S.11: Comparison Respondents' and Non-Respondents' Characteristics, Age 48-75

	Mean Non-Resp.	Mean Respondents	Difference	Observations
Male	0.53	0.46	0.07***	54,174
Father years of education	11.14	11.43	-0.29***	30,452
Mother years of education	10.14	10.41	-0.27***	34,164
Father personal income	138.88	141.64	-2.76	32,771
Mother personal income	144.30	146.34	-2.04	35,775
Years of education	13.24	14.15	-0.91***	53,020
Personal income	361.77	406.90	-45.13***	54,138
Days spent in hospital	3.04	2.81	0.23**	54,174
GP visits	1.36	1.37	-0.01	54,174
Biological siblings	1.83	1.76	0.07***	37,111
Married/Cohabiting	0.66	0.76	-0.10***	53,994
Non-Dane	0.09	0.03	0.05***	54,174

Note: All income measures are in 1,000 Danish Crowns of 2019.

or non-response. We use the variables in Tables S.9 to S.11 to predict an individual's probability of responding to the survey: gender, whether they are non-Danish (defined as 1st or 2nd-generation immigrant), the number of days the individual spent in hospital in 2017, their number of visits to the general practitioner, their number of siblings, and an indicator for whether they are currently married or cohabiting. Additionally, we control for these background variables by age:

- **For individuals up to 29 years old:** educational attainment of father and mother, father's and mother's total personal income before transfers
- **For individuals 30-62 years old:** educational attainment—own and that of father and mother, own and father's and mother's total personal income before transfers
- **For individuals 63 years and older:** own educational attainment , own total personal income before transfers

Educational attainment is measured in months, as reported by the statistics office on the basis of the standard length of study for the degree one obtained.

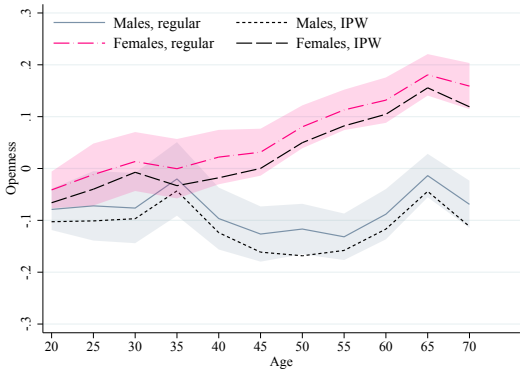
Within 5-year age bins, we predict response to the BFI-2-S on the basis of these covariates for each individual, from binary probit regressions. The inverse probability weight is computed as the inverse of this predicted probability. We then regress the individual BFI-2-S score on age indicators (in the same 5-year age groups), separately by SES-groups (defined by either own or parents' education or income, on the appropriate age ranges as described in the main text), weighting the regressions with the IWP as a "pweight" in Stata. The resulting predicted averages (and 95% confidence bands) are presented in Fig. S.3 and Fig. S.4.

For an easier direct comparison, we also present average traits by the age groups of Tables S.9 to S.11, with and without adjustment for non-response with IPW, in Tables S.12 to S.15.

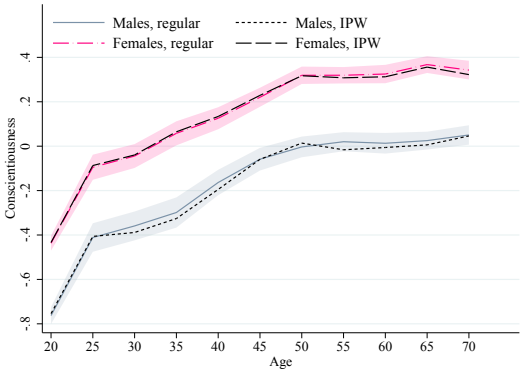
Adjusting the average traits by age for selection into the sample, on the basis of a wide array of important covariates, does not alter the life-cycle profile of these traits, or their gradients by sex, income, or education.

