

CEBI WORKING PAPER SERIES

Working Paper 16/20

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CYCLE

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ISSN 2596-44TX

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Inequality in Personality over the Life Cycle

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December 4, 2020

Abstract

We document gender and socioeconomic inequalities in personality over the life cycle (age 18-75), using the Big Five 2 (BFI-2) inventory linked to administrative data on a large Danish population. We estimate life-cycle profiles non-parametrically and adjust for cohort and sample-selection effects. We find that: (1) Women of all ages score more highly than men on all personality traits, including three that are positively associated with wages; (2) High-education groups score more favorably on Openness to Experience, Extraversion, Agreeableness, and Neuroticism than low-education groups, while there is no socioeconomic inequality by Conscientiousness; (3) Over the life cycle, gender and socioeconomic gaps remain constant, with two exceptions: the gender and SES gaps in Openness to Experience widen, while gender differences in Neuroticism, a trait associated with worse outcomes, diminish with age. We discuss the implications of these findings in the context of gender wage gaps, household production models, and optimal taxation.

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

Keywords: Inequality; Personality; Big Five-2 Inventory; Life cycle dynamics; Gender disadvantage; Socioeconomic disadvantage .

Funding: 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.

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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 inequalities in personality, which we observe at early ages (Attanasio et al., 2020; Elkins and Schurer, 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; Blau and Kahn, 2017; Petrongolo and Ronchi, 2020).¹ In order to understand inequalities in lifetime economic and social outcomes, we must understand inequalities in personality.

In this paper, we document both gender and socioeconomic inequalities in personality at every stage of the life cycle, from late adolescence into old age. We take advantage of a novel survey on a large Danish population merged to administrative registers (N=38,798), in which we collected among others the Big Five 2 personality inventory, one of the most widely used inventories to capture personality at the broadest level (Goldberg, 1992). The BFI-2 uses 60 items to hierarchically assess the Big Five personality domains, together with 15 more specific facet traits (Soto and John, 2017a,b). We linked this survey at the individual level to administrative register data, which allows us to measure gender,² income, education, parental income and education, and many other background variables at high precision. A distinctive strength of our study is that we provide detailed evidence on multiple dimensions of non-cognitive skill, captured in the Big Five and their lower-level facets.³ To document personality profiles over the life

¹A recent overview by Blau and Kahn (2017) suggested that "Psychological attributes or noncognitive skills comprise one of the newer explanations for gender differences in outcomes. Our effort to assess the quantitative evidence on the importance of these factors suggests that they account for a small to moderate portion of the gender pay gap, considerably smaller than, say, occupation and industry effects, though they appear to modestly contribute to these differences." (p. 789)

²The administrative registers list 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.

³There 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

cycle, we use kernel regression methods which allow us to estimate non-linearities in the life cycle profiles in the most flexible way, without imposing specific functional forms (Wand and Jones, 1995). This improves upon the few previous studies – which we will review in detail in Section 2 – which estimate age-personality gradients either with a linear or second-order polynomials interacted with gender or provide mean values for pre-specified age groups separately by gender (e.g. Anusic et al., 2012; Donnellan and Lucas, 2008; Soto et al., 2011; Srivastava et al., 2003), and not generally by education and income groups.⁴ To address self-selection into the survey, we use the wealth of the administrative and survey data to correct for sample selection issues with inverse probability weighting methods.

The estimated inequalities of personality between men and women (or between high and low SES groups) across the life cycle should be interpreted as inequalities at different ages. The life-cycle profiles cannot be interpreted solely as evidence of changes in personality as people age, but may – at least partly – reflect differences in personality by birth cohort.⁵ It is not possible to identify simultaneously age, period and cohort (‘apc’) effects as these are perfectly correlated (see Browning et al., 2012; Clark, 2007; Deaton and Paxson, 1994; Heckman and Roeb, 1985). This identification problem exists even if one is fortunate to have access to longitudinal data. We follow the literature, by controlling for cohort effects with observable proxies derived from macroeconomic data measured in late adolescence (age 18), such as gender-specific unemployment rates (Schwandt and von Wachter, 2019), inflation (Dohmen et al., 2017), or GDP growth (Kapteyn et al., 2005).

We 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 positively correlated with socioeconomic status (SES) – they also score more highly on Agreeableness and Neuroticism,

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.

⁴We know of only one previous study which tested for socioeconomic inequalities in the age-personality profile, defining SES through education. Donnellan and Lucas (2008) finds no evidence that age-personality profiles differ by SES.

⁵Empirical evidence suggests that personality may reflect different public policies that were influential in critical periods of a cohort’s formative years. For example, some birth cohorts are said to become neurotic in response to China’s One-child-policy (Cameron et al., 2013) or because they grew up in times of low levels of social connectedness (Twenge, 2000). Initial conditions experienced in childhood and adolescence can have long-lasting effects on beliefs (see, e.g. Giuliano and Spilimbergo, 2013).

traits that are 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 at every stage of the life cycle—regardless of whether SES is measured with parental background or own education and income. High SES is associated with higher scores on Openness to Experience, Extraversion, and Agreeableness, and lower scores on Neuroticism. Yet, we find no SES gap in Conscientiousness. Third, most of the gender and SES inequalities in personality remain constant over the life cycle, with two exceptions. Both gender and SES inequalities in Openness to Experience widen significantly over the life cycle, while extremely wide gender gaps in Neuroticism observed in late adolescence converge over the life cycle.

Each of the five dimensions of personality relates to different domains of individual decision-making. Thus, each affects life-time education, 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), 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).

Thus, men and women, and to some degree high and low SES groups, are disadvantaged in terms of their non-cognitive skill endowments at different stages of their

life. This has important implications for economic theory and empirical evidence related to, e.g., models of household production, optimal taxation, and the roots of gender pay gaps. We discuss these in detail in Section 5. The remainder of the manuscript is as follows. We review the main literature on inequalities in personality and life cycle profiles in Section 2. We describe our linked survey and administrative data in Section 3. The main results are presented in Section 4.

2 Literature

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; Heckman, 2000; Heckman et al., 2006; Lindqvist and Vestman, 2011; Lundberg, 2018). Some argue that gender (Bertrand, 2020; Blau and Kahn, 2017; Petrongolo and Ronchi, 2020) and socioeconomic inequalities (e.g. Cunha and Heckman, 2009; Heckman, 2000) in economic outcomes can only be understood if we better understand inequalities in personality. Yet, the evidence base on gender and socioeconomic inequalities in personality 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).⁶

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. We focus in this study on gender and socioeconomic inequalities in personality across the lifespan. We do so, to learn at what life stages inequalities in personality are most pronounced. Under the assumption that some personality traits act as either facilitators or barriers to success in life, knowledge about life-cycle inequalities in personality traits can help to understand

⁶For 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 laboratory experiments, which are rooted in children from more advantaged families being more patient and altruistic, and less risk-seeking.

at what life stages which groups in society are most vulnerable.

2.1 The Big Five personality traits

To measure personality, we rely on the Five Factor personality structure, which captures 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 experiences. 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.

Some of the Big Five 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 well-being (Post, 2005).⁷ 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).

2.2 Life-cycle inequalities in the Big Five personality traits

A substantial body of research has emerged in the psychology literature on age gradients in the Big Five personality traits (e.g. Allemand et al., 2008; Anusic et al., 2012; Bleidorn et al., 2013; Branje et al., 2007; Donnellan and Lucas, 2008; McCrae and Costa, 1999; Soto et al., 2011; Srivastava et al., 2003; Wortman et al., 2012). This literature is most concerned about the question whether personality is “set like plaster” or involves “persistent change” (Srivastava et al., 2003). This is not the focus of our study, but we are building on previous research which depicted age profiles (graphically) over the full age range from adolescence into older age. Of greatest interest are studies which allowed for non-linearities in age profiles. The previous work used either cross-sectional or two-wave longitudinal data to construct age profiles in the Big Five Personality traits.

⁷It 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.

Most previous studies used a low-dimensional instrument (3-5 items per trait) of the Big Five personality traits collected in nationally-representative surveys such as the German Socio-Economic Panel (N=14,039) and the British Household Panel (N=20,852) (Donnellan and Lucas, 2008), the Income and Labour Dynamics Survey in Australia (N=13,134) (Wortman et al., 2012), or the US-based General Social Survey (N=1,486) and the Swiss Household Panel (N=7,026) (Anusic et al., 2012). Others collected large, global online surveys to study the age profiles in personality across cultures, such as Bleidorn et al. (2013), with a sample of over 800,000 observations from 62 countries, Soto et al. (2011) with a sample of over 1.2 million observations from six English-speaking countries and Srivastava et al. (2003) with a sample of over 132,000 observations from the US and Canada.

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). Declining age trends are most pronounced for Neuroticism, while increasing age trends are most pronounced for Agreeableness and Conscientiousness. Age trends in Extraversion and Openness to Experience are the least strong and inconsistent profiles have been reported across studies. The literature suggests that “there is very little support for the idea that men and women change in distinct ways” over the life cycle (Roberts et al., 2006, p. 15). Indeed, none of the previous work finds evidence for gender inequalities, if they are tested through interaction effects between age and gender. The exceptions are Srivastava et al. (2003) and Soto et al. (2011), which find that life-cycle profiles in one personality trait, Neuroticism, change differently between men and women. Both studies show that women experience greater challenges from Neuroticism in young adulthood relative to men, but in older age there are few differences in Neuroticism between men and women.⁸

We found only one study that plotted age profiles separately by socioeconomic status (Donnellan and Lucas, 2008) or age-personality profiles separately by the facets of the Big Five traits (Soto et al., 2011). Overall, most studies work with relatively large sample sizes that are needed to estimate average personality scores by age groups. Some studies test for gender heterogeneity in age-profiles of personality by regressing personality on

⁸It should be noted that Srivastava et al. (2003) do not discuss this finding reported in Figure 1.c, while Soto et al. (2011) write “Age trends for Neuroticism and Openness to Experience differed both by gender and by facet.” (p. 340) with respect to Figure 3.A.

age (or a non-linear function) and an interaction term of age with gender (e.g. [Branje et al., 2007](#); [Donnellan and Lucas, 2008](#); [Klimstra et al., 2009](#); [Roberts et al., 2001](#)).

Closest to our study design are therefore [Soto et al. \(2011\)](#) and [Srivastava et al. \(2003\)](#). Both describe the age-personality gradient over the full life cycle separately for men and women. However, neither allows for inequalities in personality by socioeconomic 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 profiles 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 profiles across the life span, so that the specific growth path could disguise important inequalities in personality as people age.⁹

The main contribution of our paper to this literature is to document personality inequalities in both gender and socioeconomic background at every stage of the life course, using a newly collected survey on a large Danish population. We use advanced statistical methods to estimate the inequalities allowing for non-linearities in the life cycle profile with fewer modeling assumptions (non-parametric estimation). We contribute to a mature personality psychology (but a non-existing economics) literature by documenting these inequalities, including for the facets of each personality trait. A particular advantage of our study is that we were able to link our survey data with high-precision administrative data. Thus, our analysis does not suffer from systematic measurement error in gender, education and income, as well as parental background. We can therefore examine and discuss cohort (versus age) effects, and account for selection on observables into responding to the survey - something online samples and surveys not linked to registers cannot.

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

⁹Donnellan and Lucas (2008) use German Socio-Economic panel data on 14,000 Germans and a short-form of the Big Five Inventory (15 items, 3 per personality trait). This paper regresses personality on a linear or quadratic term of age. This term is then interacted with a dummy variable of gender or high-education group. The authors then test whether the interaction term significantly increases the explained variation in personality. They fail to reject the null hypothesis in all cases. This modeling approach is very different to ours. We document the personality differences at every stage of the life cycle between high and low educated (income) groups, making no assumptions about the functional form. We estimate confidence intervals for each profile and then test whether they are overlapping between groups.

(Soto and John, 2017a) and an abbreviated 30-item instrument (Soto and John, 2017b) for different groups.¹⁰ 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 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.4 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).

¹⁰See 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.

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.¹¹ 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,¹² 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%.

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

¹¹Note 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.

¹²This system is called “e-Boks”—see <https://www.e-boks.com/danmark/en/what-is-e-boks/>.

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 include 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 2019).

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.

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

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).

from higher SES groups (although the differences are numerically small, see Tables S.10 to S.12). 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. This is a first sanity check to our newly collected Danish data. We use these numbers to gain a broad understanding of inequalities in personality as they appear on average, and how they differ from the received literature.

We then document gender and socioeconomic inequalities in personality across the life cycle by plotting mean personality scores at every age, plotted separately by gender, education and income.¹³ All age gradients are estimated non-parametrically with bivariate kernel density functions and their 95% confidence intervals are constructed using the delta method.

¹³Our 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. We do so, because we are interested in the unadjusted differences. 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.

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 2 Inventory (BFI-2) 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. Older individuals are more open, conscientious, agreeable, and extraverted, and less neurotic than younger individuals. 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.¹⁴

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 (0.59 SD), Neuroticism (0.37 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 to Experience (0.4 SD, mainly driven by the facet Intellectual Curiosity) and Extraversion (0.19 SD, mainly driven by the facet Assertiveness), and relatively smaller for the other traits (around 0.1 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

¹⁴Denmark provides a universal tax financed old age pension to all elderly citizens, currently when individuals turn 65. Moreover, an Early Retirement Program (ERP) is offered to workers after age 60 for cohorts born before 1953, ([García-Miralles and Leganza, 2020](#)). On top of these partly tax-financed schemes, a large proportion of Danes in this age group have contributed to employer-based private pensions. On average around 65% of the 60+ year-olds in our sample received some kind of retirement benefit. Our results do not change when dropping the very old sample members (age 60+) from the analysis. These results are provided upon request.

