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## ABSTRACT

### **Personality and Mental Health: The Role and Substitution Effect of Emotional Stability and Conscientiousness\***

A growing number of economic studies show that low emotional stability is typically negatively related to socioeconomic outcomes, while conscientiousness predicts desirable results. However, possible mechanisms behind these relations are far less explored. Gaining insights into the mechanisms is important, because this knowledge is crucial to develop pre- and intervention programs. We address this research gap by analyzing the relation between low emotional stability and mental ill-health as well as the possible substitution effect of conscientiousness both theoretically and empirically. Using the British Cohort Study, we find that low emotional stability at ages 10 and 16 significantly predicts mental ill-health at ages 16, 26, 30, 34 and 42 and that more conscientiousness significantly mitigates the negative relation between low emotional stability and mental health. Our results suggest that particularly both low emotionally stable and low conscientious individuals are more likely to experience mental ill-health related to a reduced problem-solving ability.

JEL Classification: D03, I12, I14, I18, I24

Keywords: mental health, personality differences, health inequality, child development, socioeconomic disadvantage

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## 1 Introduction

A rapidly growing number of economic studies use personality traits to predict various socioeconomic outcomes and show that low emotional stability is typically negatively related to education, labor market and mental health outcomes, while conscientiousness is almost seen as a guarantor for desirable results (Cuijpers et al. (2010), Almlund et al. (2011), Fletcher (2013), Golsteyn and Schils (2014), Mendolia and Walker (2014)). However, possible mechanisms behind these relations are far less explored. Nevertheless, gaining insights into the mechanisms would be important, because this knowledge is crucial to develop effective and efficient pre- and intervention programs. We address this research gap by analyzing the relation between low emotional stability and mental ill-health as well as the possible substitution effect of conscientiousness.<sup>1</sup>

Our approach is twofold: on the one hand, we investigate the psychological literature and put the insights gained into an economic framework; and on the other hand, we analyze the relation between personality and mental health empirically, using personality at ages 10 and 16 and mental health outcomes at ages 16, 26, 30, 34 and 42. We use the British Cohort Study, which allows following people from birth up until the age of 42, with information about personality and a measure for mental health in adolescence and adulthood.

The empirical analysis shows that low emotional stability at age 16 significantly predicts mental ill-health in both adolescence and adulthood. Accordingly, an increase in emotional stability by 1 standard deviation in adolescence is related to a decrease in mental health problems by between 0.08 and 0.17 of a standard deviation at ages 16, 26, 30, 34 and 42. In addition, scoring low in both emotional stability and conscientiousness at age 16 is on average even related to an increase in mental ill-health by between 0.25 and 0.35 of a standard deviation in adolescence and adult age for both genders. Higher conscientiousness at age 16 significantly mitigates the positive relation at adult age. The coefficients for mental ill-health in adulthood remain significant also after controlling for mental health problems at age 16, which further emphasizes that apart from an indisputable genetic predisposition, an additional component is likely to contribute to mental health problems.

Psychological models provide valuable insights into the mechanisms of the relation between personality traits and mental health. Ursin and Eriksen (2004) show that maladaptive and ineffective coping strategies in influenceable challenging situations based on pessimistic expectations are related to feelings of sustained stress that bear the risk of mental ill-health.<sup>2</sup> Roberts (2009) argues that expectations, feelings and behaviors are stimulated by personality in a non-conscious, repetitive manner so that destructive pat-

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<sup>1</sup>To assess personality, we make use of the prominent Big Five personality inventory (McCrae and John (1992) or Goldberg (1993)), which contains five personality traits (OCEAN): openness (O), conscientiousness (C), extraversion (E), agreeableness (A) and neuroticism (N). The term neuroticism is contrasted by the term emotional stability, which we mostly use throughout the article.

<sup>2</sup>Coping is defined as “problem-solving thoughts and actions” (Penley et al. (2002), p. 552).

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terns are likely to persist over the life-cycle.<sup>3</sup> Low emotionally stable individuals are more likely to be worrying, insecure and nervous (Cervone and Pervin (2014)), to have a higher stress-reactivity and to use disengagement and emotion-focused coping strategies such as procrastination and avoidance (Connor-Smith and Flachsbart (2007)). This suggests that low emotionally stable individuals are more likely to be trapped in destructive and unhealthy patterns of expectations, feelings and behavior.

Putting these psychological theories into economic terms, we argue that the individual aims to solve an influenceable, challenging situation with a utility-maximizing level of effort determined by the expected benefits and costs related to that effort. Individuals with lower levels of emotional stability are likely to have lower expected benefits owing to pessimistic beliefs. This is likely to be related to procrastination or even avoidance behavior, i.e. lower effort. Both discouraging expectations and procrastination or avoidance are likely to contribute to the development of mental health problems, because the perceived and actual problem-solving ability is reduced and the uncomfortable challenge is likely to persist both mentally and actually, i.e. lower utility. However, higher conscientiousness might be able to mitigate the negative relation based on a higher probability of engagement and problem-focused coping (Connor-Smith and Flachsbart (2007)). The extent to which this substitution can exist is theoretically ambiguous and an empirical question.

Focusing on mental health seems to be an economically relevant starting point, because mental health problems are negatively related to important areas in life such as school or work performance (OECD (2011), Tefft (2012), Cornaglia et al. (2015), Bubonya et al. (2016)) and cause high monetary and non-pecuniary costs (Helliwell et al. (2013), Layard et al. (2013), Maclean et al. (2014), Anderson et al. (2015)). There is a line of economic literature that targets extrinsic risks for mental health such as working conditions (Karasek (1979), Karasek and Theorell (1992), Siegrist (1996), Bardasi and Francesconi (2004), Straathof and Weehuizen (2005), Cottini and Lucifora (2013), Hudson and Barrett (2014), Drydakis (2015)), environmental shocks (Lindeboom et al. (2002), Cesur et al. (2013), Cornaglia et al. (2014), Dustmann and Fasani (2016), Danzer and Danzer (2016)) or family characteristics (Johnston et al. (2013), Layard et al. (2014), Persson and Rossin-Slater (2016)).

In contrast to these studies, we build on the emerging economic literature that focusses on intrinsic risks for psychological and physical health related to variation in expectations, behaviors and feelings. For instance, some studies suggest that individuals with an internal locus of control expect higher returns to health-related activities (Cobb-Clark et al. (2014)) and are more likely to invest in healthy activities (Mendolia and Walker (2014)).<sup>4</sup> Further, Blázquez Cuesta and Budría (2015) analyze the relation between income deprivation and mental health outcomes finding that low emotionally stable people are more deprivation-sensitive than emotionally stable individuals. However, these studies do not

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<sup>3</sup>However, according to Roberts (2009), environmental (e.g. family background, working conditions) and biological factors (e.g. gender) also play a role for variation in thoughts, feelings and behavior. However, in this article, we focus on the role of personality traits that are likely to influence how individuals cope with everyday problems as well as when facing serious challenges.

<sup>4</sup>Judge and Bono (2001) argue that self-esteem, locus of control and emotional stability are not equal but related psychological concepts.

provide a coherent framework of possible mechanisms and there are in general only a few attempts to integrate psychological concepts into economic models (Ruhm (2012), Rustichini et al. (2012), Caliendo et al. (2015), Polachek et al. (2015)), because the relation between psychological concepts and socioeconomic outcomes is not straightforward and more complicated mechanisms are likely to play a large role.

We target this research gap and contribute to the understanding of the variation in mental health outcomes throughout life related to personality differences. Therefore, we (1) investigate and connect psychological models and put the insights gained into an economic framework, (2) analyze the predictive power of emotional stability and other personality traits at adolescence for mental health problems at young and older age, (3) test the potential substitution effect of conscientiousness for the relation between emotional stability and mental health problems at various ages and (4) discuss implications that relate low emotional stability and low conscientiousness to an increased risk of socioeconomic disadvantage. Thus, our study provides an important contribution to the economic literature. In the next sections, we discuss our theoretical considerations, before we subsequently introduce the data and present our results. Finally, we conclude and provide policy implications.

## 2 Theoretical Considerations

In a first step, we explore the psychological literature to learn more about the relation between personality and mental health outcomes. We relate our theoretical considerations to the example of an exam at school considering that its outcome is influenceable by the individual. In a second step, we put the insights gained into an economic framework, which we subsequently test regarding the relation between personality and mental health problems.

### 2.1 Insights from Psychology

Psychological literature offers some important insights that help to understand the relationship between emotional stability as well as conscientiousness and mental health outcomes. Personality psychologists show that differences in personality traits are related to variation in coping styles, i.e. problem-solving thoughts and actions. Psychologist often distinguish between emotion- versus problem-focused coping (Lazarus and Folkman (1984)) or disengagement versus engagement coping (Rothbaum et al. (1982)). Emotion-focused and disengagement coping strategies aim to reduce negative emotions by keeping distance from the source of stress, whereas problem-focused and engagement coping aim to reduce or to resolve the cause of stress and to gain control over the stressor. Low emotional stability is typically related to emotion-focused and disengagement coping strategies, while conscientiousness is considered to be associated with problem-focused and engagement coping strategies (Campbell-Sills et al. (2006)).<sup>5</sup> In view of facing an exam, problem-focused and

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<sup>5</sup>See Connor-Smith and Flachsbart (2007). Various coping structures exist. An overview about different structures of coping and its relation to personality is provided by for instance Compas et al. (2001), Skinner et al. (2003), Connor-Smith and Flachsbart (2007).

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engagement coping relates to the proper preparation of the exam to gain control over its outcome, while emotion-focused and disengagement coping is associated with deferring the exam preparation to reduce negative emotion.