Figure S.2: Personality by Age and Sex, IPW-Adjusted for Selection into Sample

(a) Openness

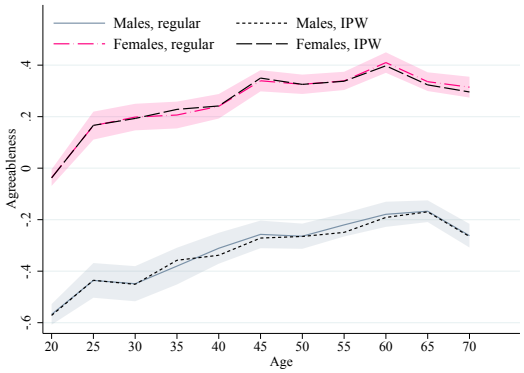


(b) Conscientiousness



(c) Extraversion

(d) Agreeableness



(e) Neuroticism

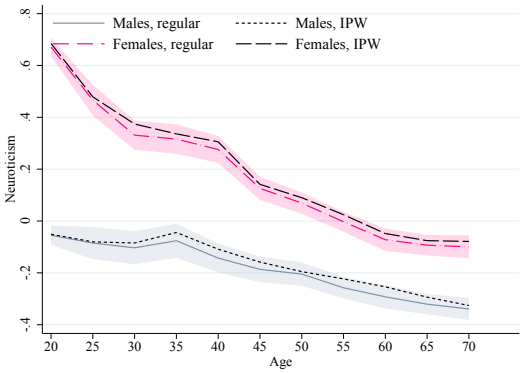


Figure S.3: Personality by Age and Education, IPW-Adjusted for Selection into Sample