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.

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, weakly U-shaped 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

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

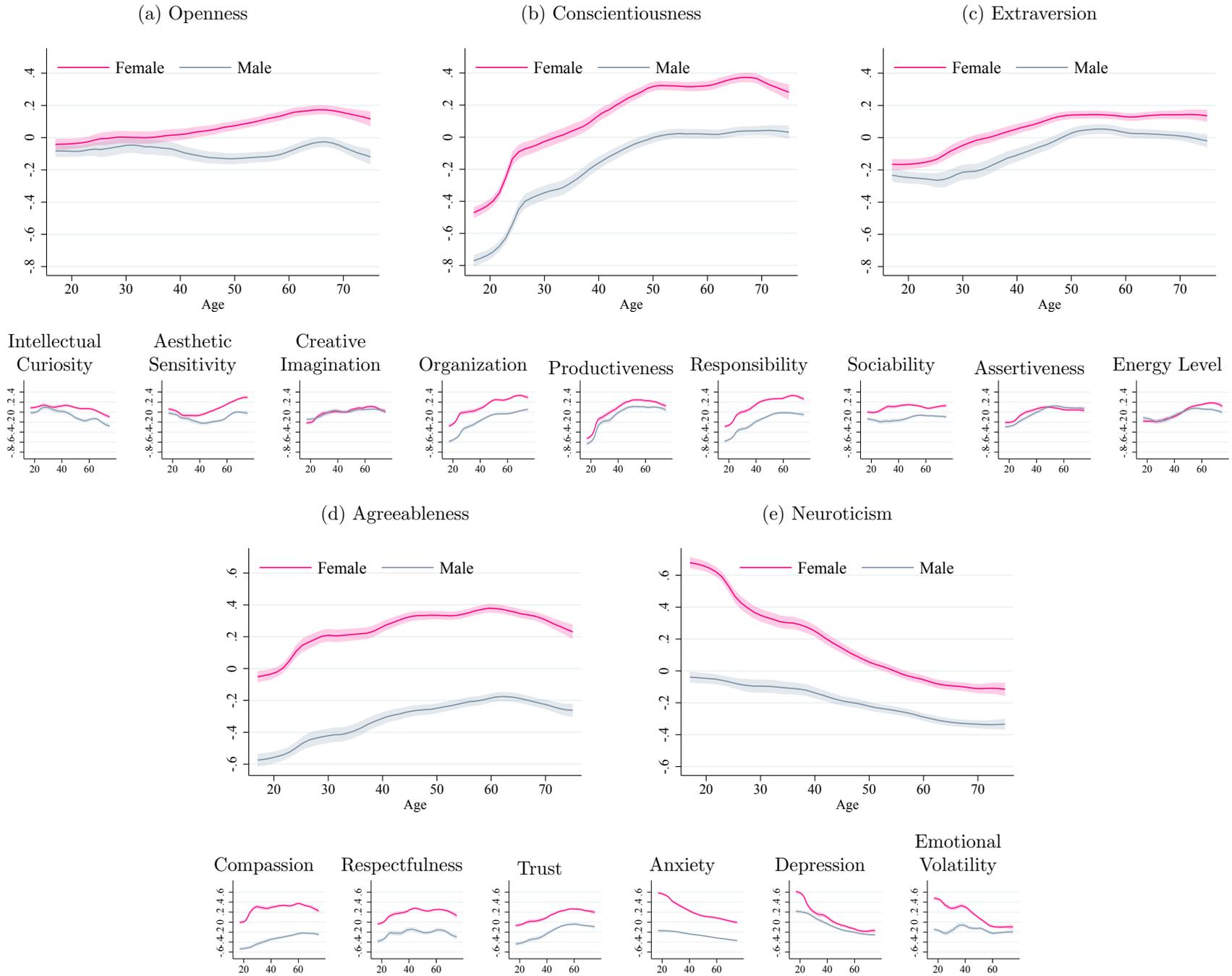
	(1) Age	(2) Female	(3) High Education	(4) High Income
Openness	0.002*** (0.000)	0.153*** (0.010)	0.400*** (0.010)	0.106*** (0.010)
Openness, Intellectual Curiosity	-0.004*** (0.000)	0.159*** (0.010)	0.450*** (0.010)	0.139*** (0.010)
Openness, Aesthetic Sensitivity	0.003*** (0.000)	0.182*** (0.010)	0.324*** (0.010)	0.065*** (0.010)
Openness, Creative Imagination	0.004*** (0.000)	0.007 (0.010)	0.153*** (0.010)	0.045*** (0.010)
Conscientiousness	0.014*** (0.000)	0.301*** (0.010)	-0.082*** (0.010)	0.096*** (0.010)
Conscientiousness, Organization	0.011*** (0.000)	0.284*** (0.010)	-0.136*** (0.010)	0.011 (0.010)
Conscientiousness, Productiveness	0.012*** (0.000)	0.113*** (0.010)	-0.030** (0.010)	0.155*** (0.010)
Conscientiousness, Responsibility	0.011*** (0.000)	0.315*** (0.010)	-0.006 (0.010)	0.075*** (0.010)
Extraversion	0.006*** (0.000)	0.117*** (0.010)	0.188*** (0.010)	0.274*** (0.010)
Extraversion, Sociability	0.002*** (0.000)	0.203*** (0.010)	0.092*** (0.010)	0.127*** (0.010)
Extraversion, Assertiveness	0.006*** (0.000)	0.012 (0.010)	0.197*** (0.010)	0.234*** (0.010)
Extraversion, Energy Level	0.006*** (0.000)	0.032** (0.010)	0.141*** (0.010)	0.267*** (0.010)
Agreeableness	0.006*** (0.000)	0.558*** (0.010)	0.113*** (0.010)	0.009 (0.010)
Agreeableness, Compassion	0.005*** (0.000)	0.593*** (0.010)	0.089*** (0.010)	-0.035*** (0.010)
Agreeableness, Respectfulness	0.003*** (0.000)	0.406*** (0.010)	0.128*** (0.010)	0.029** (0.010)
Agreeableness, Trust	0.007*** (0.000)	0.319*** (0.010)	0.052*** (0.010)	0.030** (0.010)
Neuroticism	-0.011*** (0.000)	0.372*** (0.010)	-0.119*** (0.010)	-0.303*** (0.010)
Neuroticism, Anxiety	-0.008*** (0.000)	0.486*** (0.010)	-0.105*** (0.010)	-0.273*** (0.010)
Neuroticism, Depression	-0.012*** (0.000)	0.145*** (0.010)	-0.062*** (0.010)	-0.250*** (0.010)
Neuroticism, Emotional Volatility	-0.007*** (0.000)	0.300*** (0.010)	-0.127*** (0.010)	-0.228*** (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 younger, 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: *($p < 0.05$), **($p < 0.01$), ***($p < 0.001$). N=38,798. See Tables S.4 to S.8 for multivariate regression models, in which we control for age, gender, education and income simultaneously.

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)



4.3 Education Inequalities in Personality over the Life Cycle

We next describe the education inequalities 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”).¹⁵ 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 30¹⁶, 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.¹⁷

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.

¹⁵According to this classification, 38.3% of our respondents had high education, vs 25.8% in the Danish population.

¹⁶It is not uncommon in Denmark that students complete their degrees in their late 20s. The age 30 cut off also accommodates for mature students who enter university after years of working.

¹⁷In a robustness check, we dropped all self-employed from the analysis (less than 3% of the sample). The self-employed could score particularly highly on Conscientiousness in older age (among other factors), thus they may drive some of the life cycle patterns we find. As men and women (and low/high SES) differ in their propensity to be self-employed, this could also affect the gender inequalities across the life span. Our main results do not change when dropping the self-employed. These additional results are presented in Table S.9 in the appendix.

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 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.¹⁸ 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

¹⁸Own 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.

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.

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

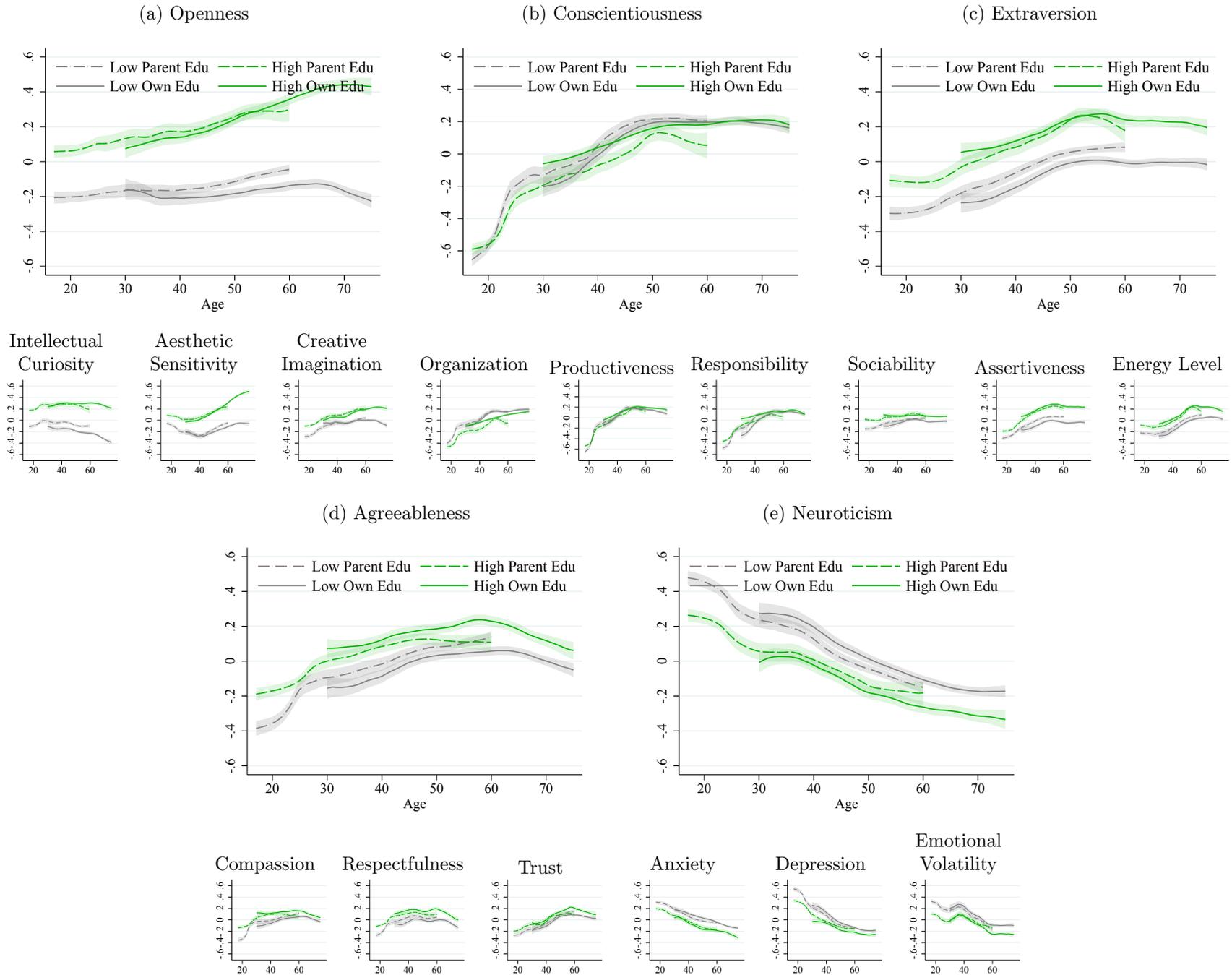
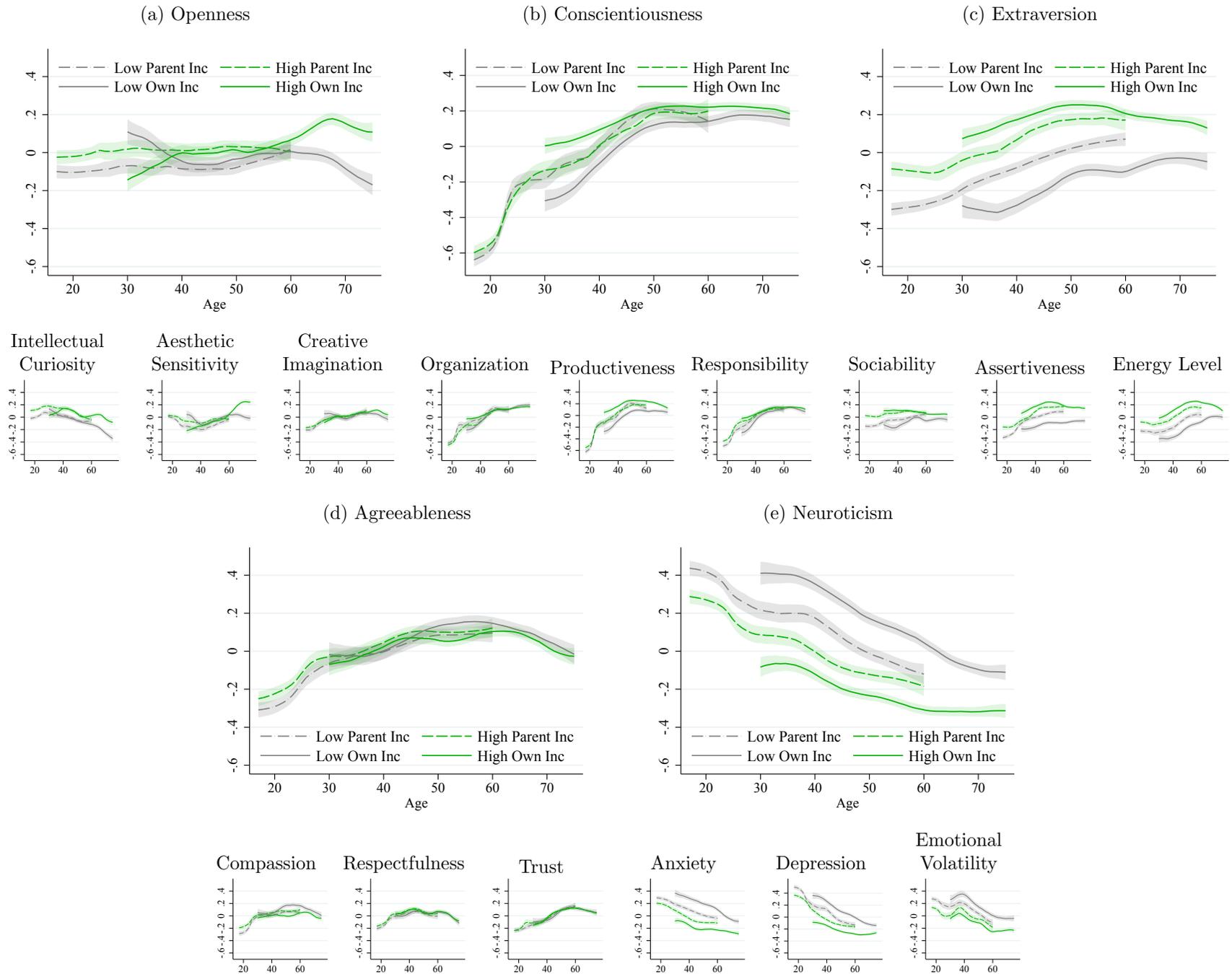