To gain deeper insights, Ursin and Eriksen (2004)'s Cognitive Activation Theory of Stress is useful, arguing that individuals react with arousal when they are confronted with a stimulus that is defined as the discrepancy between what the individual expects and what happens in reality. The announcement of an exam in school might be considered as a negative and threatening stimulus. Individuals "report this as stress" (Ursin and Eriksen (2004), p. 571), whereby the extent of stress depends on the student's stimulus expectancies<sup>6</sup>, which are based on previous experiences and learning and are expected to differ with the level of emotional stability that has the strongest stress association (Eysenck (1988), Ebstrup et al. (2011), Cervone and Pervin (2014)). This suggests that it is likely that less emotionally stable individuals perceive more exams in school as threatening compared with more emotionally stable individuals and that low emotionally stable individuals are likely to perceive an exam as more threatening compared with more emotionally stable individuals. Accordingly, Connor-Smith and Flachsbart (2007) state "personality may affect coping strategy selection directly, by constraining or facilitating use of specific strategies, or indirectly, by influencing the nature and severity of stressors experienced [...] the treat sensitivity underlying N may trigger disengagement [...] N is associated with high rates of stress exposure and intense emotional and physiological reactivity to stress" (p. 1081).<sup>7</sup>

The stress response is uncomfortable but not per se problematic regarding mental health outcomes. It is much more a "safety system, which guarantees priority to serious and sudden discrepancies" (Ursin and Eriksen (2004), p. 573). Therefore, phasic stress is vitally important to find proper solutions in challenging situations, i.e. it might initiate a proper exam preparation. Nonetheless, feelings of stress persist until the problem is at least mentally solved and "sustained arousal may lead to pathology" (Ursin and Eriksen (2004), p. 570).

Whether the individual's arousal in the challenging exam situation causes harmless phasic or damaging sustained stress depends on his/her response outcome expectancy, which is also based on previous experiences and learning and is assumed to vary with the level of emotional stability. "When the subject has learned that performance of a response [...] brings a certain outcome [...] this is referred to as response outcome expectancy" (Ursin and Eriksen (2004), p. 573). Response outcome expectancies are defined as positive (coping), negative or uncertain. Coping is defined as the positive response outcome expectancy and means that the student has established the expectancy to be able to handle the exam with a positive result. Coping leads to harmless, phasic stress. An uncertain or negative outcome expectancy is much more problematic. An uncertain response outcome expectancy means that the individual cannot recognize a relationship between the response and the outcome and thus the student perceives having no control over the exam's outcome. By contrast, a negative response outcome expectancy reflects

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<sup>6</sup>"When the subject has learned that one stimulus [...] predicts the occurrence of another event [...] this is referred to as stimulus expectancy" (Ursin and Eriksen (2004), p. 573).

<sup>7</sup>N refers to the personality trait neuroticism.

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the opposite of coping, i.e. the student expects exam failure whatever he/she does and considers this as his/her fault, which is related to a feeling of guilt. Both uncertain and negative response outcome expectancies are related to harmful sustained stress because the perceived individual problem-solving ability is reduced and the challenge mentally persists.

Low emotionally stable individuals are prone to anxiety, chronic worry, distress and maladaptive coping strategies (Cervone and Pervin (2014), p. 265). This suggests that low emotional individuals are likely have a reduced perceived problem-solving ability based on negative or uncertain response outcomes expectancies, which is related to uncomfortable sustained stress. Emotion-focused and disengagement coping might reduce these negative emotions and produce relief, which can be considered a short-run gain. However, procrastination or avoidance i.e. a reduced actual problems-solving ability is likely to result in a worsened exam result. Thus, a vicious circle based on negative expectations and negative experiences is completed and likely to be sustained. Accordingly, Connor-Smith and Flachsbart (2007) argue that “although N may facilitate disengagement, and make it beneficial in the short-term, these immediate benefits for vulnerable individuals are likely outweighed by long-run costs” (p. 1102). Furthermore, “short-term, personality-related benefits of disengagement for N individuals may amplify the direct effect of N on the tendency to disengage, explaining why N individuals continue to use strategies that produce poor long-term results” (p. 1082).<sup>8</sup>

By contrast, conscientious individuals are more likely to apply problem-focused and engagement coping strategies (Connor-Smith and Flachsbart (2007)) and are considered as organized, persistent and ambitious (Cervone and Pervin (2014)). In the context of the exam preparation, conscientious students are more likely to establish and refine an appropriate work organization and a proper time management, but also to have the self-discipline to realize the own plan. Being able to rely on such skills and routines is likely to increase control and decrease arousal in influenceable challenging situations so that less emotionally stable, but more conscientious individuals are less likely to experience sustained stress and mental health issues compared with low emotionally stable individuals who score lower in conscientiousness. Further, these skills and routines increase the probability of being properly prepared and of being able to effectively cope with influenceable challenges so that the also the exam outcome is likely to be better.

Roberts (2009) argues that states of thoughts (expectancies), feelings (arousal) and behaviors (avoidance or effort) are to some extent triggered by personality traits in an unconscious, repetitive manner. Therefore, we have three hypotheses for our analysis. First, under the assumption that individuals are confronted with various smaller and larger challenges day-by-day (e.g. in school or at work as well as in social relations), situations where feelings of sustained stress related to destructive expectations and avoidance behavior may occur are likely to cumulate particularly for less emotionally stable individuals. This might be associated with mental health problems in the long run. This line of reasoning is consistent with the psychological literature. Based on a meta-analytic review, Penley et al.

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<sup>8</sup>Again, N refers to neuroticism, which is used as a synonym for low emotional stability.



(2002) show that avoidance coping is negatively correlated with mental health outcomes.<sup>9</sup> They provide several explanation approaches for the negative relation between avoidance coping and psychological health outcomes, including a further rise in anxiety and worsened outcomes, an impairment of social relations and an increase in unhealthy behaviors such as taking drugs or alcohol. Second, given that personality traits are considered mostly rank-order stable in adult age (Roberts and Del Vecchio (2000), Borghans et al. (2008)), we expect that people who suffer from mental health problems in adolescence are also more likely to suffer from them in older age, because they are likely to be trapped in unhealthy and destructive expectation, feeling and behavior patterns. This is also in line with results from economics (e.g. Roy and Schurer (2013)). Third, we expect that higher conscientiousness is able to substitute for lower emotional stability.

Finally, psychological studies show that school-based mental ill-health prevention programs targeting negative cognition and improved problem-solving abilities may significantly decrease the risk of depressive symptoms (Chaplin et al. (2006), Gillham et al. (2006), Young et al. (2006), Cardemil et al. (2007) or Horowitz et al. (2007)).<sup>10</sup> However, Horowitz and Garber (2006) and Stice et al. (2009) argue that larger effects result from programs that target high-risk individuals rather than universal programs. “Theoretically, the distress that characterizes high-risk individuals motivates these participants to engage more effectively in the prevention program [...]” (Stice et al. (2009), p. 11). Our article contributes to the literature by further determining groups at-risk based on personality traits within a longitudinal study.

### 2.2 Economic Framework

Putting these insights from the psychological literature into economic terms, we argue that the individual aims to solve an influenceable challenging situation with a utility-maximizing level of effort determined by the individual’s expected benefits and costs related to effort. We consider the development of mental health problems to be influenced by the individual’s personality, which affects the individual problem-solving ability. We are particularly interested in neuroticism and conscientiousness.

To illustrate our model, we consider an example of students who face an exam at school. We assume that the exam result fully depends on the student’s effort related to exam preparation. Effort can be the time that the student devotes to exam preparation, although it could also represent the intensity with which the student prepares (i.e. concentration). We refrain from any teacher effects and assume that the students have equal initial cognitive ability, live in an equal social environment and have equal biological characteristics. Therefore, students only differ with respect to the personality traits neuroticism and conscientiousness. Following human capital theory, it is assumed that every student makes his/her effort decision in order to maximize the own utility ( $U$ , e.g. exam grade or

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<sup>9</sup>See also Folkman and Lazarus (1985), Aldwin and Revenson (1987) or Carver et al. (1989).

<sup>10</sup>Horowitz and Garber (2006), Stice et al. (2009) or Corrieri et al. (2014) provide detailed overviews of existing prevention programs.

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happiness) based on the expected benefits ( $B$ ) and the costs of effort ( $C$ ):

$$\text{Max } U = B - C$$

Benefits are the returns to effort, i.e. the grade on the exam or other factors such as parental or labor market recognition. Costs are the costs of effort, i.e. time and energy put in the exam preparation. However, as discussed above, expected benefits ( $B$ ) are likely to be influenced by the individual personality. Therefore, the utility function can be described such that:

$$U(f, n, c) = cF(f) + (1 - c)(1 - n)F(f) - \beta f$$

The first part of the equation ( $cF(f) + (1 - c)(1 - n)F(f)$ ) relates to benefits of effort, while the second part ( $\beta f$ ) equals the costs of effort. Benefits of effort are related to a production function which comprises two elements: a routine component ( $cF(f)$ ) and a non-routine component ( $(1 - c)(1 - n)F(f)$ ). The routine component is related to universally relevant skills such as an appropriate work organization and time management, but also the ambition and self-discipline to realize the own plan. These skills are likely to increase the translation of effort into utility and, as shown above, they are related to conscientiousness ( $c$ ,  $0 < c < 1$ ). Thus, the higher conscientiousness, the higher the probability that the individual establishes and refines these skills. Related to the example of the exam preparation, this means that the more conscientious student is more likely to have his/her learning material completed and organized, is more likely to have a schedule prepared that splits the learning content into smaller and better digestible pieces, is more likely to stick to his/her learning schedule, and thus, is more likely to have enough time to clarify open questions. Therefore, the routine-based component ( $cF(f)$ ) is related to a gain of control over the challenge's outcome and a decrease of arousal in the challenging situation so that the translation of effort into utility is not hindered by negative or distracting emotions and cognition.