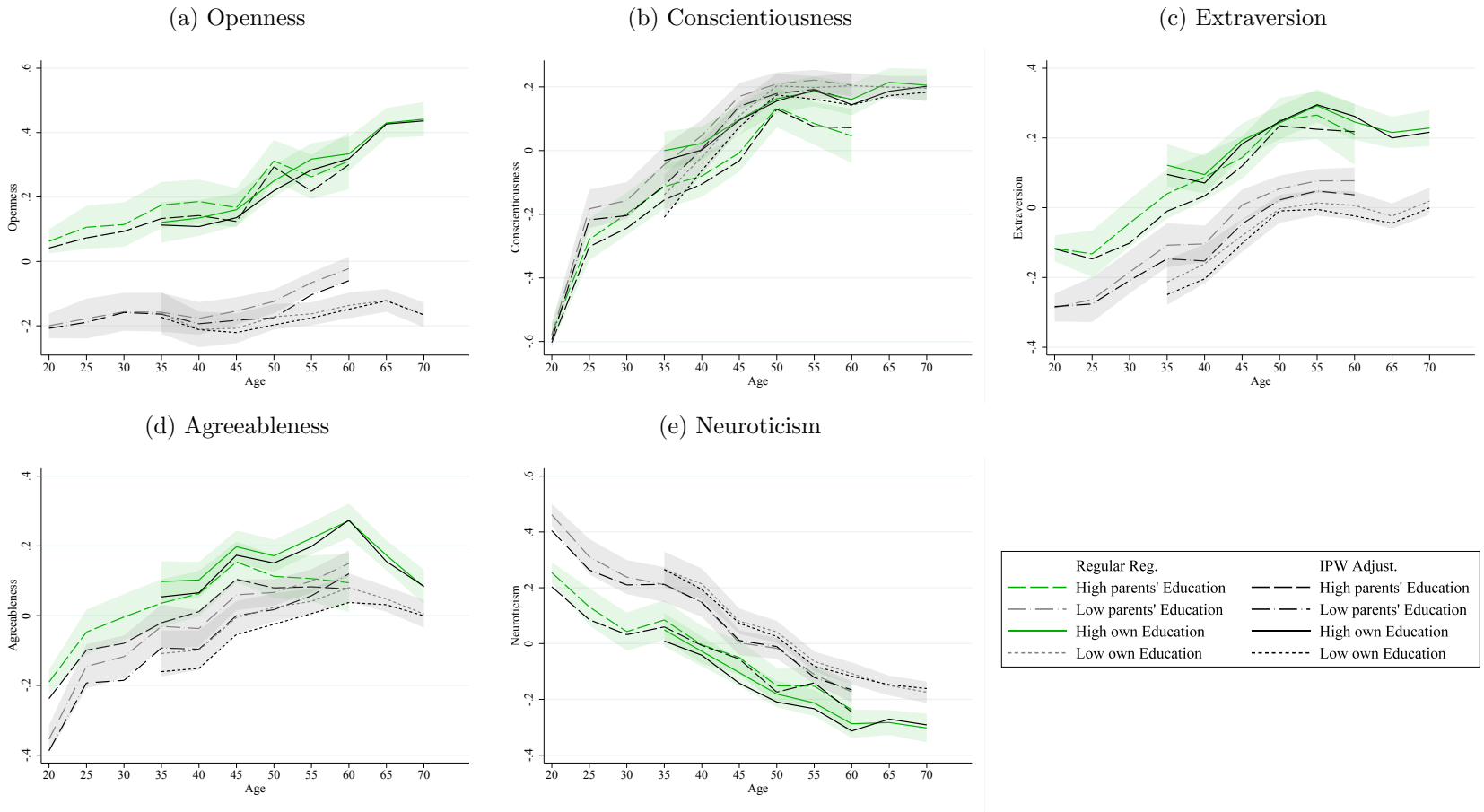


Figure S.4: Personality by Age and Income, IPW-Adjusted for Selection into Sample