Figure 3: Income Inequalities in Personality over the Life Cycle (in Standard Deviations)



4.5 Controlling for Age, Cohorts and Time Effects

Although strictly speaking the literature would interpret the presented personality profiles across the life cycle 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 (year of birth) of the individual in question. The problem, as stated in the apc model literature is that 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).

Our data contains only one period of observation, and we thus cannot follow individuals over time. Given that our period is fixed (one survey wave), 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 by 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 three specific cohort controls: gender-specific unemployment rates, the average GDP growth rate, and the inflation rate (average annual consumer price index), all 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.¹⁹

Figure 4 and Fig. 5 contrast the age profiles with and without cohort controls. Controlling for each of these three 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 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 processes.

Obviously, it is possible that other cohort proxies than macroeconomic conditions may lead to a different outcome. This reservation pertains also to other recent papers like e.g. Dohmen et al. (2017), Kapteyn et al. (2005), and Schwandt and von Wachter (2019), which all take a similar pragmatic approach to distinguishing between cohort and age effects as ours. Thus, this 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, as stated above, 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. However, we conclude from this robustness check that when we control for factors that should influence cohorts' initial levels of traits when entering adulthood,

¹⁹Available 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 the average unemployment rate instead of a gender specific 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.

there is still a clear age profile to be observed. This additional variation over cohorts is consistent with e.g. [Donnellan and Lucas \(2008\)](#).

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

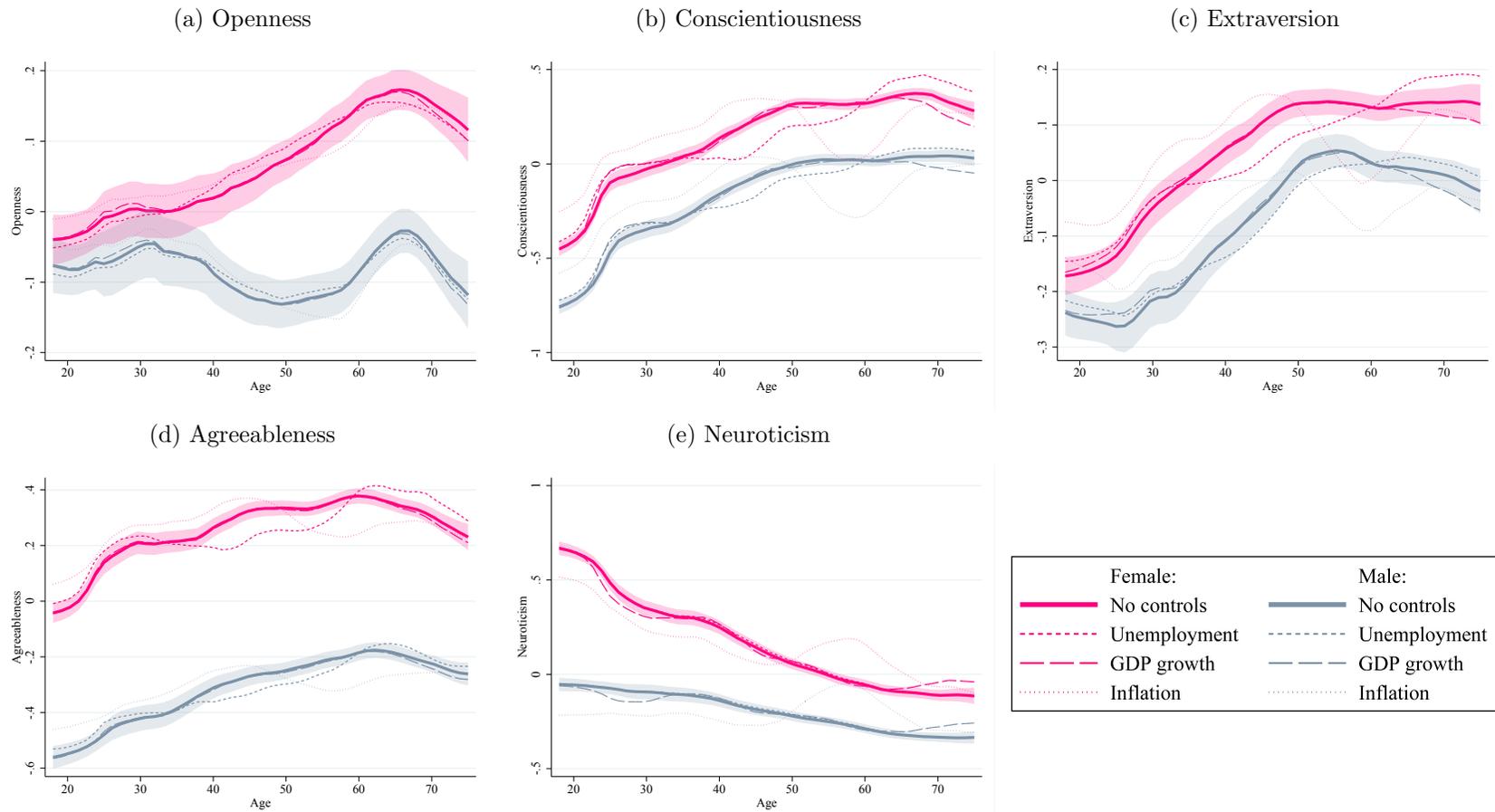
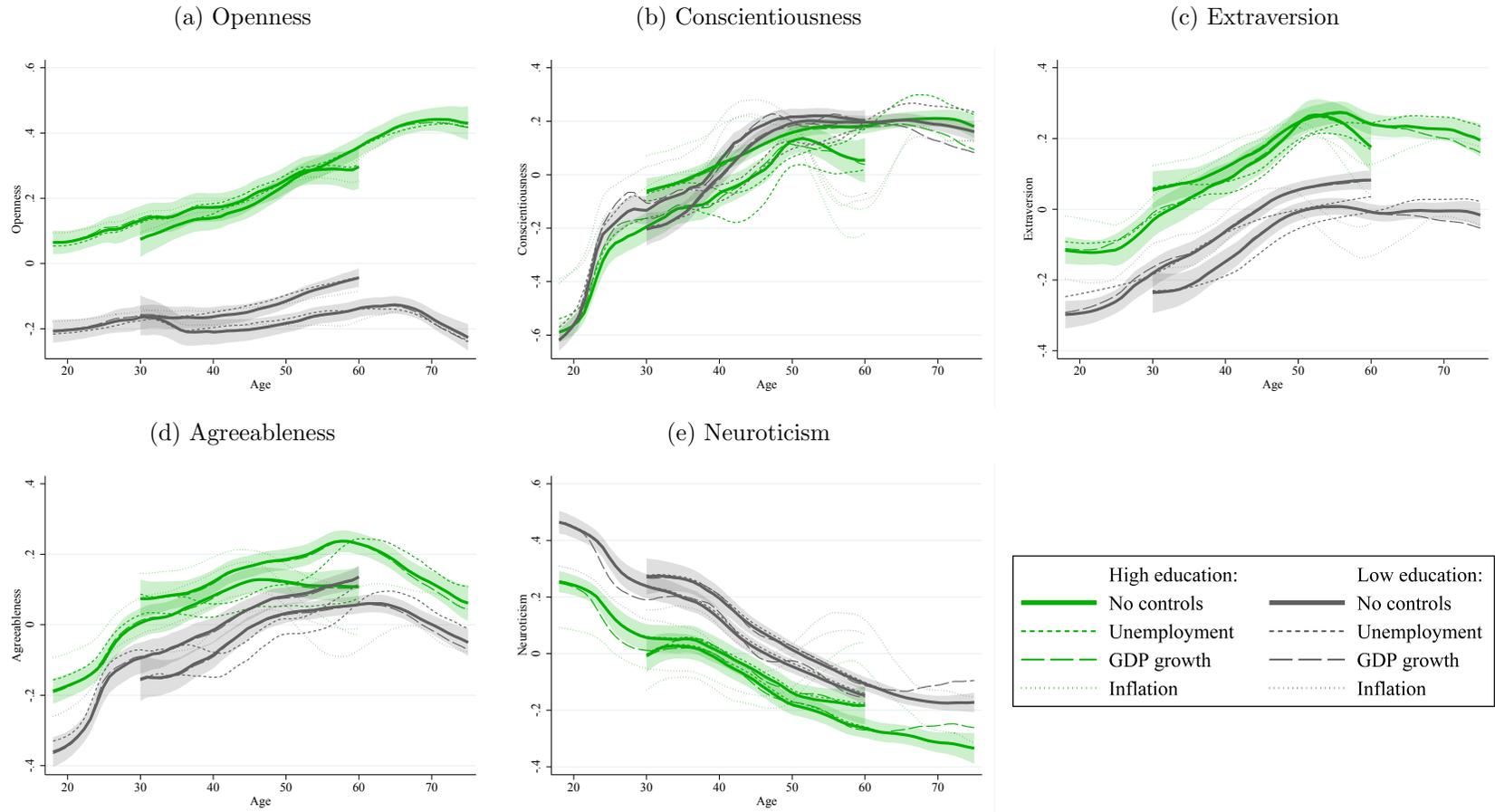


Figure 5: Education Inequalities in Personality over the Life Cycle (in Standard Deviations), Controlling for Cohort Effects with Macroeconomic Proxies



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 based on observables 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.3](#) 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 on observables 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.4](#) to [S.6](#) and Tables [S.13](#) to [S.16](#).

5 Discussion and Conclusion

In this study, we provide a comprehensive analysis of inequalities in personality at every stage of the life course. We document inequalities in personality traits across gender

and socioeconomic status. 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 - at almost every stage of the life cycle. Thus, while women score more highly on Conscientiousness, Extraversion, and Openness – traits that are usually positively correlated with SES – they also score more highly on Agreeableness and Neuroticism, traits that are negatively associated with wages.

Second, we find large and significant SES gaps in personality at every stage of the life cycle—regardless of whether SES is measured with parental background or own education and income. High SES is associated with higher scores on Openness to Experience, Extraversion, and Agreeableness, and lower scores on Neuroticism. Yet, we find no SES gap in Conscientiousness.

Third, most of the gender and SES inequalities in personality remain constant over the life cycle, with two exceptions. Both gender and SES inequalities in Openness to Experience widen significantly over the life cycle, while extremely wide gender gaps in Neuroticism observed in late adolescence converge over the life cycle.

Our findings contribute to a rich international literature that has documented life-cycle profiles in personality as well. On average, our age gradients in personality are not so different from previous research. Ignoring gender and SES inequalities, we also find that older individuals tend to be more agreeable and conscientious, and less neurotic than younger individuals ([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 strongest age gradient before the age of 30 ([Hopwood et al., 2011](#); [Pullmann et al., 2006](#); [Roberts and DelVecchio, 2000](#); [Terracciano et al., 2005](#)). Yet, we differ markedly in our findings from the previous literature in three respects.

First, in our data, we find no evidence that Extraversion scores are high in adolescence but lower in older age, which is equally true for men and women. The previous literature documented a flat or declining age profile in Extraversion over the life course (e.g. [Donnellan and Lucas, 2008](#); [Soto et al., 2011](#); [Srivastava et al., 2003](#)). Second, changing gender inequalities in both Openness to Experience and Neuroticism over the life cycle is a truly novel finding. Much of the previous literature does not find a life

cycle difference in the gender gap in these two traits ([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. \(2006\)](#) even suggested that “there is very little support for the idea that men and women change in distinct ways” over the life course (p. 15). Strictly speaking this conclusion is not quite correct, because [Soto et al. \(2011\)](#) and [Srivastava et al. \(2003\)](#), the only other two studies which plot gender gaps over the life cycle, also find that Neuroticism declines strongly for women over the life cycle, while the profile remains flat for men. However, neither study comments on or highlights their important finding.