However, another part of the challenge is related to entering new territory so that reliance on preparation and previous developed skills is impossible. The non-routine component ( $(1 - c)(1 - n)F(f)$ ) involves two types of production losses. First, the production loss increases with the non-routine character of the task, which is negatively related to conscientiousness ( $1 - c$ ). Second, the production loss increases with neuroticism ( $1 - n$ ,  $0 < n < 1$ ). From the psychological literature, we have learned that the level of neuroticism affects the extent to which the student considers the exam as a challenge. Taking into account that the exam is decisive for the student's future, it can potentially be threatening to the student and might work as a stress stimulus. A student with a higher level of neuroticism is probably more stressed about living up to the teacher's expectations and is expected to experience a higher level of arousal. This is leaving him/her with an uneasy feeling and the neurotic student is likely to devote effort to eliminate this uncomfortable arousal. This is expected to lower his/her grade, but also his/her happiness compared with a student who is less neurotic.

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Finally, the cost of effort are related to a scaling factor ( $\beta$ ) times the effort ( $f$ ) put. The benefit function is positive and upward sloping, albeit at diminishing marginal returns to effort or concave. The cost function is assumed to be linear and increasing with effort. The student aims at maximized utility levels and he/she can choose an effort level to achieve this. Let's assume that  $F(f) = f^\alpha$  with  $0 < \alpha < 1$  so that:

$$U(f, n, c) = cf^\alpha + (1 - c)(1 - n)f^\alpha - \beta f \quad (1)$$

The optimal level of effort  $f^*$  to face the challenge of the exam is found by solving the first-order condition with respect to effort. From this condition the optimal effort  $f^*$  can be derived (Equation 2):

$$\begin{aligned} \frac{\partial U}{\partial f} &= \alpha cf^{\alpha-1} + \alpha(1 - c)(1 - n)f^{\alpha-1} - \beta = 0 \\ f^* &= \left( \frac{\beta}{\alpha(1 - n + cn)} \right)^{\frac{1}{\alpha-1}} \end{aligned} \quad (2)$$

The student's optimal effort level is affected by his/her personality, here neuroticism ( $n$ ) and conscientiousness ( $c$ ).  $f^*$  can be written as a function of  $n$  and  $c$ :  $f^* = f^*(n, c)$ . Taking the partial derivative of Equation 2 with respect to  $n$  yields:

$$\frac{\partial f^*}{\partial n} = \frac{1}{\alpha - 1} \frac{\beta^{\frac{1}{\alpha-1}} \alpha(1 - c)}{(\alpha(1 - n + cn))^{\frac{\alpha}{\alpha-1}}} < 0$$

Since  $0 < \alpha < 1$ ,  $0 < \beta < 1$  and  $0 < c < 1$ , it follows that the first term is negative and the second term is positive. Thus,  $f_n^* < 0$  and optimal effort is decreasing in neuroticism.

Taking the partial derivative of Equation 2 with respect to  $c$  yields:

$$\frac{\partial f^*}{\partial c} = \frac{1}{\alpha - 1} \frac{-\beta^{\frac{1}{\alpha-1}} \alpha n}{(\alpha(1 - n + cn))^{\frac{\alpha}{\alpha-1}}} > 0$$

Since  $0 < \alpha < 1$ ,  $0 < \beta < 1$  and  $0 < c < 1$ , both the first term is negative and the second term is negative (nominator is negative and denominator is positive). Thus,  $f_c^* > 0$  and optimal effort is increasing in conscientiousness.

Further, the substitution effect of conscientiousness  $c$  on optimal effort related to neuroticism  $f_n^*$  can be derived:

$$\frac{\partial^2 f^*}{\partial n \partial c} = -\alpha \beta^{\frac{1}{\alpha-1}} \left( \frac{\alpha^2 - \alpha(1 - n + cn)}{(\alpha - 1)^2 (\alpha(1 - n + cn))^{\frac{\alpha}{\alpha-1} + 1}} \right) > 0$$

Given that both terms are negative, it is shown that the substitution effect of  $c$  on optimal effort  $f_n^*$  is positive ( $f_{nc}^* > 0$ ).

Next, the relation between optimal utility  $U^*$ , neuroticism  $n$  and conscientiousness  $c$  is

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derived. Optimal utility  $U^*$  can be written as:

$$U^*(f^*, n, c) = f^\alpha(1 - n + cn) - \beta f^*$$

Optimal effort  $f^*$  is:

$$f^* = \beta^{\frac{1}{\alpha-1}} (\alpha(1 - n + cn))^{\frac{1}{1-\alpha}}$$

Putting optimal effort  $f^*$  into optimal utility  $U^*$  yields:

$$\begin{aligned} U^*(f^*, n, c) &= \left( \beta^{\frac{1}{\alpha-1}} (\alpha(1 - n + cn))^{\frac{1}{1-\alpha}} \right)^\alpha (1 - n + cn) \\ &\quad - \beta (\beta^{\frac{1}{\alpha-1}} (\alpha(1 - n + cn))^{\frac{1}{1-\alpha}}) \end{aligned} \quad (3)$$

Taking the partial derivative of Equation 3 with respect to  $n$  yields:

$$\frac{\partial U^*}{\partial n} = -\beta^{\frac{\alpha}{\alpha-1}} (1 - c) (\alpha(1 - n + cn))^{\frac{\alpha}{1-\alpha}} < 0$$

Given that  $-\beta^{\frac{\alpha}{\alpha-1}} < 0$ ,  $1 - c > 0$  and  $\alpha(1 - n + cn)^{\frac{\alpha}{1-\alpha}} > 0$ , it follows that  $U_n^* < 0$ . Optimal utility is decreasing in neuroticism. Based on the psychological literature, it is expectable that neurotic students are more likely to suffer from sustained stress and to procrastinate or even avoid the challenging exam preparation. Thus, general discomfort is likely and the exam grade achieved is probably lower for the procrastinating or avoiding student compared to a student who actively targets the influenceable challenge. In sum, this scenario is related to a reduced utility for the neurotic student.

Taking the partial derivative of Equation 3 with respect to  $c$  yields:

$$\frac{\partial U^*}{\partial c} = n\beta^{\frac{\alpha}{\alpha-1}} (\alpha(1 - n + cn))^{\frac{\alpha}{1-\alpha}} > 0$$

Given that  $n\beta^{\frac{\alpha}{\alpha-1}} > 0$  and  $\alpha(1 - n + cn)^{\frac{\alpha}{1-\alpha}} > 0$ , it follows that  $U_c^* > 0$ . Optimal utility is increasing in conscientiousness. Conscientious individuals are by definition organized, ambitious and self-disciplined and more likely to use problem-focused coping so that the conscientious student is probably better prepared, less aroused and receives a better grade in the exam.

Moreover, conscientiousness can potentially mitigate the positive relation between neuroticism and mental health problems. To observe this, we derive  $U_{nc}^*$ , which yields:

$$\frac{\partial^2 U^*}{\partial n \partial c} = \beta^{\frac{\alpha}{\alpha-1}} \left( \frac{1 - \alpha - n + cn}{1 - \alpha - n + cn + \alpha n - \alpha cn} (\alpha(1 - n + cn))^{\frac{\alpha}{1-\alpha}} \right) > 0$$

Given that  $\beta^{\frac{\alpha}{\alpha-1}} > 0$  and  $(\alpha(1 - n + cn))^{\frac{\alpha}{1-\alpha}} > 0$ ,  $U_{nc}^* > 0$ . This substitution effect

### 3 DATA

is generally positive. However, for very high levels of neuroticism in relation to conscientiousness, though, or when  $n > \frac{1-\alpha}{1-c}$ , the substitution effect is negative. This means that for extremely neurotic individuals, conscientiousness is no “rescue” for taking up the challenge.

Our theoretical considerations suggest that low emotionally stable individuals are more likely to react with procrastination or avoidance in challenging situations based on short-run gains related to a reduction of negative emotion. However, these benefits are likely to be outweighed by the long-run costs. Nevertheless, these short-term benefits of procrastination or avoidance as well as the self-fulfilling prophecy related to destructive expectations and negative experiences make it likely that low emotionally stable individuals unconsciously and repetitively make use of maladaptive and ineffective coping strategies related to poor long-term outcomes. Therefore, low emotionally stable individuals are likely to be trapped in a self-sustained circle of mental health risk which is related to multidimensional disadvantage.

Behavioral economists might interpret this scenario as variation in economic preferences. Accordingly, low emotionally stable individuals might be present-biased and prefer the short-run relief, while they discount possible future losses. In contrast, we suppose that the scenario should be rather interpreted as a rational, but biased choice than as naive hyperbolic discounting.<sup>11</sup> In this context, the individual choice is considered as primarily rational, which is in line with the standard economic framework. However, it is biased, because the foresight of low emotionally stable individuals is likely to be more pessimistic compared to more emotionally stable individuals due to higher arousal and destructive thoughts.<sup>12</sup> Choosing present gains in favor of uncertain or unlikely future benefits is rather rational than a naive preference. However, our economic framework suggests that the biased expectations of highly neurotic individuals are likely to be related to an individual welfare loss based on an increased risk of mental ill-health and socioeconomic disadvantage.<sup>13</sup> This scenario is related to market failure and suggests that a reduction of the expectation bias based on a decrease of sustained arousal and negative cognition might reduce mental health problems and improve various socioeconomic outcomes. Higher conscientiousness can be regarded as a proxy for a more organized and conscious mindset that is likely to reduce the noise adhered to process of decision-making and problem-solving.

In the next sections, these theoretical considerations are tested empirically regarding their implication for the relationship between personality and mental health outcomes.

## 3 Data

We make use of the 1970 British Cohort Study (BCS70), which is conducted by the Center for Longitudinal Studies (CLS) at the Department for Quantitative Social Science in the Institute of Education at London University and follows the lives of 17,196 people born

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<sup>11</sup>This idea is related to a forthcoming paper by Gabaix and Laibson (2016).