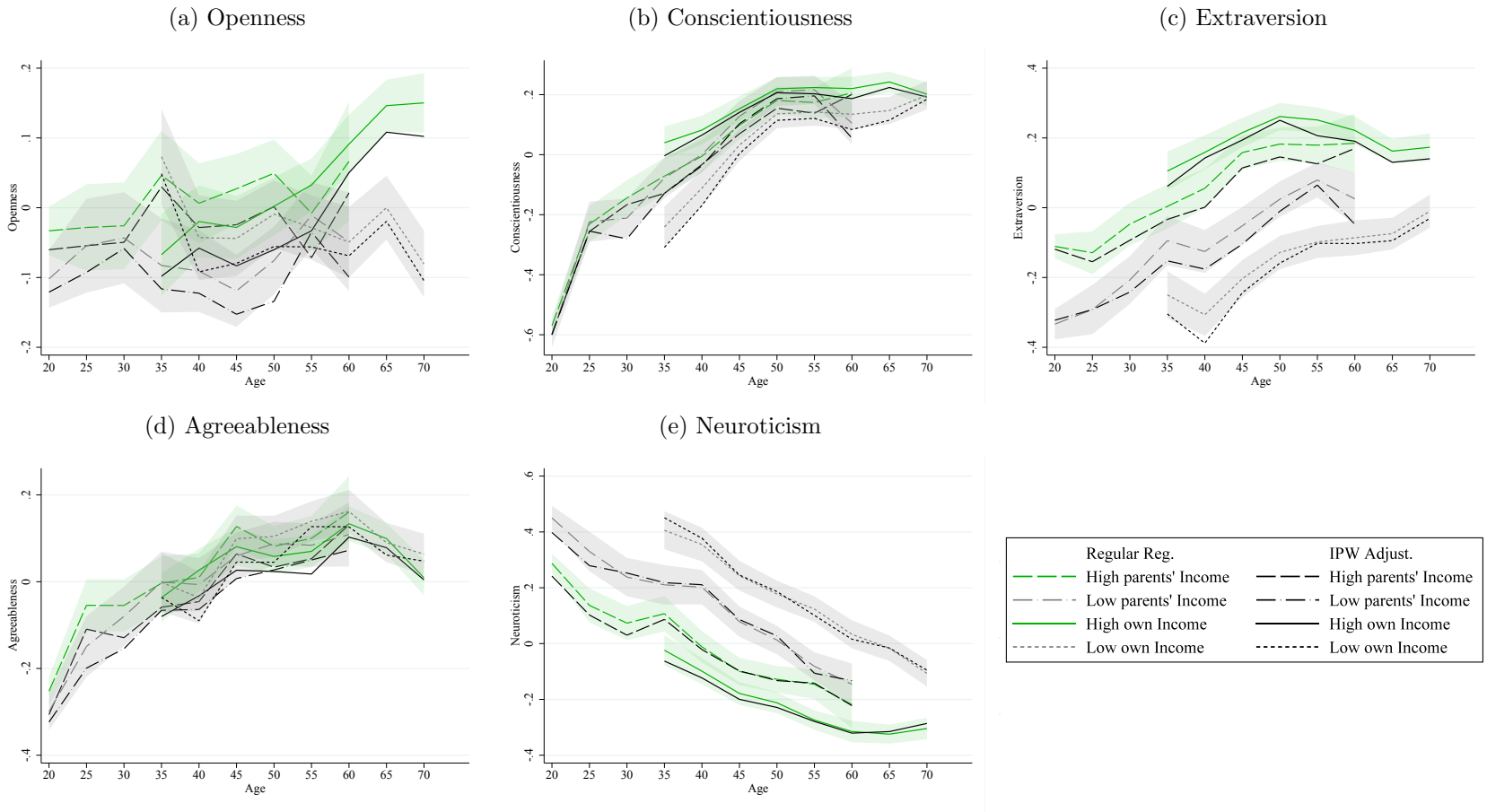


Table S.12: Average Traits by Age, Low Parental Income: Regular vs IPW-adjusted

	Openness		Conscientiousness		Extraversion		Agreeableness		Neuroticism	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Reg	IPW	Reg	IPW	Reg	IPW	Reg	IPW	Reg	IPW
20	−0.10***	−0.12***	−0.60***	−0.60***	−0.33***	−0.32***	−0.30***	−0.32***	0.45***	0.40***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)
25	−0.05	−0.09**	−0.22***	−0.25***	−0.29***	−0.29***	−0.15***	−0.20***	0.33***	0.28***
	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
30	−0.04	−0.06	−0.21***	−0.28***	−0.21***	−0.24***	−0.08**	−0.15***	0.24***	0.25***
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)
35	−0.08**	−0.12***	−0.08**	−0.13***	−0.09***	−0.15***	−0.00	−0.07	0.21***	0.22***
	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
40	−0.09***	−0.12***	0.00	−0.04	−0.13***	−0.18***	−0.01	−0.06*	0.20***	0.21***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)	(0.04)
45	−0.12***	−0.15***	0.13***	0.10***	−0.05*	−0.10***	0.06**	0.01	0.08***	0.09***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
50	−0.08***	−0.13***	0.21***	0.19***	0.02	−0.01	0.09***	0.03	0.01	0.03
	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
55	−0.01	−0.03	0.22***	0.20***	0.08***	0.06**	0.08***	0.05*	−0.08***	−0.11***
	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
60	−0.05	−0.10**	0.11***	0.06	0.03	−0.05	0.11***	0.07*	−0.15***	−0.13***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
N	10992	9666	10996	9667	10997	9668	10997	9668	10999	9668

Note: "Reg" = average trait by age, or coefficients from regular regression, unweighted. "IPW" = coefficients from regression adjusted for non-response with inverse probability weights. Standard errors in parentheses. $^{*}(p < 0.10)$,** $(p < 0.05)$,*** $(p < 0.01)$

Table S.13: Average Traits by Age, High Parental Income: Regular vs IPW-adjusted

	Openness		Conscientiousness		Extraversion		Agreeableness		Neuroticism	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Reg	IPW	Reg	IPW	Reg	IPW	Reg	IPW	Reg	IPW
20	−0.03*	−0.06***	−0.57***	−0.60***	−0.11***	−0.12***	−0.25***	−0.31***	0.29***	0.24***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
25	−0.03	−0.05*	−0.23***	−0.26***	−0.13***	−0.15***	−0.05*	−0.11***	0.14***	0.10***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
30	−0.03	−0.05	−0.14***	−0.17***	−0.05	−0.09***	−0.05*	−0.13***	0.07**	0.03
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
35	0.05	0.03	−0.07**	−0.13***	0.00	−0.03	−0.00	−0.06*	0.11***	0.09**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
40	0.01	−0.03	−0.01	−0.03	0.06*	0.00	0.01	−0.05	−0.01	−0.02
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
45	0.03	−0.02	0.10***	0.07***	0.16***	0.11***	0.13***	0.06**	−0.10***	−0.10***
	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)
50	0.05**	0.00	0.18***	0.15***	0.18***	0.15***	0.08***	0.03	−0.13***	−0.13***
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
55	−0.01	−0.07**	0.17***	0.14***	0.18***	0.13***	0.10***	0.05*	−0.15***	−0.14***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
60	0.07	0.02	0.21***	0.20***	0.18***	0.17***	0.16***	0.13***	−0.22***	−0.22***
	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
N	12709	12364	12709	12364	12710	12365	12709	12364	12709	12364

Note: "Reg" = average trait by age, or coefficients from regular regression, unweighted. "IPW" = coefficients from regression adjusted for non-response with inverse probability weights. Standard errors in parentheses. $^{*}(p < 0.10)$,** $(p < 0.05)$,*** $(p < 0.01)$