Our findings suggests that women are heavily disadvantaged early in life (because of high Neuroticism scores) and privileged later in life (because of high Openness scores) relative to men. In late adolescence, women score 0.75 standard deviations higher than for men on Neuroticism. This is a time when adolescents have to make life-changing human capital decisions. If Neuroticism is a hindrance to rational and forward-looking decision-making, then women have it harder than men to prepare for life. These gender inequalities shrink continuously until they stabilize at 0.2 standard deviations in older age. Although true for all facets of Neuroticism, the converging age profiles are most remarkable for Emotional Volatility, a trait associated with unstable decision-making.

Older age becomes more easy for women also with respect to Openness to Experience, a trait associated with intellectual curiosity – some studies have linked it to intelligence ([Ackerman and Heggestad, 1997](#); [Aitken Harris, 2004](#); [Schretlen et al., 2010](#)) – creative imagination and aesthetic sensitivity. 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. Women are protected against the steep declines in Intellectual Curiosity over the life course, which we observe for men. If it is true that intellectual curiosity is a key factor in cognitive functioning and ability to learn new things, then men are heavily disadvantaged in older age relative to women.

Although our findings must be understood as a description of what is, they allow some speculation on their economic implications and avenues for future research. We focus in this discussion on gender wage gaps, household production models and divorce, and optimal taxation, three areas of economics where gender inequalities have been

discussed most widely.

A recent literature has suggested that gender wage gaps could be due to inequalities in psychological attributes such as personality (Bertrand, 2020; Blau and Kahn, 2017). As we demonstrate, women score more highly on three traits that the literature considers as productive—raising the question of why gender gaps in earnings still exist.²⁰ Both Conscientiousness and Extraversion, for instance, have 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 to Experience should only grow in importance in today’s labor markets, which should close the gender gap in earnings. One explanation for why women are still disadvantaged in the labor market is that they also score more highly in Neuroticism and Agreeableness at any stage of the life cycle. Both are negatively associated with wages. A second explanation is that men and women have differential returns of personality traits (Mueller and Plug, 2006), which would prevent a gender gap from closing. The implication of our findings is that gender gaps in wages should be less pronounced in older age (*ceteris paribus*), as women tend to have better soft skills in older age than in younger age relative to men.

The better endowment in some soft skills also means that in older age division of labor in household production should change. Observing that women score more highly on productive traits should, all else equal, result in relatively higher wages for women in the labor market in older age, 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. The division of labor in household production 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 gender division of labor through subsequent

²⁰It should be noted that the literature on gender gaps emphasize many other factors that explain gender wage gaps (see Blau and Kahn, 2017, for an overview). Some argue that the gender wage gap really is a family wage gap, because once women have children dents in their careers emerge (Kleven et al., 2019; Schurer et al., 2016). Others argue that it is selection into industries and occupations that pay less (Blau and Kahn, 2017). Another explanation for gender wage gaps is that men and women adhere to more traditional gender norms and stereotypes, influencing their labor market behaviors, despite equal educational qualifications (Bertrand, 2020; Blau and Kahn, 2017). Labour market outcomes may be the result of men and women shaping their identity according 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 reputation 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.

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](#)).

Changing gender disadvantages in personality over the life cycle may have important implications for the design of optimal taxation and transfer systems. 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. Optimal taxation policy is concerned with setting optimal tax and transfer rates to maximise tax revenue and create incentives to work. To avoid creating disincentives to work, this literature suggests to set taxes according to innate abilities (and not on abilities based on effort such as formal education). Optimal taxation policy could factor in gender inequalities in innate ability such as personality observed at different stages of the life cycle. Our findings suggest that young women would benefit from incentives in young age that helped them invest more in their human capital and participate in the labor market. Men, on the other hand, face innate ability disadvantage in late adulthood due to hefty declines in Intellectual Curiosity. 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 periods of retirement. Our findings suggest that men would benefit from incentives that helped them adjust better to the pre-retirement challenges of the labor market.

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 infor-

mation 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.

Finally, our findings on the socioeconomic inequalities in some but not all personality traits also have economic implications. Observing how skills are unevenly distributed in the population, and differentially so across the life cycle, enhances our understanding of the origins of inequality. Our finding that children from disadvantaged backgrounds score higher on Openness, Extraversion, and Agreeableness, and lower on Neuroticism at every stage of the life cycle is a new finding. Socioeconomic gaps are present when considering parental and own SES, which suggests that the early-life origins of skill disadvantage are not easily overcome in adulthood. Another new finding is that in our Danish population we find no socioeconomic inequalities in Conscientiousness, which is one of the most important predictors of educational attainment, and performance at work and university. Although SES gaps (or their lack of) in personality remain constant over the life cycle for most personality traits, they widen significantly for Openness to Experience. In the context of SES gaps this is a very important finding, because previous literature has shown that this trait is highly beneficial to disadvantaged populations in terms of overcoming education barriers (Lundberg, 2013).

The strong persistence of socioeconomic inequalities in personality from late adolescence, when they are largely the result of parental background, to late adulthood, when they are associated with own circumstances, may be one reason why economic inequalities persist over the life course and across generations. Our study cannot say why socioeconomic inequalities in personality emerge by late adolescence and why they remain present or even widen over the life cycle. Previous research suggests that childhood inequalities in personality result from socioeconomic inequalities in parenting styles and behaviors rooted in childhood (Elkins and Schurer, 2020; Falk et al., 2020). Future research is certainly needed to explain the mechanisms driving persisting or widening

inequalities in personality across the life span.

References

- Ackerman, P. and E. Heggstad (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.
- Blau, F. D. and L. M. Kahn (2017). The gender wage gap: Extent, trends, and explanations. *Journal of Economic Literature* 55(3), 789–865.
- 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.
- 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.
- 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 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. and S. Schurer (2020). Exploring the role of parental engagement in non-cognitive skill development over the lifecycle. *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. M. (2013). The effects of personality traits on adult labor market outcomes: Evidence from siblings. *Journal of Economic Behavior & Organization* 89, 122–135.
- García-Miralles, E. and J. Leganza (2020). Public pensions and private savings. *working paper, University of Copenhagen*.
- 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.
- Grossbard-Shechtman, A. (1984). A Theory of Allocation of Time in Markets for Labour and Marriage. *The Economic Journal* 94(376), 863–882.
- 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.
- 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.
- 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.
- Kleven, H., C. Landais, and J. E. Sogaard (2019, October). Children and gender inequality: Evidence from denmark. *American Economic Journal: Applied Economics* 11(4), 181–209.
- 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.
- 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.
- 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). Altruism, 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 Psychology* 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., D. Kuehnle, A. Scott, and T. C. Cheng (2016). A man’s blessing or a woman’s curse? the family earnings gap of doctors. *Industrial Relations: A Journal of Economy and Society* 55(3), 385–414.
- 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.
- 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/wr Psychologie* 215(2), 132–151.
- 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). The Surprising Power of Age-Dependent Taxes. *The Review of Economic Studies* 78(4), 1490–1518.
- 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
Age on May 1 2020	47.33	17.60
Female	0.55	0.50
High education (parents/own)	0.42	0.49
High education of parents	0.34	0.47
High education	0.35	0.48
Education: Compulsory	0.26	0.44
Education: Upper secondary	0.10	0.29
Education: Vocational secondary	0.30	0.46
Education: Short tertiary	0.04	0.20
Education: Medium tertiary	0.18	0.39
Education: Bachelor and longer tertiary	0.13	0.33
Above-median income (parents/own)	1.55	0.50
Total parental income	509,041	639,197
Income	350,783	454,115
Single	0.37	0.48
Number of children under 18	0.15	0.43
Number of children	1.11	1.18
Ethnic minority	0.06	0.24
Survey completion on Monday	0.09	0.29
Survey completion on Tuesday	0.10	0.30
Survey completion on Wednesday	0.25	0.43
Survey completion on Thursday	0.17	0.37
Survey completion on Friday	0.13	0.34
Survey completion on Saturday	0.11	0.32
Survey completion on Sunday	0.15	0.35
Survey complete time: morning	0.15	0.36
Survey complete time: working hours	0.57	0.49
Survey complete time: evening	0.23	0.42
Survey complete time: night	0.04	0.20
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
Observations	38,798	

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*** (0.000)	-0.002*** (0.000)	0.005*** (0.000)	0.005*** (0.000)
Female	0.137*** (0.010)	0.141*** (0.010)	0.167*** (0.010)	0.001 (0.010)
High education	0.412*** (0.011)	0.420*** (0.011)	0.343*** (0.011)	0.183*** (0.011)
Above-median income	-0.004 (0.011)	0.042*** (0.011)	-0.024* (0.011)	-0.019 (0.011)
Constant	-0.429*** (0.022)	-0.207*** (0.022)	-0.420*** (0.022)	-0.304*** (0.022)
Observations	38371	38109	38309	38319

Note: Multivariate regressions of personality trait and facet on demographic variables (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 younger, 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*** (0.000)	0.011*** (0.000)	0.012*** (0.000)	0.011*** (0.000)
Female	0.340*** (0.010)	0.313*** (0.010)	0.148*** (0.010)	0.341*** (0.010)
High education	-0.072*** (0.010)	-0.121*** (0.011)	-0.026* (0.011)	-0.002 (0.011)
Above-median income	0.125*** (0.010)	0.060*** (0.011)	0.150*** (0.011)	0.090*** (0.011)
Constant	-1.020*** (0.021)	-0.723*** (0.022)	-0.882*** (0.022)	-0.820*** (0.022)
Observations	38378	38364	38334	38331

Note: See note to Table S.4.

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

	(1)	(2)	(3)	(4)
	Extraversion	Sociability	Assertiveness	Energy Level
Age on May 1 2020	0.006*** (0.000)	0.002*** (0.000)	0.006*** (0.000)	0.006*** (0.000)
Female	0.149*** (0.010)	0.223*** (0.010)	0.032** (0.010)	0.066*** (0.010)
High education	0.138*** (0.011)	0.048*** (0.011)	0.172*** (0.011)	0.099*** (0.011)
Above-median income	0.237*** (0.011)	0.136*** (0.011)	0.174*** (0.011)	0.230*** (0.011)
Constant	-0.788*** (0.022)	-0.426*** (0.022)	-0.648*** (0.022)	-0.725*** (0.022)
Observations	38381	38348	38321	38337

Note: See note to Table S.4.

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

	(1)	(2)	(3)	(4)
	Agreeableness	Compassion	Respectfulness	Trust
Age on May 1 2020	0.007*** (0.000)	0.006*** (0.000)	0.003*** (0.000)	0.007*** (0.000)
Female	0.568*** (0.010)	0.599*** (0.010)	0.408*** (0.010)	0.334*** (0.010)
High education	0.106*** (0.010)	0.084*** (0.010)	0.112*** (0.011)	0.056*** (0.011)
Above-median income	0.032** (0.010)	-0.001 (0.010)	0.038*** (0.011)	0.039*** (0.011)
Constant	-0.735*** (0.021)	-0.635*** (0.021)	-0.493*** (0.022)	-0.605*** (0.022)
Observations	38382	38360	38349	38351

Note: See note to Table S.4.

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

	(1)	(2)	(3)	(4)
	Neuroticism	Anxiety	Depression	Emotional Volatility
Age on May 1 2020	-0.011*** (0.000)	-0.008*** (0.000)	-0.012*** (0.000)	-0.007*** (0.000)
Female	0.343*** (0.010)	0.465*** (0.010)	0.110*** (0.010)	0.284*** (0.010)
High education	-0.130*** (0.010)	-0.119*** (0.010)	-0.069*** (0.011)	-0.136*** (0.011)
Above-median income	-0.195*** (0.010)	-0.160*** (0.010)	-0.186*** (0.011)	-0.135*** (0.011)
Constant	0.690*** (0.021)	0.414*** (0.021)	0.832*** (0.022)	0.449*** (0.022)
Observations	38375	38344	38344	38323

Note: See note to Table S.4.