<sup>12</sup>Initial evidence provide Delaney et al. (2014) who analyze effects of stress on financial decision making and find that the individual discounting rate is increasing with the stress level.

<sup>13</sup>As an example, see for instance Mani et al. (2013) who state that people affected by poverty “often behave in less capable ways, which can further perpetuate poverty” (p. 976).

### 3 DATA

in England, Scotland and Wales during one week in 1970. The BCS70 provides detailed information about the individual’s family background, cognitive ability, personality and indicators of mental health problems.

Appendix Table 8 provides an overview of the BCS70 datasets used in the analysis, the variables investigated and the general number of observations in each of the eight waves. The initial number of observations (unrestricted sample) presented in Appendix Table 8 is not congruent with the actual number of observations (working sample) used in the analysis due to panel attrition and missing values within our variables of interest. Our working sample restricts for the availability of the personality traits emotional stability, conscientiousness, agreeableness and extraversion at ages 10 and 16, cognitive ability at age 10, mother’s age, parental socioeconomic status and region of birth as well as one mental ill-health score at a time, resulting in five separate samples with 2559 (age 16), 3436 (age 26), 4200 (age 30), 3789 (age 34) and 3369 (age 42) observations.

We look into the issue of sample selection by descriptively comparing our working sample with the unrestricted sample (Appendix Section B) and conclude that our results suffer from positive selection. On average, people in our working sample less commonly suffer from problematic characteristics such as low emotional stability, low extraversion, low conscientiousness, and mental health problems, but have higher cognitive ability, are from a more advantaged socioeconomic background, and have slightly older mothers. This is an intuitive result given that people with less preferable characteristics such as low conscientiousness, are less likely to continuously participate in the survey. The result further suggests that the individuals who are not covered at all by the survey presumably have even worse characteristics. Therefore, we expect that we estimate lower bound results and that the observed associations are even more oppressive in the unrestricted sample.

To test the robustness of our results, we conduct two tests. First, we repeat all descriptives and analyses based on a fully restricted sample, which restricts for the availability of all variables used and includes 1,270 observations. Second, we perform multiple imputation with regard to our indicator of mental health problems and the personality trait variables resulting in an increase of the sample size with 3142 (age 16), 4066 (age 26), 4910 (age 30), 4399 (age 34) and 3878 (age 42) observations. Both procedures show that the results are consistent with our main results and are available upon request.

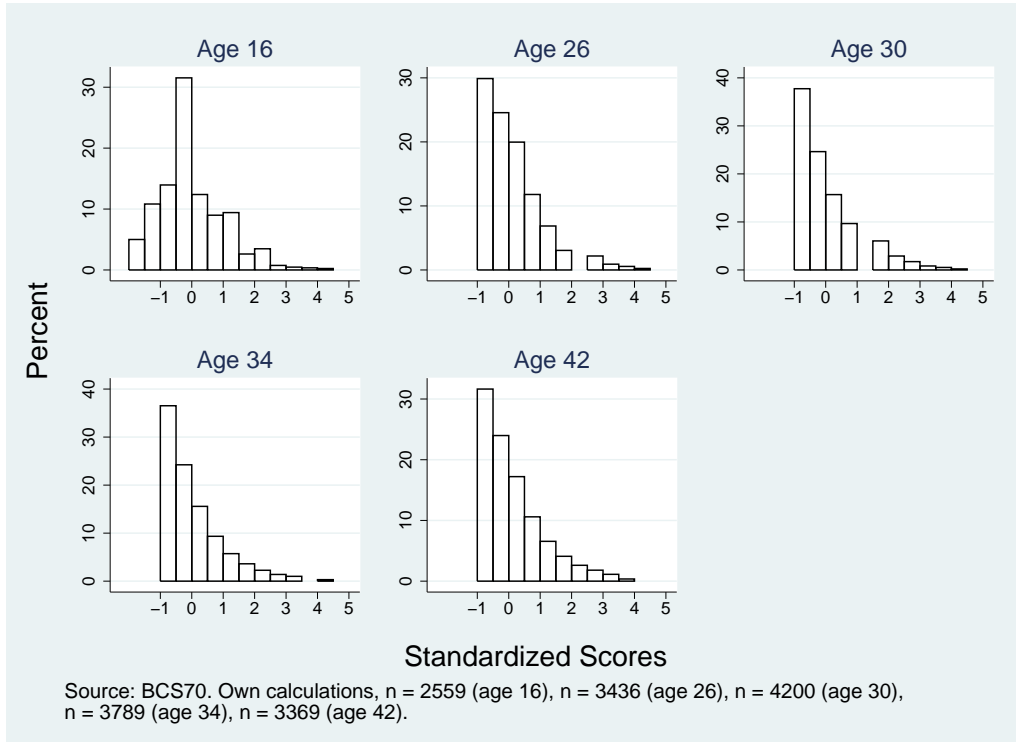
#### 3.1 Mental Health Problems

Our indicator of mental health problems is assessed by Rutter et al. (1970)’s Malaise Inventory, which is measured at ages 16, 26, 30, 34 and 42 and that covers emotional disturbance and associated physical symptoms (UK Data Service (2016)). The Malaise Inventory is based on the Cornell Medical Index Health Questionnaire (CMI), which comprises 195 self-completion questions (Brodman et al. (1949), Brodman et al. (1952)).

The internal consistency and validity of the Malaise Inventory has been tested and shown to hold in various socioeconomic groups (Rodgers et al. (1999)) and has been used in many studies (Rutter and Madge (1976), McGee et al. (1986), Grant et al. (1990)). Rutter et al. (1970) confirm that “the inventory differentiates moderately well between

### 3 DATA

Figure 1: Mental Health Problems at Ages 16, 26, 30, 34 and 42



individuals with and without psychiatric disorder” (p. 160, see UK Data Service (2016)). The Malaise Inventory include questions such as “Do you feel tired most of the time?”, “Do you often feel depressed?” and “Do you often get worried about things?” The items are coded to the rule “the worse the mental ill-health symptom, the higher the item value.” The individual malaise score by wave is generated by summing up the responses to the item set.

Both the number of items within the item set and the measurement scale vary between waves. At age 16, the item set includes 22 items, whereby the malaise items are measured on a three-point scale with the categories 0 “rarely or never,” 1 “some of the time” and 2 “most of the time.” At ages 26 and 30, the item set includes 24 items, while at ages 34 and 42, it includes only 9 items. At ages 26, 30, 34 and 42, the malaise items are measured on a two-point scale with the categories 0 “no” and 1 “yes.”

Appendix Table 9 provides an overview of the questions, the availability of each item for different ages, the measurement scales for the items, the measurement scales for the sum scores and the threshold that is regarded as a sign that the respondent experiences symptoms related to depression. To make the mental ill-health variable comparable between different ages, we restrict our score for mental health problems to the nine questions that are available in all five waves. Therefore, the questions used are the items 2, 3, 5, 9, 12, 14, 16, 20, and 21 (marked in bold in Appendix Table 9). Only individuals who have zero missing values in the nine items are taken into account in the analysis. We use standardized mental ill-health scores in our analysis. Figure 1 depicts the distribution

### 3 DATA

of mental health problems. The scores are standardized based on the restricted working sample.

Table 1 shows the correlation coefficients for the mental ill-health scores at ages 16, 26, 30, 34 and 42. The size of the correlation coefficients moves between 0.26 and 0.57. The results show that mental health problems seem to be more malleable in younger age, while they seem to be more stable at older age: the correlation between mental health problems at ages 16 and 26 is only 0.39 and is 0.56 or 0.57 between ages 26 and 30, ages 30 and 34 as well as ages 34 and 42.

Table 1: Correlation of Mental Ill-Health Scores between Ages 16 and 42

	Age 16	Age 26	Age 30	Age 34
<b>Age 26</b>	0.39	.	.	.
<b>Age 30</b>	0.35	0.57	.	.
<b>Age 34</b>	0.35	0.50	0.56	.
<b>Age 42</b>	0.26	0.47	0.48	0.57

Source: BCS70. The sample applied is the fully restricted working sample (n = 1270).

Note: Scores are standardized. Correlation coefficients are significant at the 5 percent level or higher.