Table S.14: Average Traits by Age, Low Own Income: Regular vs IPW-adjusted

	Openness		Conscientiousness		Extraversion		Agreeableness		Neuroticism	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Reg	IPW	Reg	IPW	Reg	IPW	Reg	IPW	Reg	IPW
35	0.07**	0.05	−0.24***	−0.31***	−0.25***	−0.30***	−0.00	−0.04	0.41***	0.45***
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.05)	(0.03)	(0.04)	(0.03)	(0.05)
40	−0.04	−0.09**	−0.11***	−0.17***	−0.31***	−0.39***	−0.04	−0.09**	0.35***	0.38***
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)
45	−0.04	−0.08***	0.03	0.00	−0.20***	−0.24***	0.10***	0.05	0.24***	0.25***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
50	−0.01	−0.06**	0.14***	0.11***	−0.13***	−0.16***	0.10***	0.04	0.18***	0.19***
	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)
55	−0.03	−0.06**	0.14***	0.12***	−0.10***	−0.10***	0.14***	0.13***	0.12***	0.10***
	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)
60	−0.05*	−0.07**	0.13***	0.08**	−0.09***	−0.10***	0.16***	0.13***	0.03	0.02
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
65	0.00	−0.02	0.15***	0.11***	−0.07***	−0.09***	0.09***	0.06**	−0.02	−0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
70	−0.08***	−0.10***	0.20***	0.18***	−0.01	−0.03	0.06***	0.05*	−0.11***	−0.10***
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.02)
N	11556	9783	11558	9782	11559	9784	11563	9788	11552	9777

Note: "Reg" = average trait by age, or coefficients from regular regression, unweighted. "IPW" = coefficients from regression adjusted for non-response with inverse probability weights. Standard errors in parentheses. *($p < 0.10$),** ($p < 0.05$),*** ($p < 0.01$)

Table S.15: Average Traits by Age, High Own Income: Regular vs IPW-adjusted

	Openness		Conscientiousness		Extraversion		Agreeableness		Neuroticism	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Reg	IPW	Reg	IPW	Reg	IPW	Reg	IPW	Reg	IPW
35	−0.07**	−0.10***	0.04	−0.00	0.10***	0.06*	−0.04	−0.08**	−0.02	−0.06**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
40	−0.02	−0.06**	0.08***	0.07**	0.16***	0.14***	0.03	−0.03	−0.10***	−0.12***
	(0.03)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)
45	−0.03	−0.08***	0.15***	0.14***	0.22***	0.19***	0.08***	0.03	−0.18***	−0.20***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
50	0.00	−0.06***	0.22***	0.21***	0.26***	0.25***	0.06***	0.02	−0.21***	−0.23***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
55	0.03*	−0.03	0.22***	0.20***	0.25***	0.21***	0.07***	0.02	−0.27***	−0.28***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
60	0.09***	0.05*	0.22***	0.19***	0.22***	0.19***	0.13***	0.10***	−0.32***	−0.32***
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.02)
65	0.15***	0.11***	0.24***	0.22***	0.16***	0.13***	0.10***	0.08***	−0.32***	−0.32***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
70	0.15***	0.10***	0.20***	0.19***	0.17***	0.14***	0.01	0.00	−0.30***	−0.29***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
N	16104	14450	16107	14453	16107	14452	16105	14450	16108	14453