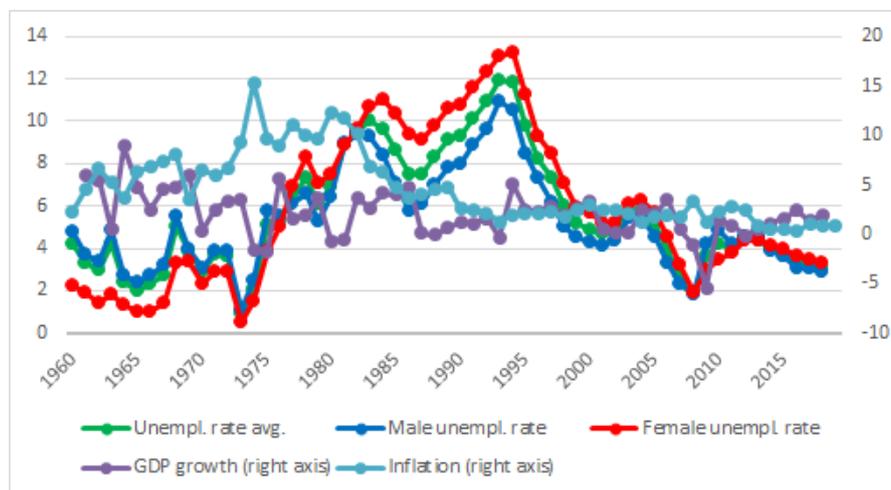
Table S.9: Robustness Check: Restricting Sample to Exclude Self-Employed

	(1) Age	(2) Female	(3) High Education	(4) High Income
Openness	0.002*** (0.000)	0.149*** (0.010)	0.397*** (0.010)	0.114*** (0.010)
Openness, Intellectual Curiosity	-0.004*** (0.000)	0.158*** (0.010)	0.446*** (0.010)	0.146*** (0.010)
Openness, Aesthetic Sensitivity	0.003*** (0.000)	0.177*** (0.010)	0.319*** (0.010)	0.069*** (0.010)
Openness, Creative Imagination	0.004*** (0.000)	0.004 (0.010)	0.156*** (0.010)	0.053*** (0.010)
Conscientiousness	0.014*** (0.000)	0.307*** (0.010)	-0.081*** (0.011)	0.093*** (0.010)
Conscientiousness, Organization	0.011*** (0.000)	0.288*** (0.010)	-0.136*** (0.011)	0.005 (0.010)
Conscientiousness, Productiveness	0.012*** (0.000)	0.121*** (0.010)	-0.028** (0.011)	0.154*** (0.010)
Conscientiousness, Responsibility	0.011*** (0.000)	0.317*** (0.010)	-0.005 (0.010)	0.076*** (0.010)
Extraversion	0.006*** (0.000)	0.120*** (0.010)	0.187*** (0.010)	0.278*** (0.010)
Extraversion, Sociability	0.002*** (0.000)	0.202*** (0.010)	0.090*** (0.011)	0.127*** (0.010)
Extraversion, Assertiveness	0.006*** (0.000)	0.017 (0.010)	0.194*** (0.010)	0.238*** (0.010)
Extraversion, Energy Level	0.006*** (0.000)	0.037*** (0.010)	0.145*** (0.010)	0.273*** (0.010)
Agreeableness	0.006*** (0.000)	0.559*** (0.010)	0.115*** (0.010)	0.017 (0.010)
Agreeableness, Compassion	0.005*** (0.000)	0.594*** (0.010)	0.088*** (0.010)	-0.030** (0.010)
Agreeableness, Respectfulness	0.003*** (0.000)	0.407*** (0.010)	0.132*** (0.010)	0.036*** (0.010)
Agreeableness, Trust	0.007*** (0.000)	0.320*** (0.010)	0.054*** (0.011)	0.035*** (0.010)
Neuroticism	-0.011*** (0.000)	0.374*** (0.010)	-0.121*** (0.011)	-0.308*** (0.010)
Neuroticism, Anxiety	-0.008*** (0.000)	0.489*** (0.010)	-0.106*** (0.011)	-0.275*** (0.010)
Neuroticism, Depression	-0.012*** (0.000)	0.145*** (0.010)	-0.064*** (0.011)	-0.255*** (0.010)
Neuroticism, Emotional Volatility	-0.007*** (0.000)	0.301*** (0.010)	-0.131*** (0.011)	-0.233*** (0.010)

Note: Repeating Table 2 on the sub-sample of individuals who are not self-employed. N=37,472.

S.2 Additional Results on Cohort-Effects

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



Note: Figure shows annual average unemployment rate, gender specific unemployment rates, annual growth in GDP and annual inflation rate as measured as changed in the consumer price index. These are used as proxies for cohort specific conditions measured when individual was 18 in Fig. S.2 and Fig. S.3.

Figure S.2: Gender Inequalities in Personality over the Life Cycle (in Standard Deviations), Controlling for Cohort Effects with Macroeconomic Proxies

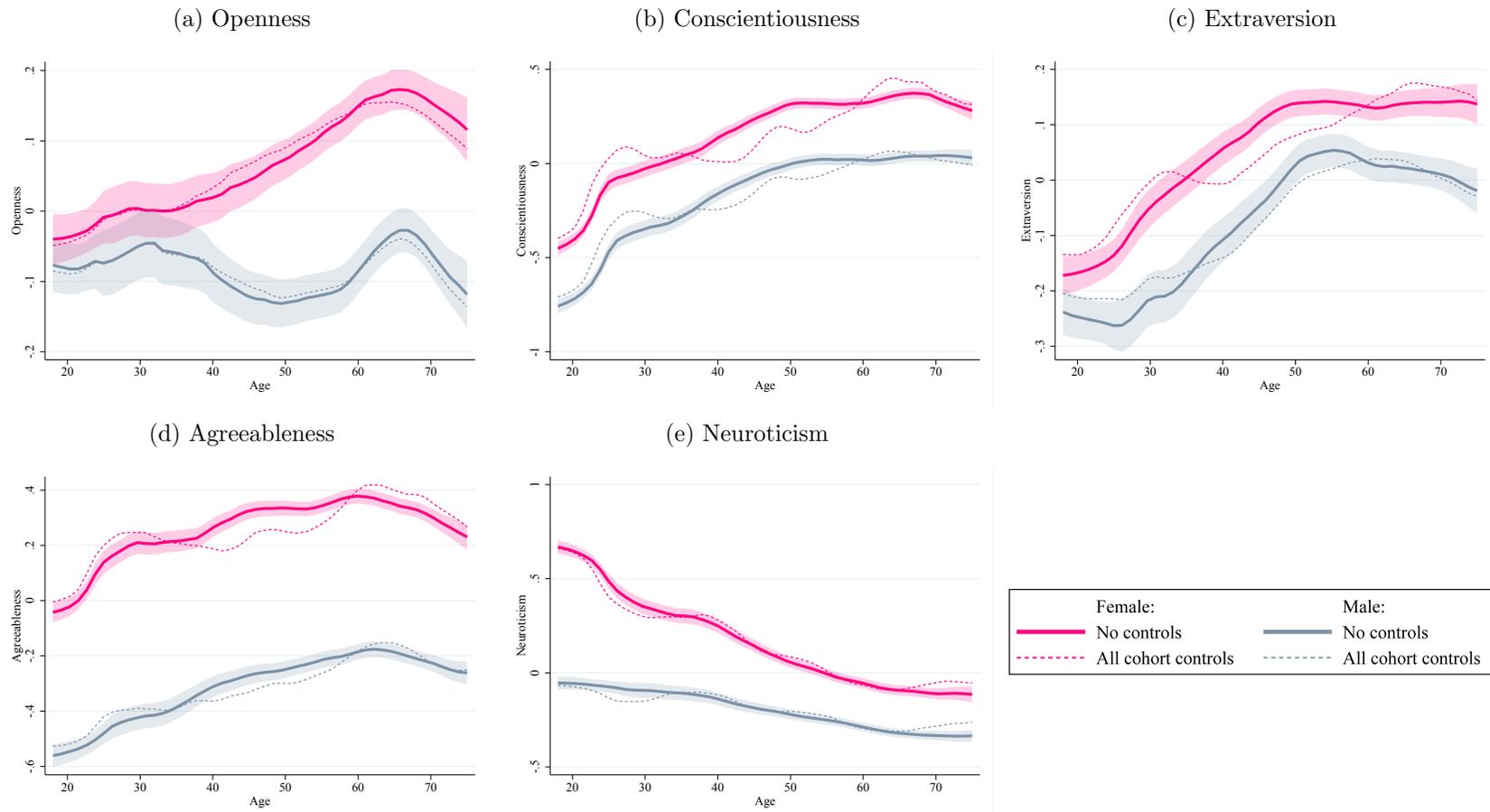
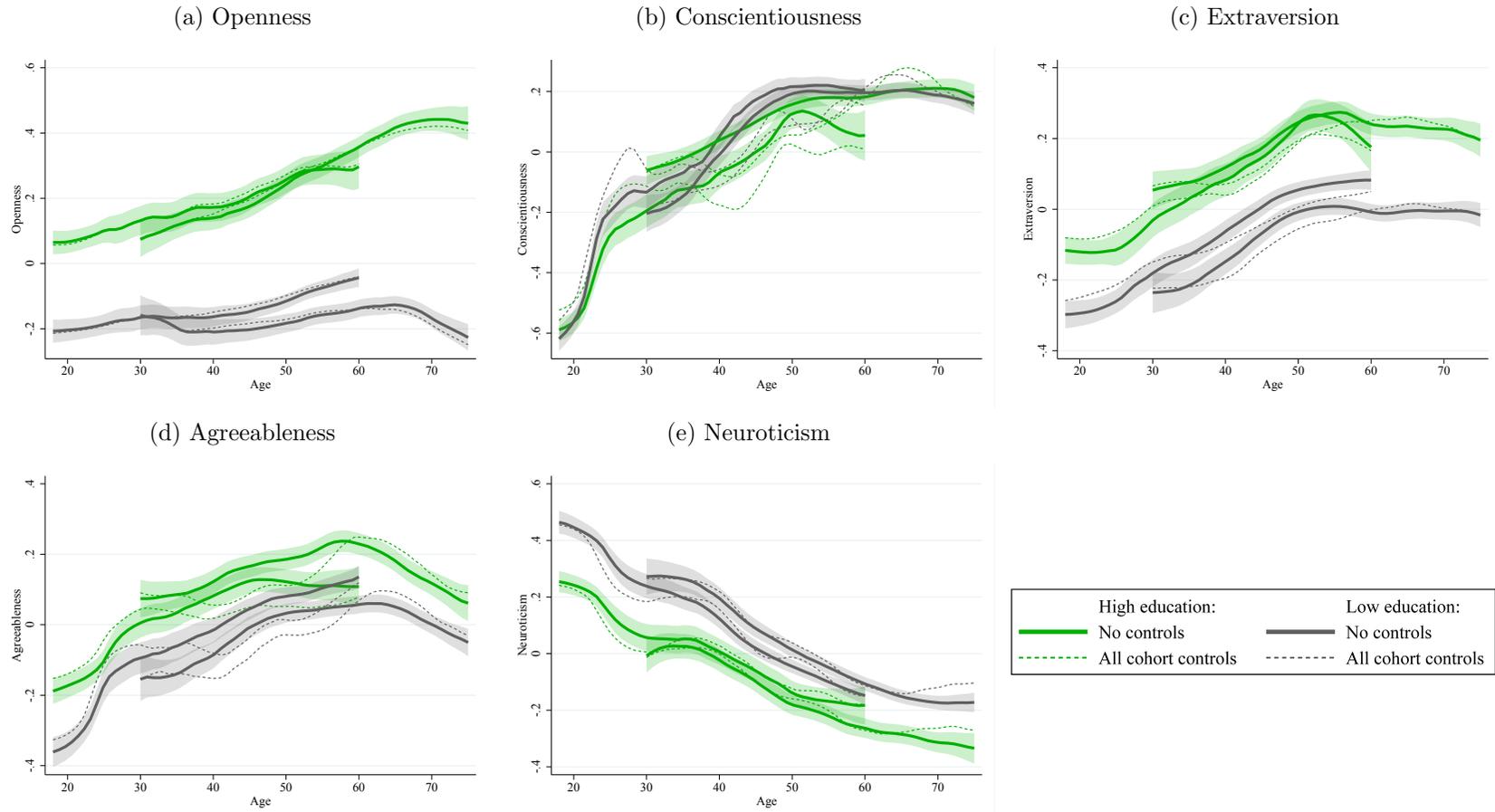


Figure S.3: Education Inequalities in Personality over the Life Cycle (in Standard Deviations), Controlling for Cohort Effects with Macroeconomic Proxies



S.3 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).²¹ 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.10 to S.12. 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 are more highly educated, are non-immigrants, 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).

²¹Only 49 individuals who responded partially to the 5 traits if they responded to any of them.