### 3.2 Personality Traits

Table 2: Personality Traits at Ages 10 and 16

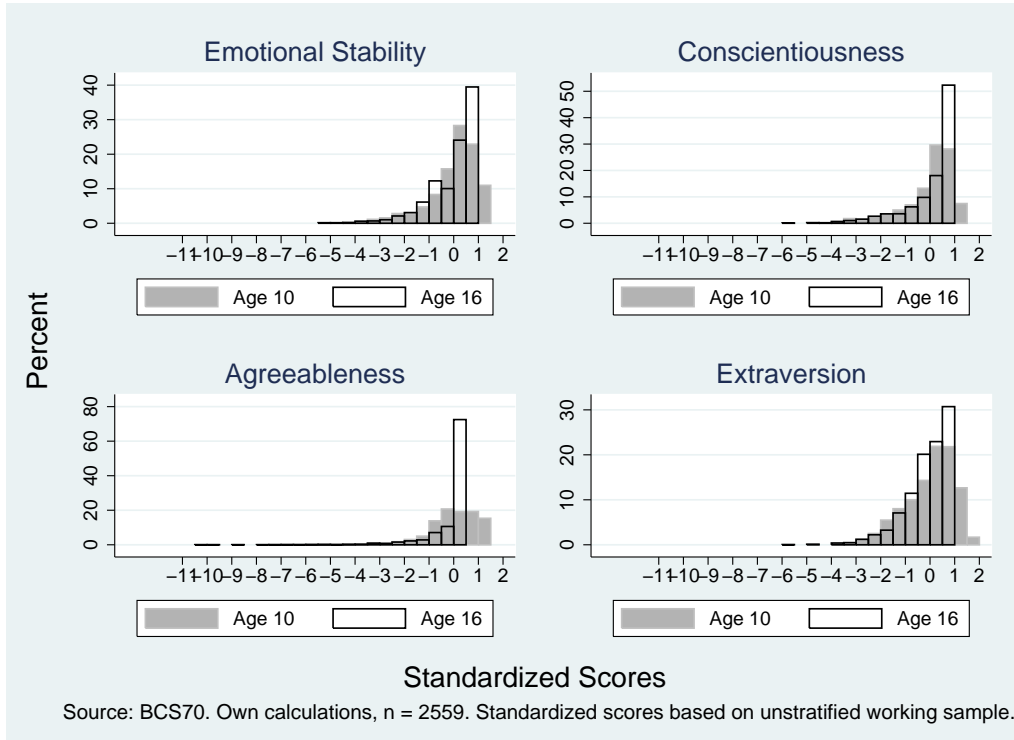
Personality Constructs and Related Items	Trait	Correlation Ages 10 and 16	Explained Variance	Cronbach's Alpha	Items
<b>Emotional Stability (ES)</b>					
Age 10			53.31%	0.82	R8. Irritable.
Age 16		0.40	55.63%	0.84	R9. Miserable and tearful. C8. Requests must be met immediately. C12. Sullen or sulky. C16. Changes mood quickly and drastically. C17. Outburst of temper unpredictable.
<b>Conscientiousness (C)</b>					
Age 10			66.34%	0.83	R15. Cannot settle.
Age 16		0.44	63.98%	0.81	C3. Inattentive, easily distracted. C13. Fails to finish things. C19. Difficulty concentrating on task.
<b>Agreeableness (A)</b>					
Age 10			46.90%	0.81	R3. Destroys own or others' belongings.
Age 16		0.31	38.93%	0.74	R4. Frequently fights with others. R14. Often disobedient. R18. Often tells lies. R19. Bullies other children. C11. Interferes with other children. R10. Takes things belonging to others.
<b>Extraversion (E)</b>					
Age 10			38.21%	0.58	R5. Not much liked by others.
Age 16		0.37	36.89%	0.56	R6. Often worried. R7. Rather solitary R16. Afraid of new things or situations. R17. Fussy or over-particular.

Source: BCS70, own calculations based on working sample n = 2559.

Note: Correlation coefficients are significant at the 5 percent level or higher.



Figure 2: Distribution of Personality Traits at Age 10 and 16



The BCS70 does not directly provide information about the personality traits emotional stability, conscientiousness, agreeableness and extraversion. In order to assess the personality of the individuals in our study, we follow Prevo and ter Weel (2015), who use BCS70 mother-rated behavior items at ages 10 and 16 and extract emotional stability, conscientiousness, extraversion and agreeableness from an initial set of 38 behavior items. An overview of the variables used is provided in Table 2.

To extract the first principle component out of the group of behavior items, we standardize the variables so that they have a zero mean and standard deviation of 1. The resulting personality scores are standardized again depending on the sample definition. We conduct the procedure with the behavior items at ages 10 and 16 to derive personality variables at these ages. An overview of the reliability measures that correspond to the four personality traits is provided in Table 2. The results are comparable to those reported by Prevo and ter Weel (2015).

Figure 2 presents the distribution of personality traits at ages 10 and 16. The graph is based on standardized scores. The underlying working sample restricts for the availability of all variables aside from the mental ill-health indicators. The graph shows that on average individuals change their personality characteristics between ages 10 and 16 which is in line with the literature (Roberts et al. (2006), Lüdtke et al. (2011)).

Taking a brief look at gender differences, our results show that women score higher on agreeableness and conscientiousness than men at both ages 10 and 16. For extraversion, the results are similar for women and men. It further becomes obvious that men score similar on emotional stability to women at age 10 but score higher on emotional stability

at age 16. This finding is mainly consistent with Schmitt et al. (2008).

### 3.3 Additional Controls

In addition to the measures discussed above, we further control for the individual’s cognitive ability. Following Prevoe and ter Weel (2015), this is measured by using test scores at age 10 because at that age cognitive ability can be considered as rank-order stable (Lebel and Beaulieu (2011)). Appendix Table 11 provides all test scores available at age 10. For our analysis, we select the results based on the Shortened Edinburgh Reading Test (ERT), the Friendly Maths Test (FMT), the Pictorial Language Comprehension Test (PLCT) and the diagnostic spelling test, because these tests contain the lowest numbers of missing values and measure a broad range of skills. To assess our measure of cognitive ability, we calculate the share of correct answers per test and derive a standardized score with zero mean and standard deviation of 1 out of these four shares by student.

Furthermore, we control for the child’s family background by including the following variables in all our regressions: mother’s age, mother’s age squared, parental socioeconomic status and region of living at birth. The variable parental socioeconomic status at birth is a binary variable with value 1 or 0. The variable is coded as 1 if the highest parental occupation status is non-manual, managerial, technical or professional, whereas it is 0 if the child has a non-working single parent, has parents who are unskilled or only partly-skilled or the highest occupation status of the parents is manual work.

## 4 Main Results

Subsection 4.1 targets the predictive power of emotional stability at age 16 for mental health problems in adolescence and adulthood and the relation with conscientiousness and possibly other personality traits. In Subsection 4.2, we address the role of personality change between ages 10 and 16 for mental health outcomes at age 16 and older age. Our results are based on ordinary least square (OLS) regression methods. To account for the possible problem of heteroscedasticity, we calculate robust standard errors.

### 4.1 Predictive Power of Personality for Mental Health Problems

In a first step, we analyze the predictive power of emotional stability and other personality traits at age 16 for mental ill-health at ages 16, 26, 30, 34 and 42. Table 3 presents our results regarding the predictive power of emotional stability and other personality traits at age 16 for mental health problems at ages 16, 26, 30, 34 and 42.

Our results reveal that emotional stability significantly predicts mental health in adolescence and adulthood and that the size of the coefficients remains relatively stable over time. An increase in emotional stability by 1 standard deviation is related to a decrease in mental health problems by between 0.08 and 0.17 standard deviation. Conscientiousness at age 16 is negatively related to mental health problems, although the coefficients are less robust over time than those for emotional stability.

Table 3: Personality and Mental Ill-Health over Time

	Mental Ill-Health Score				
	Age 16	Age 26	Age 30	Age 34	Age 42
Emotional Stability (Age 16)	-0.166*** (0.000)	-0.109*** (0.000)	-0.118*** (0.000)	-0.084*** (0.000)	-0.115*** (0.000)
Conscientiousness (Age 16)	-0.028 (0.256)	-0.058*** (0.005)	-0.070*** (0.000)	-0.087*** (0.000)	-0.015 (0.479)
Agreeableness (Age 16)	0.024 (0.418)	0.033 (0.117)	0.048** (0.015)	-0.008 (0.734)	-0.000 (0.993)
Extraversion (Age 16)	-0.136*** (0.000)	-0.124*** (0.000)	-0.099*** (0.000)	-0.070*** (0.000)	-0.120*** (0.000)
Male	-0.329*** (0.000)	-0.346*** (0.000)	-0.250*** (0.000)	-0.239*** (0.000)	-0.192*** (0.000)
$N$	2559	3436	4200	3789	3369
$R^2$	0.104	0.101	0.069	0.068	0.063

$p$ -values in parentheses \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Source: British Cohort Study (BCS70), own calculations.

Note: We estimate OLS regressions with robust standard errors and control for mother's age, mother's age squared, parental education at birth, region of birth, and child's cognitive ability at age 10.

Interestingly, extraversion seems to be another important predictor for mental health at all ages. This could point to an important role of social interaction for mental health. Connor-Smith and Flachsbart (2007) argue that extraversion “may encourage support seeking [and is associated] with low stress-reactivity and positive appraisal of available coping resources” (p. 1081). Based on a cognitive-behavioral and social problem-solving intervention designed to reduce and prevent depressive symptoms among girls, Chaplin et al. (2006) find that significantly positive effects might arise due to the participant's social interaction, which is related to friendships and exchange about destructive thoughts, problems and ways how to overcome them. However, also addressing the role of extraversion theoretically and empirically in detail goes beyond the scope of this article.

It is further shown that women are more often affected by mental ill-health than men at all ages. This result is in accordance with the psychological literature about gender differences regarding to depressive symptoms (Hankin et al. (1998), Broidy et al. (2003)).

In a second step, we include interaction terms between above- and below-mean emotional stability and conscientiousness to control for the expected interaction effects between emotional stability and conscientiousness. In Table 4, we check the association between the interaction of emotional stability and conscientiousness with mental health outcomes. Thereby, we build above- and below-mean combinations between the two traits (more emotionally stable and more conscientious, more emotionally stable and less conscientious, less emotionally stable and more conscientious, and less emotionally stable and less conscientious). The reference group comprises individuals who score high in both emo-

#### 4 MAIN RESULTS

Table 4: Personality Trait Interaction and Mental Ill-Health over Time

	Mental Ill-Health Score				
	Age 16	Age 26	Age 30	Age 34	Age 42
High Emotional Stability, Low Conscientiousness (Age 16)	0.092 (0.147)	0.054 (0.297)	0.142*** (0.003)	0.085* (0.079)	-0.012 (0.818)
Low Emotional Stability, High Conscientiousness (Age 16)	0.251*** (0.000)	0.067 (0.151)	0.113** (0.011)	0.096** (0.039)	0.154*** (0.002)
Low Emotional Stability, Low Conscientiousness (Age 16)	0.305*** (0.000)	0.263*** (0.000)	0.338*** (0.000)	0.310*** (0.000)	0.245*** (0.000)
Agreeableness (Age 16)	-0.016 (0.577)	-0.004 (0.831)	0.012 (0.493)	-0.037* (0.092)	-0.021 (0.340)
Extraversion (Age 16)	-0.158*** (0.000)	-0.143*** (0.000)	-0.115*** (0.000)	-0.082*** (0.000)	-0.131*** (0.000)
Male	-0.343*** (0.000)	-0.356*** (0.000)	-0.263*** (0.000)	-0.242*** (0.000)	-0.198*** (0.000)
<i>N</i>	2559	3436	4200	3789	3369
<i>R</i> <sup>2</sup>	0.097	0.096	0.066	0.065	0.062

*p*-values in parentheses \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Source: British Cohort Study (BCS70), own calculations.