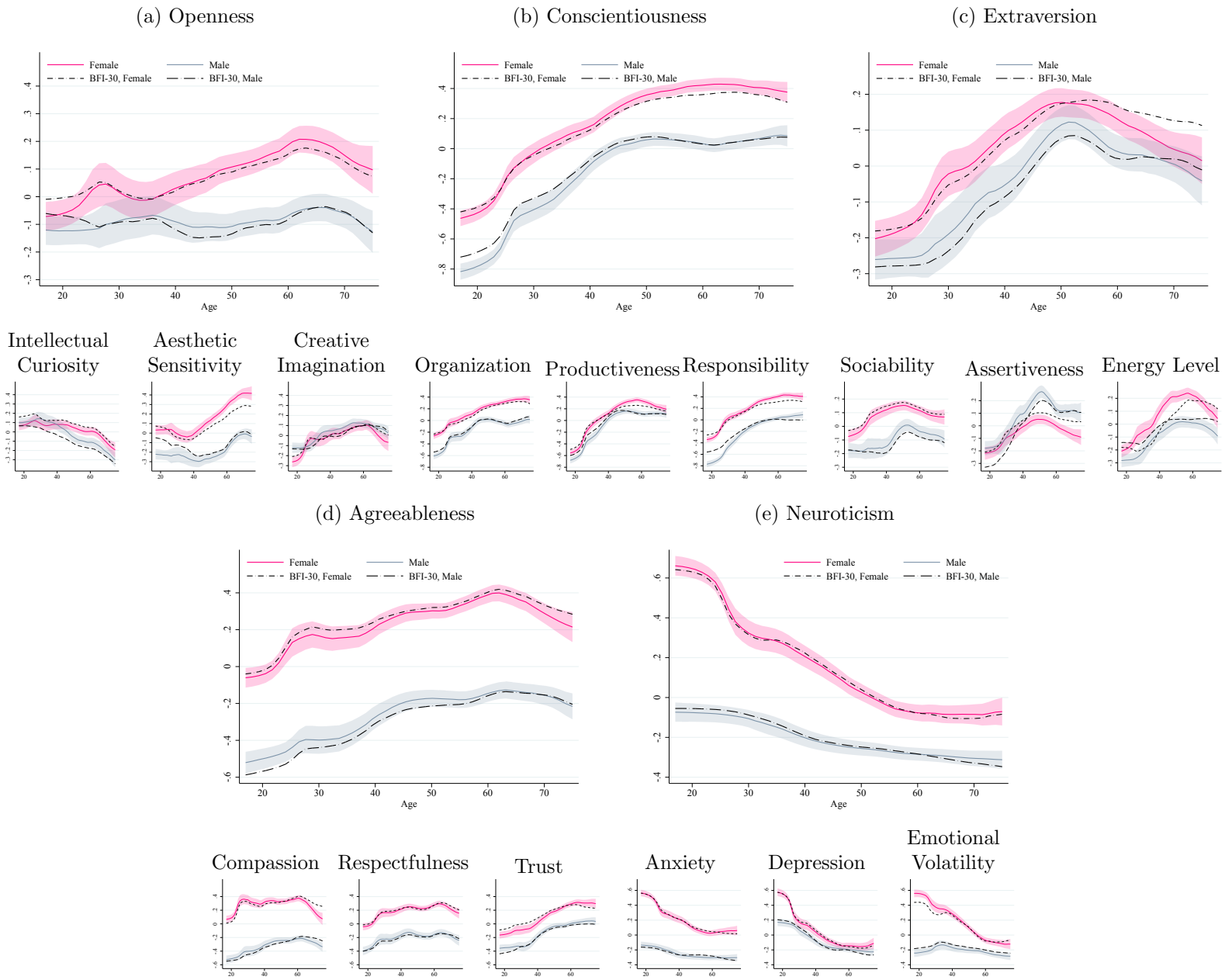
Note: "Reg" = average trait by age, or coefficients from regular regression, unweighted. "IPW" = coefficients from regression adjusted for non-response with inverse probability weights. Standard errors in parentheses. *($p < 0.10$),** ($p < 0.05$),*** ($p < 0.01$)

S.3 Robustness Check: Comparing BFI-30 to BFI-60

Survey participants were randomized into being given the full BFI-2 with 60 items, or the abbreviated BFI-2 with only 30 items. Since the abbreviated version is a perfect subset of the long version, we use the abbreviated version in the main text, to maximize the number of respondents (simply not using the information from all items for the respondents who were given the long battery). As a robustness check, Figs. S.5 to S.7 contrast the age-profiles by gender, education, and income for the full BFI-2 measures with the abbreviated measures used in the main text. For these graphs, we use only the sub-sample of individuals who responded to the 60 items, and construct their abbreviated version (and re-standardize it within the subsample).