Table S.10: Comparison Respondents' and Non-Respondents' Characteristics, Age 18-29

	Mean Non-Resp.	Mean Respondents	Difference	Observations
Male	0.52	0.46	0.06***	49,908
Education Father: Compulsory	0.51	0.46	0.04***	26,692
Education Father: Upper secondary	0.01	0.01	-0.00**	26,692
Education Father: Vocational secondary	0.36	0.37	-0.01*	26,692
Education Father: Short tertiary	0.02	0.03	-0.01**	26,692
Education Father: Medium tertiary	0.06	0.07	-0.01**	26,692
Education Father: Bachelor and longer tertiary	0.04	0.05	-0.01***	26,692
Education Mother: Compulsory	0.68	0.64	0.04***	30,321
Education Mother: Upper secondary	0.01	0.01	-0.00***	30,321
Education Mother: Vocational secondary	0.22	0.23	-0.01*	30,321
Education Mother: Short tertiary	0.01	0.01	-0.00*	30,321
Education Mother: Medium tertiary	0.07	0.09	-0.02***	30,321
Education Mother: Bachelor and longer tertiary	0.01	0.01	-0.00***	30,321
Father personal income	118,806	122,648	-3,842	28,979
Mother personal income	135,419	135,045	374	31,920
Education: Compulsory	0.30	0.17	0.13***	49,010
Education: Upper secondary	0.05	0.05	-0.00	49,010
Education: Vocational secondary	0.41	0.41	0.00	49,010
Education: Short tertiary	0.03	0.05	-0.02***	49,010
Education: Medium tertiary	0.13	0.22	-0.09***	49,010
Education: Bachelor and longer tertiary	0.07	0.10	-0.03***	49,010
Personal income	362,963	407,214	-44,251***	49,908
Days spent in hospital	3.16	2.89	0.27**	49,908
GP visits	1.41	1.40	0.01	49,908
Biological siblings	1.82	1.76	0.07***	33,133
Married/Cohabiting	0.66	0.76	-0.10***	49,698
Non-Danish	0.09	0.03	0.05***	49,908
Number of children under 18	0.11	0.10	0.01***	49,908
Single	0.35	0.25	0.11***	49,908

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

Table S.11: Comparison Respondents' and Non-Respondents' Characteristics, Age 30-49

	Mean Non-Resp.	Mean Respondents	Difference	Observations
Male	0.54	0.42	0.12***	36,284
Education Father: Compulsory	0.32	0.29	0.03***	31,121
Education Father: Upper secondary	0.03	0.02	0.00	31,121
Education Father: Vocational secondary	0.44	0.43	0.01	31,121
Education Father: Short tertiary	0.04	0.04	-0.01**	31,121
Education Father: Medium tertiary	0.10	0.12	-0.01***	31,121
Education Father: Bachelor and longer tertiary	0.07	0.09	-0.02***	31,121
Education Mother: Compulsory	0.38	0.33	0.05***	31,872
Education Mother: Upper secondary	0.02	0.03	-0.00	31,872
Education Mother: Vocational secondary	0.35	0.35	-0.00	31,872
Education Mother: Short tertiary	0.03	0.03	-0.00	31,872
Education Mother: Medium tertiary	0.18	0.22	-0.03***	31,872
Education Mother: Bachelor and longer tertiary	0.03	0.04	-0.01***	31,872
Father personal income	288,135	286,033	2,102	31,834
Mother personal income	242,775	247,472	-4,698	32,444
Education: Compulsory	0.21	0.11	0.10***	34,922
Education: Upper secondary	0.10	0.10	-0.01*	34,922
Education: Vocational secondary	0.33	0.29	0.04***	34,922
Education: Short tertiary	0.04	0.05	-0.01***	34,922
Education: Medium tertiary	0.15	0.23	-0.08***	34,922
Education: Bachelor and longer tertiary	0.18	0.22	-0.04***	34,922
Personal income	404,496	439,532	-35,036***	36,284
Days spent in hospital	1.88	2.07	-0.19*	36,284
GP visits	0.85	0.87	-0.02	36,284
Biological siblings	1.86	1.78	0.08***	32,385
Married/Cohabiting	0.67	0.74	-0.06***	35,550
Non-Danish	0.18	0.09	0.09***	36,284
Number of children under 18	0.32	0.37	-0.05***	36,284
Single	0.32	0.25	0.07***	36,284

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

Table S.12: Comparison Respondents' and Non-Respondents' Characteristics, Age 50-75

	Mean Non-Resp.	Mean Respondents	Difference	Observations
Male	0.52	0.46	0.06***	49,908
Education Father: Compulsory	0.51	0.46	0.04***	26,692
Education Father: Upper secondary	0.01	0.01	-0.00**	26,692
Education Father: Vocational secondary	0.36	0.37	-0.01*	26,692
Education Father: Short tertiary	0.02	0.03	-0.01**	26,692
Education Father: Medium tertiary	0.06	0.07	-0.01**	26,692
Education Father: Bachelor and longer tertiary	0.04	0.05	-0.01***	26,692
Education Mother: Compulsory	0.68	0.64	0.04***	30,321
Education Mother: Upper secondary	0.01	0.01	-0.00***	30,321
Education Mother: Vocational secondary	0.22	0.23	-0.01*	30,321
Education Mother: Short tertiary	0.01	0.01	-0.00*	30,321
Education Mother: Medium tertiary	0.07	0.09	-0.02***	30,321
Education Mother: Bachelor and longer tertiary	0.01	0.01	-0.00***	30,321
Father personal income	118,806	122,648	-3,842	28,979
Mother personal income	135,419	135,045	374	31,920
Education: Compulsory	0.30	0.17	0.13***	49,010
Education: Upper secondary	0.05	0.05	-0.00	49,010
Education: Vocational secondary	0.41	0.41	0.00	49,010
Education: Short tertiary	0.03	0.05	-0.02***	49,010
Education: Medium tertiary	0.13	0.22	-0.09***	49,010
Education: Bachelor and longer tertiary	0.07	0.10	-0.03***	49,010
Personal income	362,963	407,214	-44,251***	49,908
Days spent in hospital	3.16	2.89	0.27**	49,908
GP visits	1.41	1.40	0.01	49,908
Biological siblings	1.82	1.76	0.07***	33,133
Married/Cohabiting	0.66	0.76	-0.10***	49,698
Non-Danish	0.09	0.03	0.05***	49,908
Number of children under 18	0.11	0.10	0.01***	49,908
Single	0.35	0.25	0.11***	49,908

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

We next perform an inverse-probability weighting (IPW) adjustment for attrition or non-response. We use the variables in Tables S.10 to S.12 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, an indicator for whether they are currently married or cohabiting, the number of children under 18 in the household and whether they are single. 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.

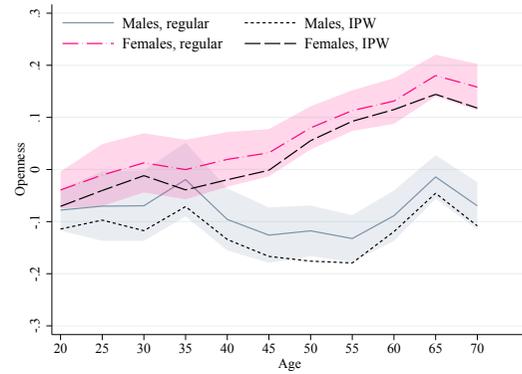
Within 5-year age bins, we predict response to the BFI-2-S on the basis of these covariates for each individual, from binary probit regressions. The inverse probability weight is computed as the inverse of this predicted probability. We then regress the individual BFI-2-S score on age indicators (in 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.5 and Fig. S.6.

For an easier direct comparison, we also present average traits by the age groups of Tables S.10 to S.12, with and without adjustment for non-response with IPW, in Tables S.13 to S.16.

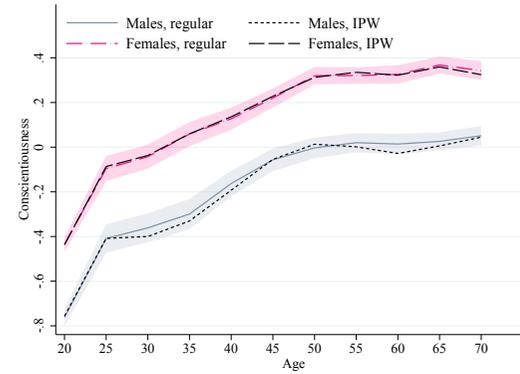
Adjusting the average traits by age for observable selection into the sample, on the basis of a wide array of important covariates, does not alter the life-cycle profile of these traits, or their gradients by sex, income, or education.

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

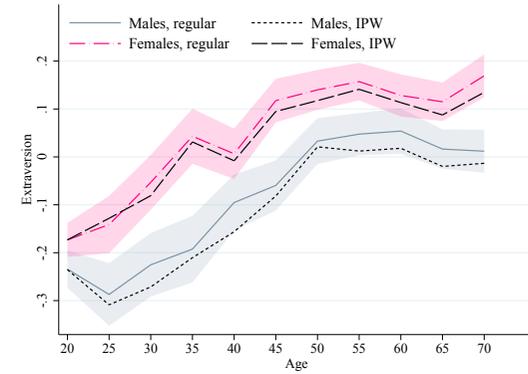
(a) Openness



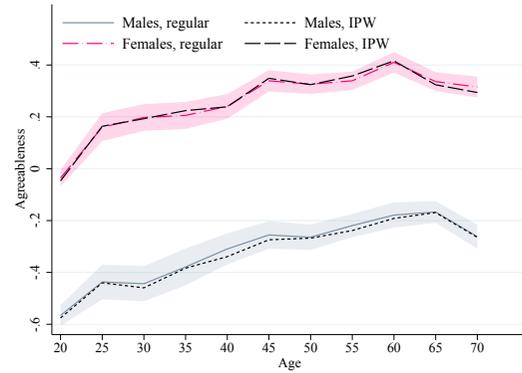
(b) Conscientiousness



(c) Extraversion



(d) Agreeableness



(e) Neuroticism

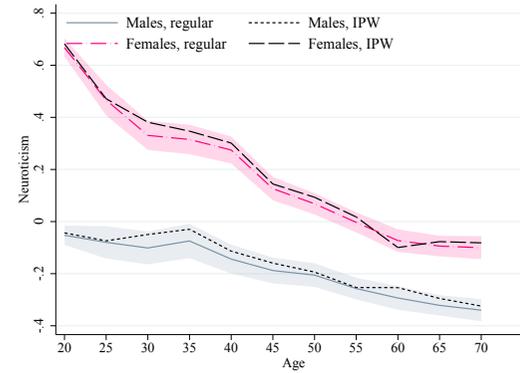
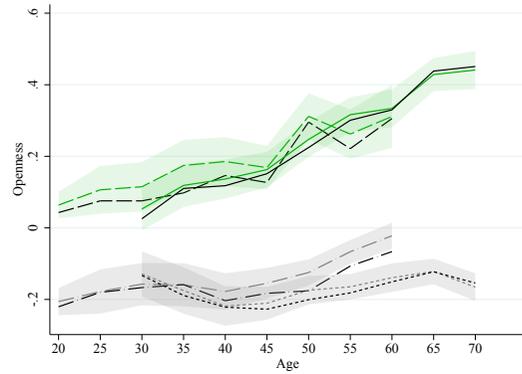
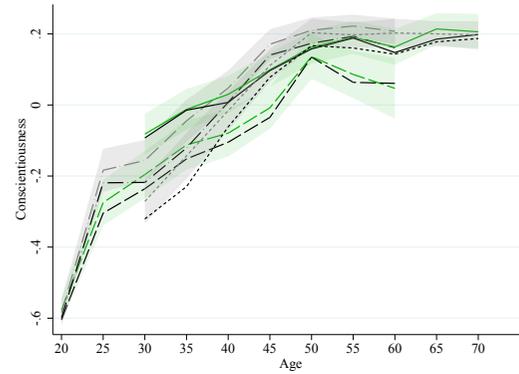


Figure S.5: Personality by Age and Education, IPW-Adjusted for observable Selection into Sample

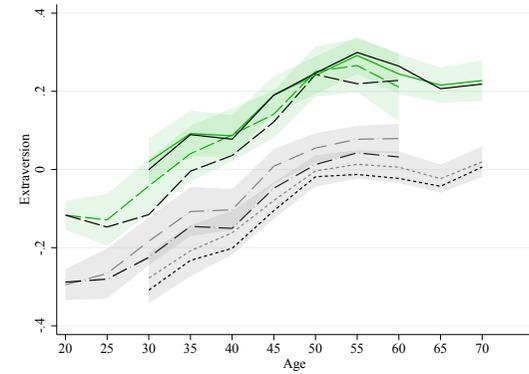
(a) Openness



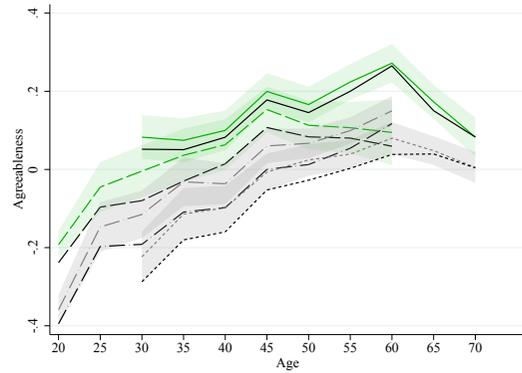
(b) Conscientiousness



(c) Extraversion



(d) Agreeableness



(e) Neuroticism

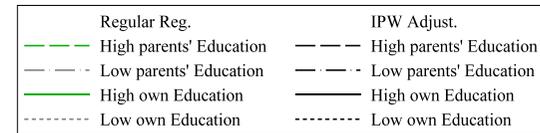
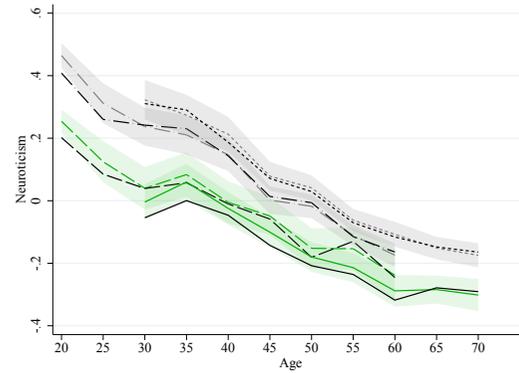


Figure S.6: Personality by Age and Income, IPW-Adjusted for observable Selection into Sample