Note: We estimate OLS regressions with robust standard errors and control for mother's age, mother's age squared, parental education at birth, region of birth, and child's cognitive ability at age 10.

tional stability and conscientiousness, i. e. theoretically considered as the most favorable combination.

We find that the most problematic combination with respect to the two personality traits of interest is low emotional stability and low conscientiousness at all ages for both women and men. Thus, scoring low on both emotional stability and conscientiousness is on average related to an increase in mental ill-health by between 0.25 and 0.35 of a standard deviation. This result is in line with our theoretical considerations in Section 2. Accordingly, individuals who score low in both emotional stability and conscientiousness are more likely to have a reduced perceived and actual problem-solving ability related to pessimistic expectations and emotion-focussed coping strategies also in influenceable challenging situation throughout life. This is likely to be related to feelings of sustained stress, an increase in anxiety and worse outcomes because the challenge mentally and actually persists. In the long run, mental ill-health might arise and endure.

Scoring higher in conscientiousness seems to be able to mitigate the negative relation between emotional stability and mental health problems. Indeed, respondents who score low in emotional stability but higher in conscientiousness are also significantly more likely to experience mental ill-health compared with individuals who score both high in emotional stability and conscientiousness. However, starting at the age of 26, they are (borderline)

Table 5: Personality and Mental Ill-Health over Time

	Mental Ill-Health Score			
	Age 26	Age 30	Age 34	Age 42
Emotional Stability (Age 16)	-0.122*** (0.000)	-0.080*** (0.004)	-0.050 (0.105)	-0.126*** (0.000)
Conscientiousness (Age 16)	-0.050* (0.083)	-0.046* (0.079)	-0.096*** (0.001)	-0.013 (0.646)
Agreeableness (Age 16)	0.060* (0.069)	0.035 (0.247)	-0.005 (0.911)	0.044 (0.222)
Extraversion (Age 16)	-0.054** (0.030)	-0.051** (0.028)	-0.033 (0.200)	-0.087*** (0.001)
Malaise Score (Age 16)	0.113*** (0.000)	0.103*** (0.000)	0.097*** (0.000)	0.078*** (0.000)
Male	-0.289*** (0.000)	-0.178*** (0.000)	-0.186*** (0.000)	-0.204*** (0.000)
$N$	1907	2149	1983	1797
$R^2$	0.207	0.154	0.152	0.135

$p$ -values in parentheses \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Source: British Cohort Study (BCS70), own calculations.

Note: We estimate OLS regressions with robust standard errors and control for mother's age, mother's age squared, parental education at birth, region of birth, and child's cognitive ability at age 10.

significantly less likely to have mental health issues compared with those who score low in both emotional stability and conscientiousness.

This result might be related to positive success experiences that are more likely to take place when the respondent overcomes the tendency to avoid challenges, but acts more problem-focused based on higher conscientiousness. Accordingly, the individual's own perceived and actual problem-solving ability might be improved so that sustained stress and mental ill-health holds lesser concern. This argumentation is supported by Campbell-Sills et al. (2006) who argue that "the tendency to respond to stressful situations with an active, problem-solving approach promotes resilience in conscientious individuals" (p. 585). Regarding to both tables, we did not find significant gender differences.

However, one could argue that mental health problems at both adolescent and adult age are to a major extent related to a genetic predisposition and not to behavioral differences. Hence, emotional stability at age 16 would only reflect mental ill-health at age 16 in the regressions for the older ages. To test for this, the regressions in Tables 3 and 4 are repeated for the ages 26, 30, 34 and 42 by additionally controlling for mental health at age 16. The results are presented in Tables 5 and 6. The tables show that an 1 point increase of the malaise score at age 16 is on average associated with a mental ill-health increase of around 0.1 of a standard deviation at older ages. Further, controlling for mental health

Table 6: Personality Trait Interaction and Mental Ill-Health over Time

	Mental Ill-Health Score			
	Age 26	Age 30	Age 34	Age 42
High Emotional Stability, Low Conscientiousness (Age 16)	0.049 (0.489)	0.082 (0.203)	0.068 (0.293)	-0.013 (0.850)
Low Emotional Stability, High Conscientiousness (Age 16)	0.046 (0.434)	0.037 (0.522)	0.002 (0.969)	0.119* (0.054)
Low Emotional Stability, Low Conscientiousness (Age 16)	0.262*** (0.001)	0.230*** (0.001)	0.232*** (0.001)	0.281*** (0.000)
Agreeableness (Age 16)	0.017 (0.594)	0.011 (0.699)	-0.037 (0.322)	0.018 (0.589)
Extraversion (Age 16)	-0.076*** (0.003)	-0.064*** (0.006)	-0.047* (0.067)	-0.100*** (0.000)
Malaise Score (Age 16)	0.116*** (0.000)	0.104*** (0.000)	0.100*** (0.000)	0.080*** (0.000)
Male	-0.298*** (0.000)	-0.185*** (0.000)	-0.185*** (0.000)	-0.211*** (0.000)
<i>N</i>	1907	2149	1983	1797
<i>R</i> <sup>2</sup>	0.202	0.153	0.149	0.134

*p*-values in parentheses \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Source: British Cohort Study (BCS70), own calculations.

Note: We estimate OLS regressions with robust standard errors and control for mother's age, mother's age squared, parental education at birth, region of birth, and child's cognitive ability at age 10.

problems at age 16 significantly increases the explained variance in the regression models. Nevertheless, the coefficients for emotional stability and the interaction term between both low emotional stability and conscientiousness stay robust. This further supports the argumentation that beside a possible underlying genetical component, behavioral variation related to personality traits matter for mental health outcomes throughout life (see also Kendler and Myers (2010)).

## 4.2 Personality Change between Ages 10 and 16 and Mental Ill-Health

To test for recursive causality at age 16 and to analyze the relevance of personality traits at younger age for mental health outcomes at adolescence and adulthood, we further look at the relation between personality at age 10 as well as a personality trait change between 10 and 16 and the incidence of mental health problems in adolescence and adulthood. A personality trait increase (decrease) is considered if the particular trait increases (decreases) by 0.5 of a standard deviation between ages 10 and 16. Individuals who do not experience a personality trait change above or below 0.5 of a standard deviation between

4 MAIN RESULTS

Table 7: Personality Trait Change and Mental Ill-Health over Time

	Mental Ill-Health Score				
	Age 16	Age 26	Age 30	Age 34	Age 42
Emotional Stability (Age 10)	-0.114*** (0.000)	-0.124*** (0.000)	-0.082*** (0.001)	-0.101*** (0.000)	-0.088*** (0.002)
Conscientiousness (Age 10)	0.006 (0.839)	-0.030 (0.246)	-0.037 (0.117)	-0.073*** (0.004)	-0.058** (0.025)
Agreeableness (Age 10)	-0.024 (0.496)	0.008 (0.783)	-0.028 (0.266)	-0.012 (0.661)	-0.023 (0.448)
Extraversion (Age 10)	-0.146*** (0.000)	-0.116*** (0.000)	-0.111*** (0.000)	-0.070*** (0.002)	-0.114*** (0.000)
Emotional Stability (Age 16-10) > 0.5	-0.151*** (0.007)	-0.153*** (0.002)	-0.095** (0.028)	-0.141*** (0.002)	-0.088* (0.087)
Emotional Stability (Age 16-10) < -0.5	0.254*** (0.000)	0.085** (0.050)	0.114*** (0.005)	0.140*** (0.001)	0.201*** (0.000)
Extraversion (Age 16-10) > 0.5	-0.058 (0.265)	-0.133*** (0.004)	-0.013 (0.763)	0.001 (0.976)	-0.145*** (0.003)
Extraversion (Age 16-10) < -0.5	0.263*** (0.000)	0.147*** (0.001)	0.179*** (0.000)	0.120*** (0.003)	0.130*** (0.002)
Agreeableness (Age 16-10) > 0.5	0.027 (0.637)	0.047 (0.340)	0.011 (0.802)	0.003 (0.949)	0.067 (0.206)
Agreeableness (Age 16-10) < -0.5	0.026 (0.616)	0.037 (0.380)	0.044 (0.262)	0.051 (0.226)	0.001 (0.987)
Conscientiousness (Age 16-10) > 0.5	0.054 (0.355)	0.015 (0.773)	-0.010 (0.816)	-0.036 (0.470)	-0.075 (0.157)
Conscientiousness (Age 16-10) < -0.5	0.112** (0.042)	0.116*** (0.010)	0.118*** (0.005)	0.094** (0.031)	0.033 (0.470)
Male	-0.329*** (0.000)	-0.361*** (0.000)	-0.265*** (0.000)	-0.240*** (0.000)	-0.209*** (0.000)
<i>N</i>	2559	3436	4200	3789	3369
<i>R</i> <sup>2</sup>	0.106	0.097	0.069	0.068	0.066

*p*-values in parentheses \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Source: British Cohort Study (BCS70), own calculations.

Note: We estimate OLS regressions with robust standard errors and control for mother's age, mother's age squared, parental education at birth, region of birth, and child's cognitive ability at age 10.

## 5 CONCLUSION

ages 10 and 16 are considered as the reference group. The results regarding personality trait change are provided in Table 7.

Our results show that emotional stability at age 10 is significantly negatively related to mental ill-health at adolescence and older age and that an increase in emotional stability between 10 and 16 is significantly associated with a decrease in mental health problems, while a decrease in emotional stability between 10 and 16 is significantly related to an increase in mental health problems at ages 16, 26, 30, 34 and 42.