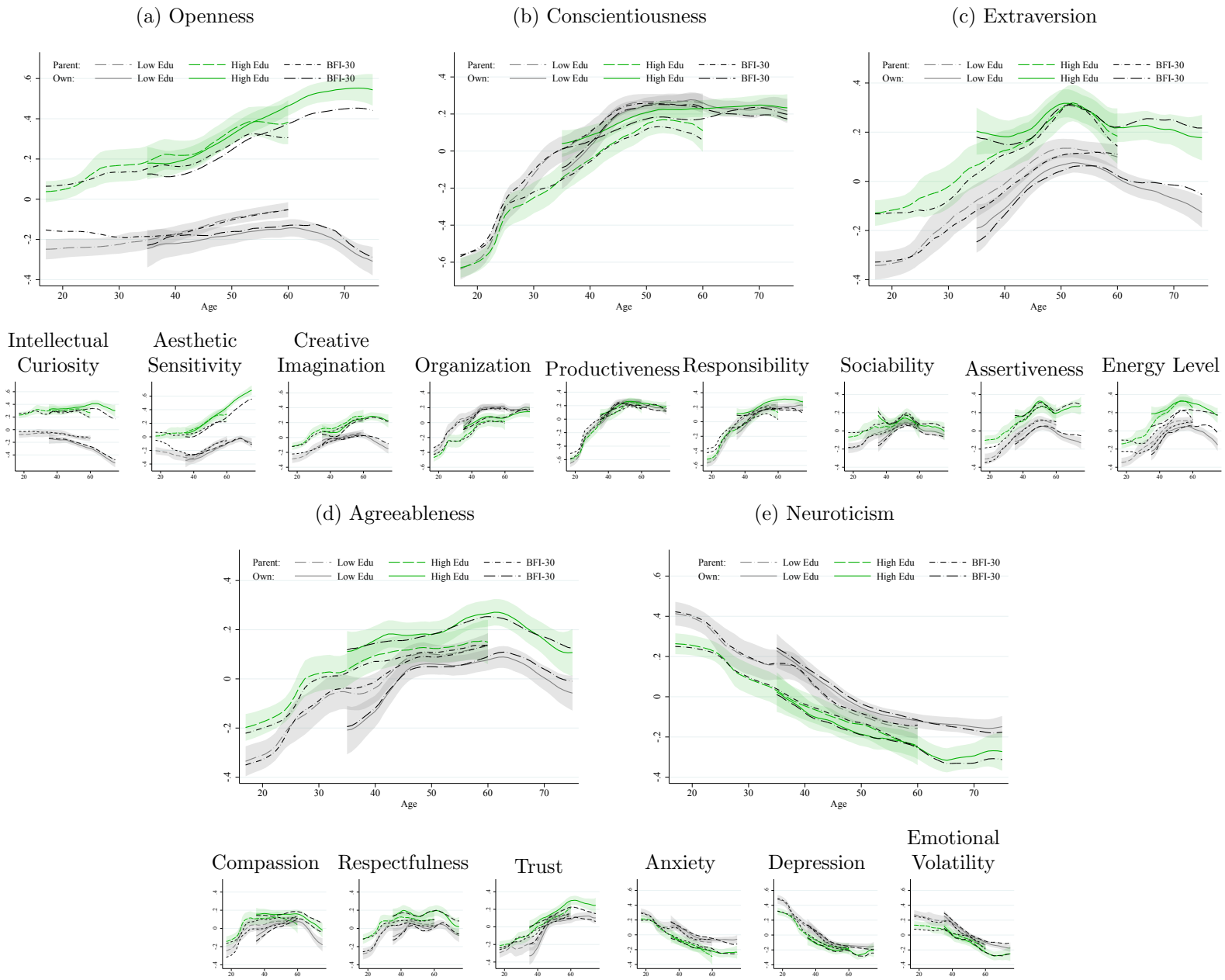
Figures S.5 to S.7 clearly show that for the vast majority of personality traits, including the facets, the choice to use only the 30-item BFI-2 has no bearing on the conclusions we draw. In the few cases where the 30-item measure is outside the confidence band of the 60-item measure, the gender or SES gaps remain unchanged—see, for example, Aesthetic Sensitivity or Responsibility (two facets of Openness) by gender or education. We want to highlight two exceptions: First, in terms of age trends, Extraversion shows a more marked decline after age 50 in terms of the full BFI-2 than the abbreviated version. Second, the gender gap in Assertiveness, a facet of Extraversion, shows a less dramatic evolution in the long BFI-2 than in the short one: In the main text, Assertiveness started out with females displaying a higher level than males, until a reversal at around age 50 (refer to Fig. 1c). Measured with the long BFI-2, there is simply no gender gap initially, and it widens by age—there is no reversal.