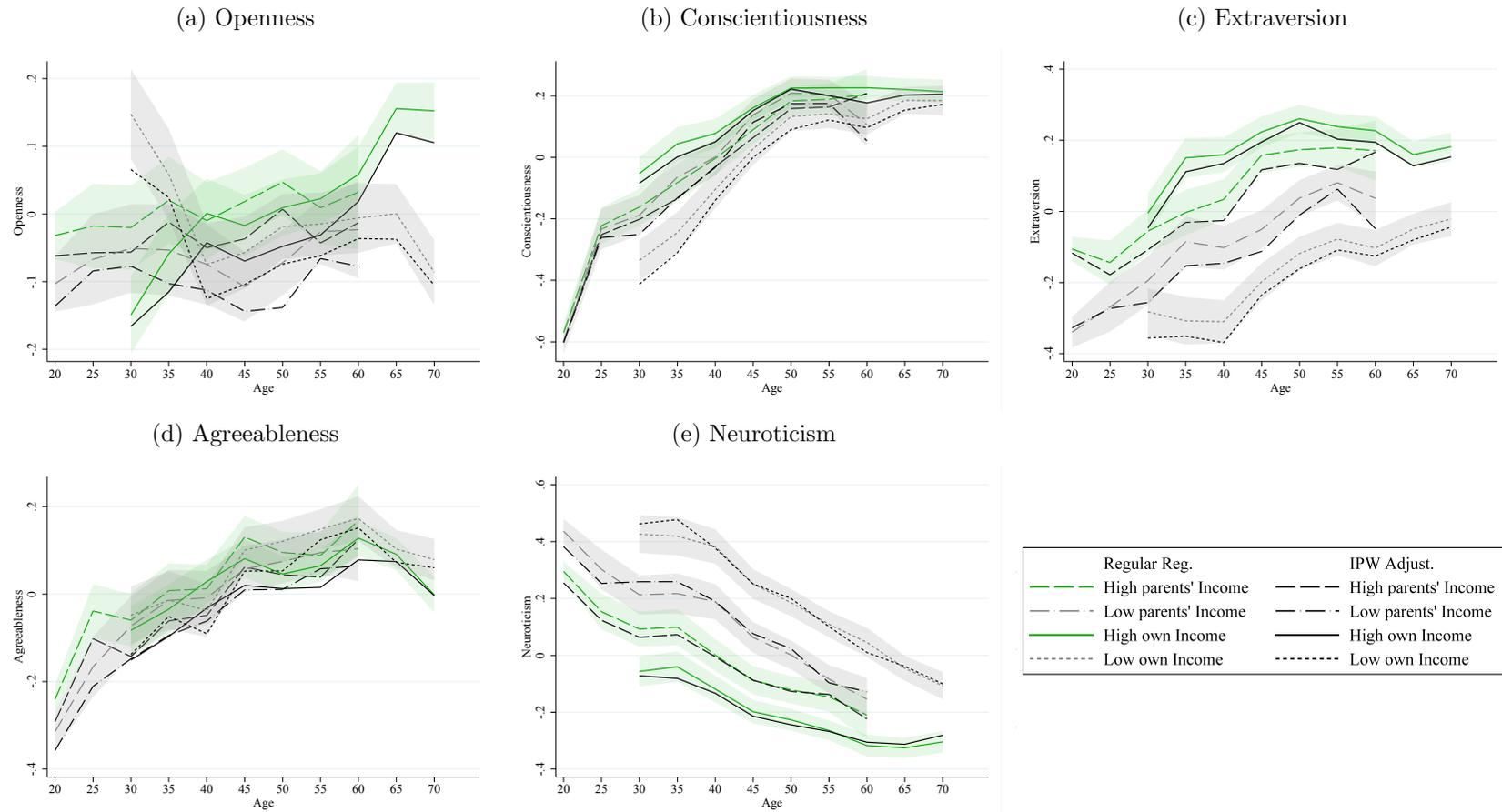


Table S.13: Average Traits by Age, Low Parental Income: Regular vs IPW-adjusted

	Openness		Conscientiousness		Extraversion		Agreeableness		Neuroticism	
	(1) Reg	(2) IPW	(3) Reg	(4) IPW	(5) Reg	(6) IPW	(7) Reg	(8) IPW	(9) Reg	(10) IPW
20	-0.10*** (0.02)	-0.14*** (0.02)	-0.60*** (0.02)	-0.60*** (0.02)	-0.34*** (0.02)	-0.33*** (0.03)	-0.31*** (0.02)	-0.36*** (0.03)	0.44*** (0.02)	0.38*** (0.02)
25	-0.07** (0.03)	-0.08** (0.04)	-0.23*** (0.03)	-0.26*** (0.04)	-0.27*** (0.04)	-0.27*** (0.04)	-0.17*** (0.04)	-0.21*** (0.04)	0.30*** (0.04)	0.25*** (0.04)
30	-0.05 (0.03)	-0.08** (0.04)	-0.19*** (0.03)	-0.25*** (0.04)	-0.19*** (0.03)	-0.26*** (0.04)	-0.07** (0.03)	-0.15*** (0.04)	0.21*** (0.03)	0.26*** (0.04)
35	-0.05 (0.03)	-0.10*** (0.04)	-0.06* (0.03)	-0.13*** (0.04)	-0.09** (0.04)	-0.15*** (0.04)	-0.01 (0.04)	-0.09** (0.04)	0.22*** (0.04)	0.26*** (0.04)
40	-0.07** (0.03)	-0.11*** (0.03)	0.00 (0.03)	-0.03 (0.03)	-0.10*** (0.03)	-0.15*** (0.04)	-0.01 (0.03)	-0.06* (0.04)	0.19*** (0.03)	0.19*** (0.04)
45	-0.11*** (0.03)	-0.14*** (0.03)	0.14*** (0.03)	0.11*** (0.03)	-0.05* (0.03)	-0.11*** (0.03)	0.06** (0.03)	0.01 (0.03)	0.06** (0.03)	0.08** (0.03)
50	-0.07*** (0.02)	-0.14*** (0.03)	0.21*** (0.02)	0.17*** (0.03)	0.04 (0.03)	-0.01 (0.03)	0.07*** (0.03)	0.01 (0.03)	0.00 (0.03)	0.02 (0.03)
55	-0.03 (0.02)	-0.07** (0.03)	0.20*** (0.02)	0.18*** (0.03)	0.08*** (0.03)	0.06** (0.03)	0.09*** (0.03)	0.06** (0.03)	-0.08*** (0.03)	-0.10*** (0.03)
60	-0.02 (0.04)	-0.08* (0.04)	0.11*** (0.04)	0.05 (0.04)	0.04 (0.04)	-0.05 (0.05)	0.10*** (0.04)	0.06 (0.04)	-0.15*** (0.04)	-0.13*** (0.04)
Observations	1082	9788	11086	9789	11087	9791	11087	9791	11089	9791

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, High Parental Income: Regular vs IPW-adjusted

	Openness		Conscientiousness		Extraversion		Agreeableness		Neuroticism	
	(1) Reg	(2) IPW	(3) Reg	(4) IPW	(5) Reg	(6) IPW	(7) Reg	(8) IPW	(9) Reg	(10) IPW
20	-0.03* (0.02)	-0.06*** (0.02)	-0.57*** (0.02)	-0.60*** (0.02)	-0.11*** (0.02)	-0.12*** (0.02)	-0.24*** (0.02)	-0.29*** (0.02)	0.29*** (0.02)	0.25*** (0.02)
25	-0.02 (0.03)	-0.06* (0.03)	-0.22*** (0.03)	-0.25*** (0.03)	-0.14*** (0.03)	-0.18*** (0.03)	-0.04 (0.03)	-0.10*** (0.03)	0.15*** (0.03)	0.12*** (0.03)
30	-0.02 (0.03)	-0.06 (0.04)	-0.16*** (0.03)	-0.20*** (0.03)	-0.06* (0.03)	-0.11*** (0.04)	-0.06* (0.03)	-0.14*** (0.04)	0.09*** (0.03)	0.06* (0.04)
35	0.02 (0.03)	-0.01 (0.03)	-0.08*** (0.03)	-0.13*** (0.03)	-0.00 (0.03)	-0.03 (0.04)	0.01 (0.03)	-0.06* (0.03)	0.10*** (0.03)	0.07** (0.04)
40	-0.01 (0.03)	-0.05 (0.03)	-0.00 (0.03)	-0.03 (0.03)	0.03 (0.03)	-0.03 (0.03)	0.01 (0.03)	-0.05 (0.03)	0.00 (0.03)	-0.00 (0.03)
45	0.02 (0.03)	-0.04 (0.03)	0.09*** (0.02)	0.06** (0.03)	0.16*** (0.03)	0.12*** (0.03)	0.13*** (0.02)	0.06** (0.03)	-0.09*** (0.03)	-0.09*** (0.03)
50	0.05* (0.02)	0.01 (0.03)	0.18*** (0.02)	0.16*** (0.02)	0.17*** (0.02)	0.14*** (0.03)	0.09*** (0.02)	0.04* (0.02)	-0.12*** (0.02)	-0.13*** (0.03)
55	0.01 (0.03)	-0.04 (0.03)	0.19*** (0.03)	0.16*** (0.03)	0.18*** (0.03)	0.12*** (0.03)	0.09*** (0.03)	0.04 (0.03)	-0.15*** (0.03)	-0.14*** (0.03)
60	0.03 (0.04)	-0.01 (0.05)	0.21*** (0.04)	0.21*** (0.04)	0.17*** (0.04)	0.17*** (0.04)	0.17*** (0.04)	0.12*** (0.04)	-0.21*** (0.04)	-0.22*** (0.04)
Observations	12638	12236	12638	12236	12639	12237	12638	12236	12638	12236

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, Low Own Income: Regular vs IPW-adjusted

	Openness		Conscientiousness		Extraversion		Agreeableness		Neuroticism	
	(1) Reg	(2) IPW	(3) Reg	(4) IPW	(5) Reg	(6) IPW	(7) Reg	(8) IPW	(9) Reg	(10) IPW
30	0.15*** (0.03)	0.07 (0.04)	-0.34*** (0.03)	-0.41*** (0.04)	-0.28*** (0.03)	-0.36*** (0.04)	-0.05 (0.03)	-0.14*** (0.04)	0.43*** (0.03)	0.46*** (0.05)
35	0.06* (0.03)	0.02 (0.04)	-0.24*** (0.03)	-0.31*** (0.04)	-0.31*** (0.03)	-0.35*** (0.05)	-0.01 (0.03)	-0.05 (0.04)	0.42*** (0.03)	0.48*** (0.05)
40	-0.07** (0.03)	-0.13*** (0.04)	-0.10*** (0.03)	-0.14*** (0.04)	-0.31*** (0.03)	-0.37*** (0.04)	-0.04 (0.03)	-0.09** (0.04)	0.38*** (0.03)	0.38*** (0.04)
45	-0.06** (0.03)	-0.10*** (0.03)	0.03 (0.03)	0.00 (0.03)	-0.20*** (0.03)	-0.24*** (0.03)	0.10*** (0.03)	0.05* (0.03)	0.25*** (0.03)	0.25*** (0.03)
50	-0.02 (0.02)	-0.07*** (0.03)	0.13*** (0.02)	0.09*** (0.03)	-0.12*** (0.02)	-0.16*** (0.03)	0.12*** (0.02)	0.05* (0.03)	0.19*** (0.02)	0.20*** (0.03)
55	-0.01 (0.02)	-0.06** (0.03)	0.14*** (0.02)	0.12*** (0.03)	-0.08*** (0.02)	-0.11*** (0.03)	0.15*** (0.02)	0.12*** (0.03)	0.11*** (0.02)	0.10*** (0.03)
60	-0.01 (0.03)	-0.04 (0.03)	0.13*** (0.03)	0.10*** (0.03)	-0.10*** (0.03)	-0.13*** (0.03)	0.17*** (0.03)	0.15*** (0.03)	0.05* (0.03)	0.01 (0.03)
65	0.00 (0.02)	-0.04 (0.02)	0.19*** (0.02)	0.15*** (0.02)	-0.05** (0.02)	-0.08*** (0.02)	0.10*** (0.02)	0.07*** (0.02)	-0.05** (0.02)	-0.04* (0.02)
70	-0.09*** (0.02)	-0.11*** (0.03)	0.18*** (0.02)	0.17*** (0.02)	-0.02 (0.02)	-0.04* (0.03)	0.08*** (0.02)	0.06** (0.03)	-0.11*** (0.02)	-0.10*** (0.02)
Observations	12663	10719	12664	10717	12663	10717	12667	10721	12659	10711

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.16: Average Traits by Age, High Own Income: Regular vs IPW-adjusted

	Openness		Conscientiousness		Extraversion		Agreeableness		Neuroticism	
	(1) Reg	(2) IPW	(3) Reg	(4) IPW	(5) Reg	(6) IPW	(7) Reg	(8) IPW	(9) Reg	(10) IPW
30	-0.15*** (0.03)	-0.17*** (0.03)	-0.05* (0.03)	-0.08*** (0.03)	-0.00 (0.03)	-0.05 (0.03)	-0.08*** (0.03)	-0.15*** (0.03)	-0.06** (0.03)	-0.07** (0.03)
35	-0.06* (0.03)	-0.12*** (0.03)	0.04 (0.03)	0.00 (0.03)	0.15*** (0.03)	0.11*** (0.03)	-0.03 (0.03)	-0.10*** (0.03)	-0.04 (0.03)	-0.08** (0.03)
40	0.00 (0.03)	-0.04 (0.03)	0.08*** (0.02)	0.05* (0.03)	0.16*** (0.03)	0.14*** (0.03)	0.03 (0.03)	-0.03 (0.03)	-0.12*** (0.02)	-0.13*** (0.03)
45	-0.02 (0.02)	-0.07*** (0.02)	0.16*** (0.02)	0.15*** (0.02)	0.22*** (0.02)	0.20*** (0.02)	0.08*** (0.02)	0.02 (0.02)	-0.20*** (0.02)	-0.21*** (0.02)
50	0.01 (0.02)	-0.05** (0.02)	0.22*** (0.02)	0.22*** (0.02)	0.26*** (0.02)	0.25*** (0.02)	0.05** (0.02)	0.01 (0.02)	-0.23*** (0.02)	-0.24*** (0.02)
55	0.02 (0.02)	-0.03 (0.02)	0.23*** (0.02)	0.20*** (0.02)	0.24*** (0.02)	0.20*** (0.02)	0.06*** (0.02)	0.02 (0.02)	-0.26*** (0.02)	-0.27*** (0.02)
60	0.06*** (0.02)	0.02 (0.03)	0.23*** (0.02)	0.18*** (0.03)	0.23*** (0.02)	0.19*** (0.03)	0.13*** (0.02)	0.08*** (0.03)	-0.32*** (0.02)	-0.31*** (0.02)
65	0.16*** (0.02)	0.12*** (0.02)	0.22*** (0.02)	0.20*** (0.02)	0.16*** (0.02)	0.13*** (0.02)	0.09*** (0.02)	0.07*** (0.02)	-0.33*** (0.02)	-0.31*** (0.02)
70	0.15*** (0.02)	0.11*** (0.02)	0.21*** (0.02)	0.21*** (0.02)	0.18*** (0.02)	0.15*** (0.02)	-0.00 (0.02)	-0.00 (0.02)	-0.30*** (0.02)	-0.28*** (0.02)
Observations	17050	15234	17054	15238	17056	15239	17054	15237	17055	15239