Table 7 further shows that conscientiousness is (borderline) negatively related to mental health issues at age 30, 34 and 42. In addition, a decrease in conscientiousness between ages 10 and 16 is significantly associated with mental health problems in adolescence and young adulthood at adolescence and adult age (except for age 42). Furthermore, we find that extraversion at age 10 is significantly negatively related to mental problems at age 16 and older age and that a decrease in extraversion between 10 and 16 is significantly associated with an increase in mental ill-health in young and adult age. Finally, we find only very limited evidence for significant gender differences in these associations. Detailed results are available upon request.

## 5 Conclusion

A increasing number of economic studies use personality traits to predict various socio-economic outcomes and show that low emotional stability is typically negatively related to education, labor market and mental health outcomes, while conscientiousness is almost seen as a guarantor for desirable results. However, possible mechanisms behind these relations are far less explored. We contribute to the literature by analyzing the relation between low emotional stability and mental ill-health as well as the possible substitution effect of conscientiousness. On the one hand, we investigate the psychological literature and put the insights gained into an economic framework. On the other hand, we analyze the relation between personality and mental health empirically, using personality at ages 10 and 16 and mental health outcomes at ages 16, 26, 30, 34, and 42.

Our theoretical examination shows that particularly low emotionally stable and low conscientious individuals are likely to be trapped in a self-sustained circle of mental health problems and socioeconomic disadvantage, because this group is more likely to unconsciously and repetitively use maladaptive and ineffective coping strategies also when facing influenceable challenges. Procrastination and avoidance promise short-term gains related to a reduction of negative emotion, although this behavior produces long-term costs that are likely to outweigh the short-term gains. Higher conscientiousness is likely to improve outcomes based on richer organization and time management skills as well as higher self-discipline.

The empirical results support our theoretical considerations. The study finds that emotional stability at age 16 significantly negatively predicts mental health problems in adolescence and adulthood. An increase in emotional stability of 1 standard deviation is related to a decrease in the mental ill-health score by between 0.08 and 0.17 of a standard deviation in adolescence and adult age which is in line with the theoretical



considerations. The analysis further shows that the highest risk to experience mental health problems at adolescence and adulthood have individuals who score both low in emotional stability and in conscientiousness at age 16. Scoring both low in emotional stability and in conscientiousness is related to an increase in mental ill-health by between 0.25 and 0.35 of a standard deviation. Higher levels in conscientiousness at age 16 significantly mitigate the positive relation at adult age. This result is again in accordance with the economic model of neuroticism and assumed to be related to an enhanced problem solving skills, an increase of perceived control in challenging situations and less feelings of sustained stress for more conscientious individuals.

However, apart from the behavioral mechanisms described, genetic factors might be related to mental health issues at young and older age. Targeting this valid objection, the analysis reveals that the predictive power of emotional stability and conscientiousness at age 16 for mental health outcomes in adult age slightly decreases, but is still significant also after controlling for mental health issues at age 16. Nevertheless, the results suggest that individuals who experience mental health problems at age 16 are also more likely to experience these issues at adult age. An increase in the mental ill-health score by 1 is related to an increase of mental ill-health by between 0.08 and 0.11 of a standard deviation. This suggests that both a behavioral and genetic component is related to mental health problems.

Finally, the results show that emotional stability at age 10 significantly negatively predicts mental ill-health. An increase in emotional stability at age 10 is associated with a decrease in mental health problems in adolescence or adult age by between 0.08 and 0.12 of a standard deviation. Individuals who are able to increase in emotional stability between ages 10 and 16 are significantly less likely to experience mental health problems at age 16 and older age, while a decrease in emotional stability is associated with a significantly increased risk of mental health problems in adolescence or later in life. An increase in emotional stability by more than 0.5 of a standard deviation between age 10 and 16 is related to a decrease in mental ill-health at young and older age by between 0.09 and 0.15 of a standard deviation, while a decrease in emotional stability by more than 0.5 of a standard deviation between age 10 and 16 is related to a increase in mental ill-health at young and older age by between 0.09 and 0.25 of a standard deviation. These also economically significant results emphasize the importance of personality development in puberty for later life mental health outcomes.

Our theoretical considerations and empirical findings have important implications for policy-makers. There is evidence that the child's level of emotional stability is both genetically and culturally highly influenced by the family. Thus, neuroticism is considered as 50% to 60% heritable, but can also develop based on continuous exposure to anxiety and stress.<sup>14</sup> This makes it likely that the parents themselves either exhibit high neuroticism

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<sup>14</sup>On the one hand, Cuijpers et al. (2010) states that "neuroticism is moderately heritable, with genetic factors determining 50% to 60% of their variance." On the other hand, Roberts (2009) argues that "continuous states of anxiety and stress can lead to neuroanatomical changes in brain structures (McEwen et al. (2006)). Stressful states likely interact with genes responsive to stress, which, in turn, affect the neuroanatomy that shapes the habitual ability of the person to respond to future environmental insults - thus, a trait is born".

## 5 CONCLUSION

or are less likely to be able to support their children due to serious and long-run family problems. Accordingly, higher neuroticism might be one important channel for intergenerational socioeconomic inequality that is mostly neglected so far in economics.

Psychological studies show that school-based mental ill-health prevention programs that aim to adjust pessimistic beliefs and expectations and to improve the individual problem-solving ability may significantly reduce the risk of mental health problems particularly when targeted at high-risk groups (Horowitz and Garber (2006), Stice et al. (2009), Corrieri et al. (2014)). Therefore, intervention that addresses particularly low emotionally stable and low conscientious students might be a promising means to prevent or at least reduce mental health problems in adolescence and adult age. Our theoretical considerations further suggest that such interventions might also be able to boost other socioeconomic outcomes such as education or labor market outcomes among the high-risk individuals.

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## A Data

Table 8: Number of Observations by Wave and Variables Used

Wave, Year	N	Dataset	Variables
Wave 1, 1970	17,196	SN2666: Chamberlain et al. (2013)	Mother's age at birth, region of birth, child's sex, parental socioeconomic status at birth.
Wave 2, 1975	13,135	not used	-
Wave 3, 1980	14,875	SN3723: Butler et al. (2014)	Test scores and personality traits at age 10.
Wave 4, 1986	11,615	SN3535: Butler et al. (2013)	Personality traits as well as mental ill-health at age 16.
Wave 5, 1996	9,003	SN3833: Bynner and University of London, Institute of Education, Centre for Longitudinal Studies (2013)	Mental ill-health at age 26.
Wave 6, 2000	11,261	SN5558: University of London, Institute of Education, Centre for Longitudinal Studies (2013b)	Mental ill-health at age 30.
Wave 7, 2004	9,665	SN5585: University of London, Institute of Education, Centre for Longitudinal Studies (2013a)	Mental ill-health at age 34.
Wave 8, 2008	8,874	not used	-
Wave 9, 2012	9,841	SN7473: University of London. Institute of Education. Centre for Longitudinal Studies (2012)	Mental ill-health at age 42.

## A DATA

Table 9: Malaise Items

Question	Age 16	Age 26	Age 30	Age 34	Age 38	Age 42
1. Do you often have back-ache?	✓	✓	✓	⊗	⊗	⊗
<b>2. Do you feel tired most of the time?</b>	✓	✓	✓	✓	⊗	✓
<b>3. Do you often feel depressed?</b>	✓	✓	✓	✓	⊗	✓
4. Do you often have bad headaches?	✓	✓	✓	⊗	⊗	⊗
<b>5. Do you often get worried about things?</b>	✓	✓	✓	✓	⊗	✓
6. Do you usually have great difficulty in falling or staying asleep?	✓	✓	✓	⊗	⊗	⊗
7. Do you usually wake unnecessarily early in the morning?	✓	✓	✓	⊗	⊗	⊗
8. Do you wear yourself out worrying about your health?	✓	✓	✓	⊗	⊗	⊗
<b>9. Do you often get into violent rage?</b>	✓	✓	✓	✓	⊗	✓
10. Do people annoy and irritate you?	✓	✓	✓	⊗	⊗	⊗
11. Have you at times had a twitching of the face, head or shoulders?	✓	✓	✓	⊗	⊗	⊗
<b>12. Do you suddenly become scared for no good reason?</b>	✓	✓	✓	✓	⊗	✓
13. Are you scared to be alone when there are no friends near you?	✓	✓	✓	⊗	⊗	⊗
<b>14. Are you easily upset or irritated?</b>	✓	✓	✓	✓	⊗	✓
15. Are you frightened of going out alone or of meeting people?	✓	✓	✓	⊗	⊗	⊗
<b>16. Are constantly keyed up and jittery?</b>	✓	✓	✓	✓	⊗	✓
17. Do you suffer from indigestion?	✓	✓	✓	⊗	⊗	⊗
18. Do you suffer from an upset stomach?	✓	✓	✓	⊗	⊗	⊗
19. Is your appetite poor?	✓	✓	✓	⊗	⊗	⊗
<b>20. Does every little thing get on your nerves and wear you out?</b>	✓	✓	✓	✓	⊗	✓
<b>21. Does your heart often race like mad?</b>	✓	✓	✓	✓	⊗	✓
22. Do you often have bad pain in eyes?	✓	✓	✓	⊗	⊗	⊗
23. Are you troubled with rheumatism or fibrosis?	⊗	✓	✓	⊗	⊗	⊗
24. Have you ever had a nervous breakdown?	⊗	✓	✓	⊗	⊗	⊗
<b>Number of malaise items</b>	22	24	24	9	0	9
<b>Measurement scale per malaise item</b>	3-point: 0, 1, 2	2-point: 0, 1	2-point: 0, 1	2-point: 0, 1	-	2-point: 0, 1
<b>Measurement scale per malaise score</b>	0-44	0-24	0-24	0-9	-	0-9
<b>Threshold for depression</b>	15	8	8	4	-	4
<b>Unrestricted number of valid observations</b>	4,673	8,044	10,251	8,866	0	7,935

Source: BCS70. Own calculations.