Figure S.5: Personality by Age and Gender, Comparing BFI-60 to BFI-30



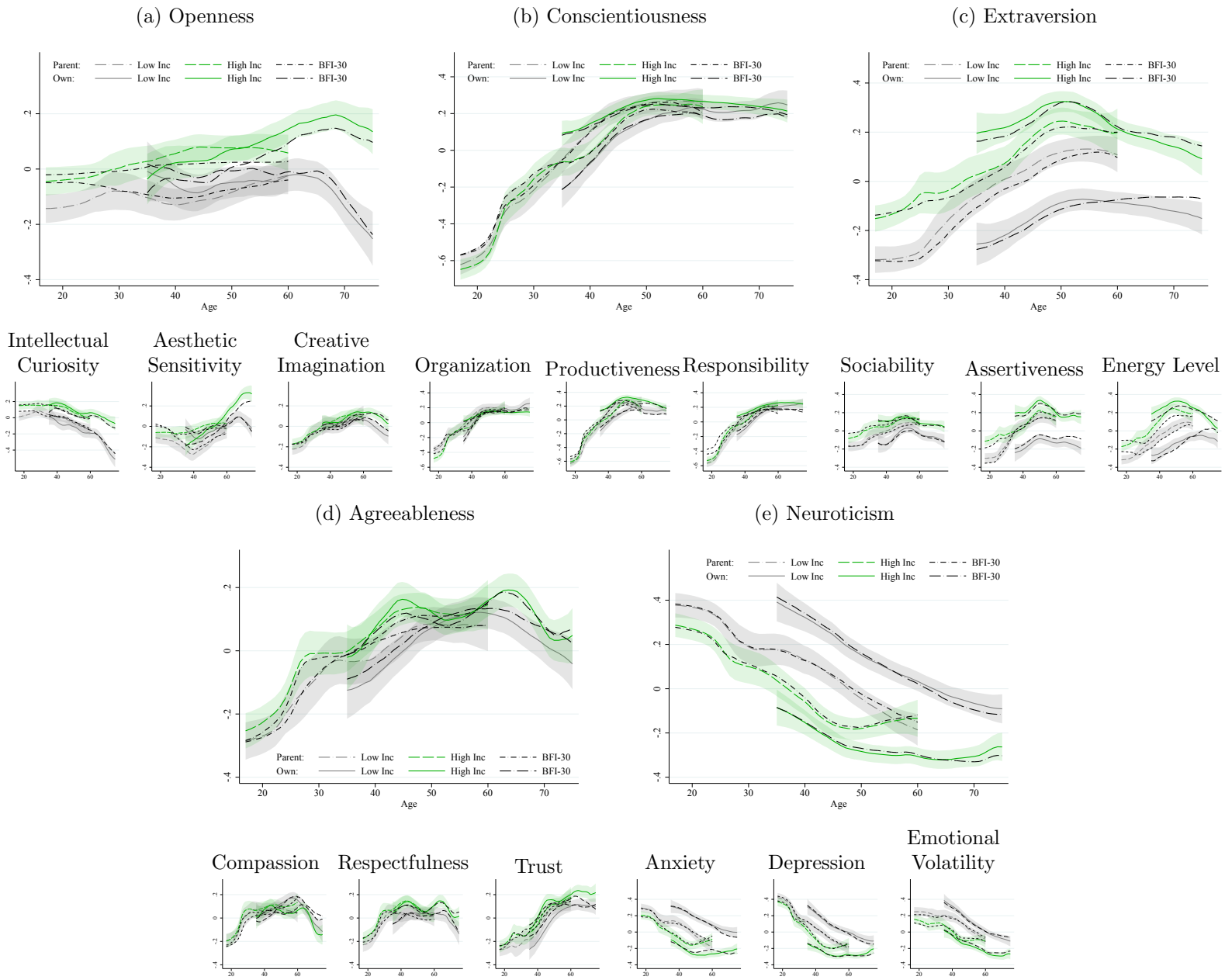
Note: Colored lines showing personality traits from the full BFI-60 inventory, using bivariate kernel regression. Shaded area corresponds to a 95% confidence interval for the mean traits by age. The black lines contrast the results using the BFI-30 (on the same sample), which is the personality inventory used in the main paper.

Figure S.6: Personality by Age and Education, Comparing BFI-60 to BFI-30



Note: Colored lines showing personality traits from the full BFI-60 inventory, using bivariate kernel regression. Shaded area corresponds to a 95% confidence interval for the mean traits by age. The black lines contrast the results using the BFI-30 (on the same sample), which is the personality inventory used in the main paper.

Figure S.7: Personality by Age and Income, Comparing BFI-60 to BFI-30



Note: Colored lines showing personality traits from the full BFI-60 inventory, using bivariate kernel regression. Shaded area corresponds to a 95% confidence interval for the mean traits by age. The black lines contrast the results using the BFI-30 (on the same sample), which is the personality inventory used in the main paper.