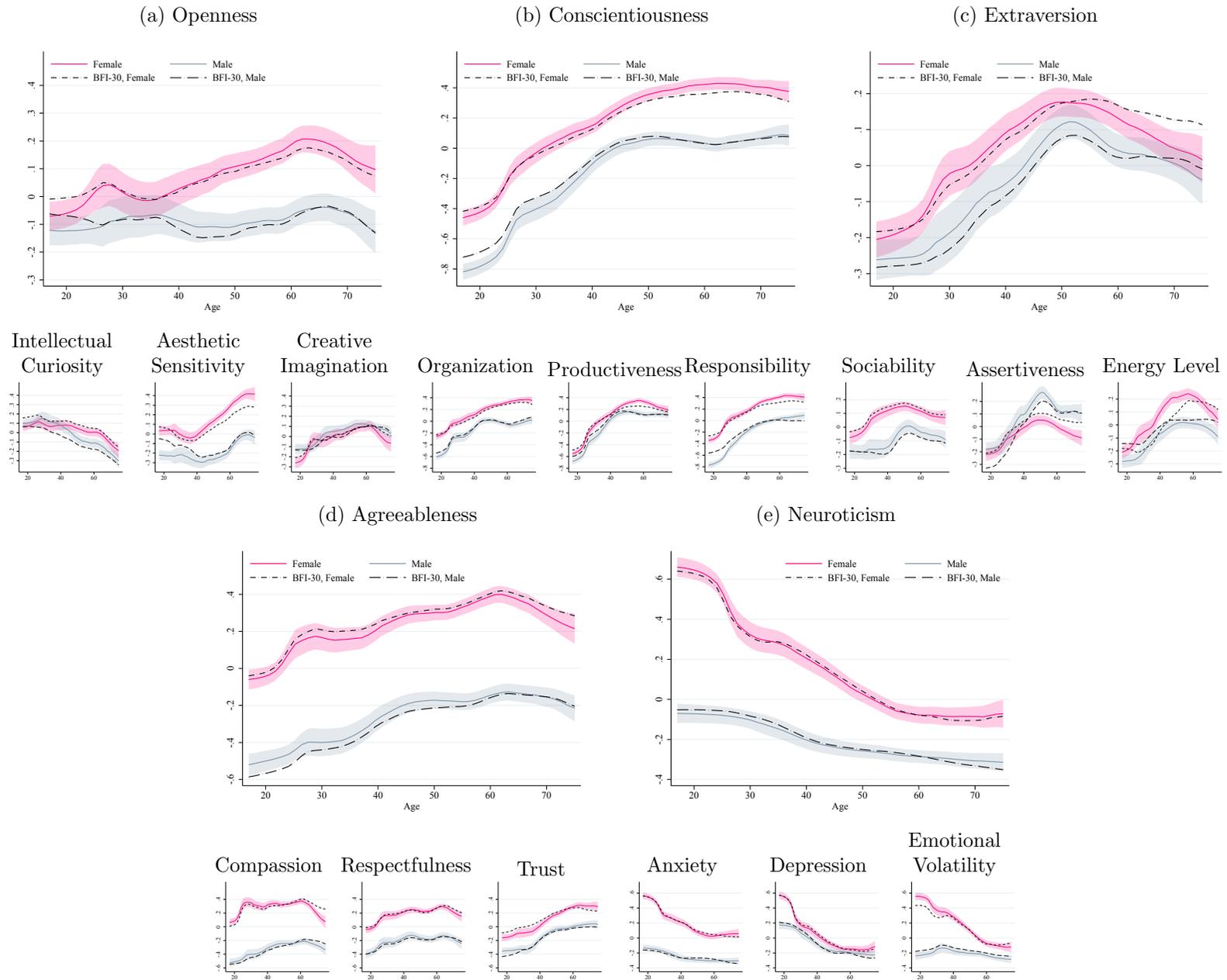
Note: “Reg” = average trait by age, or coefficients from regular regression, unweighted. “IPW” = coefficients from regression adjusted for non-response with inverse probability weights. Standard errors in parentheses. *($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$)

S.4 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.7 to S.9 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).

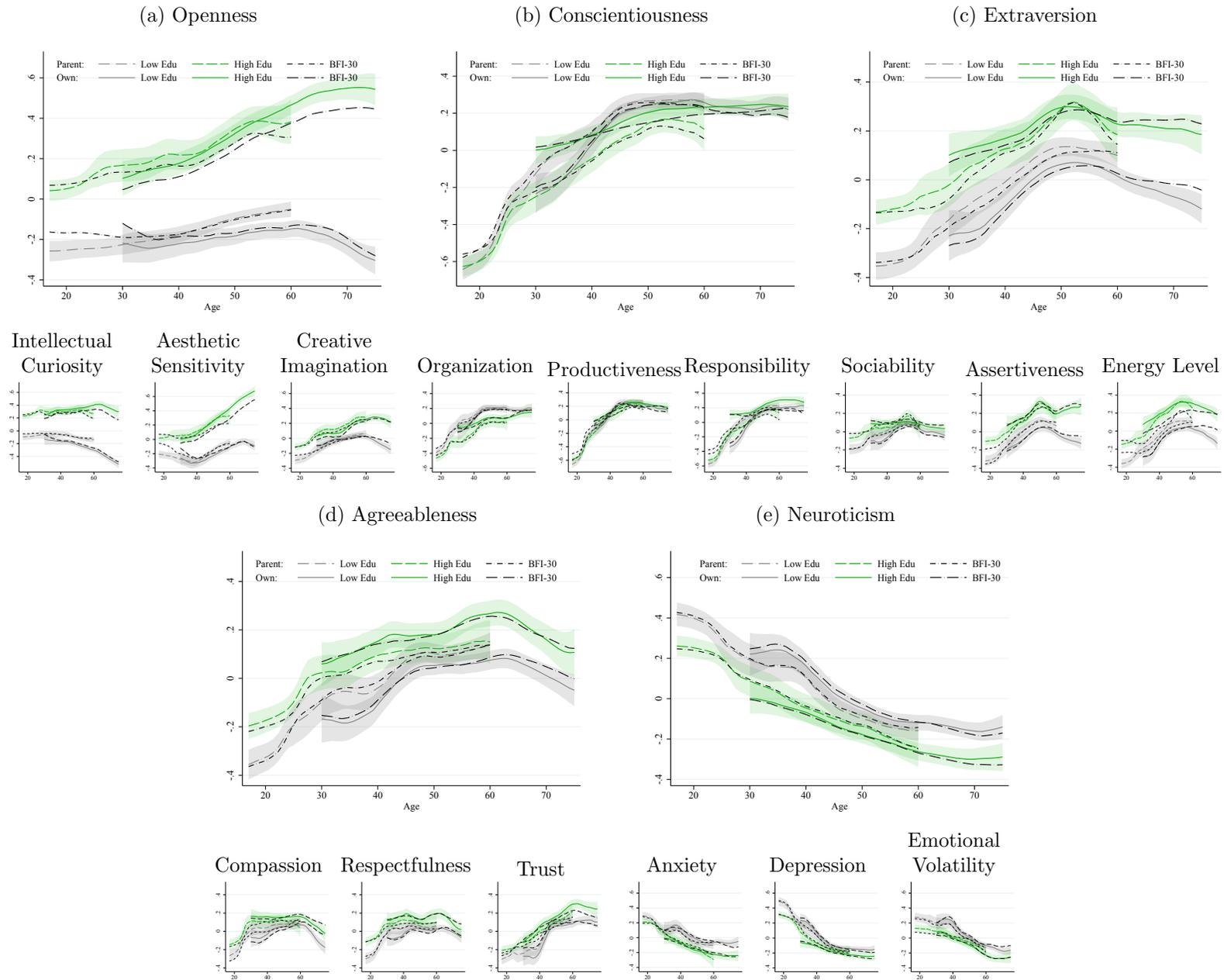
Figures S.7 to S.9 clearly show that for the vast majority of personality traits, including the facets, the choice to use only the 30-item BFI-2 has no bearing on the conclusions we draw. In the few cases where the 30-item measure is outside the confidence band of the 60-item measure, the gender or SES 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.7: 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.

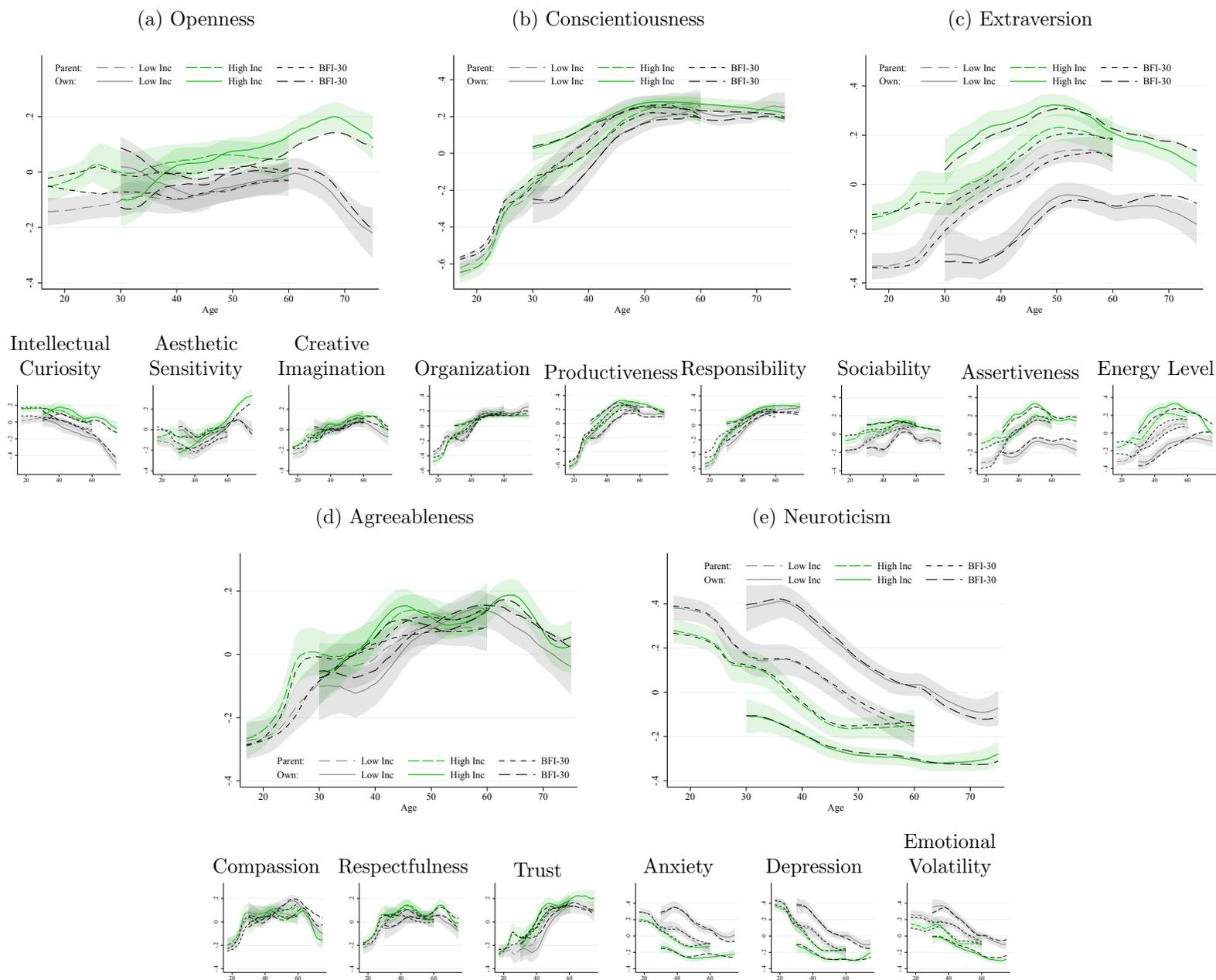
Figure S.8: Personality by Age and Education, Comparing BFI-60 to BFI-30



S21

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.9: Personality by Age and Income, Comparing BFI-60 to BFI-30



S22

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.