Note: The 9 items that are marked bold are used in our analysis.

## A DATA

Table 10: Correlation between Personality Traits and Mental Health Outcomes

Personality Traits and Related Items	MH, 16	MH, 26	MH, 30	MH, 34	MH, 42
<b>Emotional Stability (ES)</b>					
Age 10	-.11	-.13	-.12	-.12	-.12
Age 16	-.24	-.20	-.19	-.18	-.19
R8. Irritable	-.18	-.17	-.14	-.15	-.14
R9. Miserable and tearful.	-.20	-.17	-.16	-.17	-.19
C8. Requests must be met immediately.	-.12	-.11	-.11	-.10	-.11
C12. Sullen or sulky	-.20	-.13	-.14	-.15	-.15
C16. Changes mood quickly and drastically	-.20	-.17	-.15	-.14	-.15
C17. Outburst of temper unpredictable	-.18	-.15	-.14	-.13	-.12
<b>Conscientiousness (C)</b>					
Age 10	-.04	-.07	-.08	-.10	-.09
Age 16	-.12	-.14	-.14	-.16	-.11
R15. Cannot settle	-.08	-.11	-.08	-.12	-.10
C3. Inattentive, easily distracted	-.09	-.11	-.12	-.12	-.08
C13. Fails to finish things	-.10	-.11	-.13	-.14	-.09
C19. Difficulty concentrating on task	-.09	-.11	-.10	-.13	-.06
<b>Agreeableness (A)</b>					
Age 10	-.07	-.07	-.09	-.08	-.10
Age 16	-.11	-.10	-.09	-.12	-.10
R3. Destroys own or others' belongings	-.04	-.05	-.05	-.07	-.08
R4. Frequently fights with others	-.07	-.06	-.04	-.07	-.08
R14. Often disobedient	-.10	-.12	-.10	-.12	-.10
R18. Often tells lies	-.08	-.08	-.10	-.08	-.09
R19. Bullies other children	-.06	-.04	-.02	-.04	.
C11. Interferes with other children	-.07	-.07	-.05	-.09	-.04
R10. Takes things belonging to others	-.04	-.04	-.02	-.07	-.07
<b>Extraversion (E)</b>					
Age 10	-.13	-.11	-.12	-.10	-.11
Age 16	-.22	-.19	-.16	-.14	-.18
R5. Not much liked by others	-.09	-.06	-.07	-.08	-.07
R6. Often worried	-.23	-.19	-.16	-.14	-.17
R7. Rather solitary	-.09	-.10	-.07	-.04	-.07
R16. Afraid of new things or situations	-.14	-.12	-.11	-.10	-.13
R17. Fussy or over-particular	-.08	-.09	-.05	-.06	-.08

Source: BCS70, own calculations. Items are stated in original terms, but reversly used in the analysis.

Note: Correlation coefficients reported are significant at the 5 percent level or higher.

MH = Mental Health Problems at ages 16 (n=2559), 26 (n=3436), 30 (n=4200), 34 (n=3789), and 42 (n=3369).

Table 11: Cognitive Ability Measures at Age 10

Educational Test	Components
British Abilities Scale (BAS)	Self-completion; Non-verbal: Recall of digits (34 items), matrices (28 items); Verbal: Word definitions (37 items), word similarities (42 items).
Shortened Edinburgh Reading Test (ERT)	Self-completion; 64 items (67 in documentation).
Friendly Maths Test (FMT)	72 multiple choice questions.
Pictorial Language Comprehension Test (PLCT)	Vocabulary items, sequencing items, sentence comprehension items; 100 items.
Diagnostic Test	Reading (108 items) and spelling test (50 items).

Source: BCS70, SN3723: Butler et al. (2014).

## B Descriptives Working vs. Unrestricted Sample

Table 12: Descriptives Age 16 : Working, Unrestricted Sample

Variable Names	N	mean	sd	min	max	N	mean	sd	min	max
Malaise Score (Age 16)	2559	-0.03	0.98	-1.51	4.15	4673	0.00	1.00	-1.51	4.86
Emotional Stability (ES, 10)	2559	0.12	0.90	-3.23	1.26	11796	0.00	1.00	-3.51	1.34
Conscientiousness (C, 10)	2559	0.19	0.87	-3.31	1.20	11796	0.00	1.00	-3.35	1.20
Agreeableness (A, 10)	2559	0.14	0.79	-5.79	1.27	11796	0.00	1.00	-6.48	1.38
Extraversion (E, 10)	2559	0.01	1.00	-3.27	1.47	11796	-0.00	1.00	-3.62	1.47
Emotional Stability (ES, 16)	2559	0.08	0.92	-4.00	0.85	7132	-0.00	1.00	-4.00	0.85
Conscientiousness (C, 16)	2559	0.14	0.88	-4.65	0.72	7132	-0.00	1.00	-4.65	0.72
Agreeableness (A, 16)	2559	0.17	0.77	-6.54	0.53	7132	0.00	1.00	-6.61	0.53
Extraversion (E, 16)	2559	0.00	0.98	-4.82	0.96	7132	0.00	1.00	-4.82	0.96
High ES, High C (16)	2559	0.55	0.50	0.00	1.00	7132	0.49	0.50	0.00	1.00
High ES, Low C (16)	2559	0.12	0.32	0.00	1.00	7132	0.14	0.35	0.00	1.00
Low ES, High C (16)	2559	0.16	0.37	0.00	1.00	7132	0.16	0.37	0.00	1.00
Low ES, Low C (16)	2559	0.17	0.38	0.00	1.00	7132	0.21	0.41	0.00	1.00
Cog. Ability z (10)	2559	0.39	0.88	-3.21	2.44	11598	-0.00	1.00	-4.42	2.49
Social Class I or II (0)	2559	0.23	0.42	0.00	1.00	17164	0.18	0.39	0.00	1.00
Region	2559	5.71	2.70	1.00	10.00	17185	5.89	2.70	1.00	11.00
Age Mother (0)	2559	23.02	3.98	14.00	42.00	17067	22.15	4.03	12.00	47.00
Male	2559	0.41	0.49	0.00	1.00	17185	0.52	0.50	0.00	1.00

Source: British Cohort Study (BCS70), own calculations.

Table 13: Descriptives Age 26 : Working, Unrestricted Sample

Variable Names	N	mean	sd	min	max	N	mean	sd	min	max
Malaise Score (Age 26)	3436	-0.05	0.96	-1.00	4.07	8044	-0.00	1.00	-1.00	4.07
Emotional Stability (ES, 10)	3436	0.13	0.89	-3.37	1.26	11796	0.00	1.00	-3.51	1.34
Conscientiousness (C, 10)	3436	0.16	0.89	-3.11	1.20	11796	0.00	1.00	-3.35	1.20
Agreeableness (A, 10)	3436	0.12	0.82	-5.98	1.27	11796	0.00	1.00	-6.48	1.38
Extraversion (E, 10)	3436	0.01	0.98	-3.55	1.47	11796	-0.00	1.00	-3.62	1.47
Emotional Stability (ES, 16)	3436	0.08	0.94	-4.00	0.85	7132	-0.00	1.00	-4.00	0.85
Conscientiousness (C, 16)	3436	0.12	0.89	-4.65	0.72	7132	-0.00	1.00	-4.65	0.72
Agreeableness (A, 16)	3436	0.11	0.89	-6.54	0.53	7132	0.00	1.00	-6.61	0.53
Extraversion (E, 16)	3436	0.02	0.97	-4.82	0.96	7132	0.00	1.00	-4.82	0.96
High ES, High C (16)	3436	0.54	0.50	0.00	1.00	7132	0.49	0.50	0.00	1.00
High ES, Low C (16)	3436	0.13	0.34	0.00	1.00	7132	0.14	0.35	0.00	1.00
Low ES, High C (16)	3436	0.16	0.37	0.00	1.00	7132	0.16	0.37	0.00	1.00
Low ES, Low C (16)	3436	0.17	0.38	0.00	1.00	7132	0.21	0.41	0.00	1.00
Cog. Ability z (10)	3436	0.32	0.88	-3.21	2.44	11598	-0.00	1.00	-4.42	2.49
Social Class I or II (0)	3436	0.21	0.41	0.00	1.00	17164	0.18	0.39	0.00	1.00
Region	3436	5.61	2.69	1.00	10.00	17185	5.89	2.70	1.00	11.00
Age Mother (0)	3436	22.85	3.96	15.00	46.00	17067	22.15	4.03	12.00	47.00
Male	3436	0.43	0.49	0.00	1.00	17185	0.52	0.50	0.00	1.00

Source: British Cohort Study (BCS70), own calculations.

## B DESCRIPTIVES WORKING VS. UNRESTRICTED SAMPLE

Table 14: Descriptives Age 30 : Working, Unrestricted Sample

Variable Names	N	mean	sd	min	max	N	mean	sd	min	max
Malaise Score (Age 30)	4200	-0.05	0.96	-0.88	4.24	10251	-0.00	1.00	-0.88	4.24
Emotional Stability (ES, 10)	4200	0.10	0.92	-3.45	1.28	11796	0.00	1.00	-3.51	1.34
Conscientiousness (C, 10)	4200	0.11	0.92	-3.31	1.20	11796	0.00	1.00	-3.35	1.20
Agreeableness (A, 10)	4200	0.08	0.87	-6.37	1.27	11796	0.00	1.00	-6.48	1.38
Extraversion (E, 10)	4200	0.01	0.98	-3.61	1.47	11796	-0.00	1.00	-3.62	1.47
Emotional Stability (ES, 16)	4200	0.06	0.95	-4.00	0.85	7132	-0.00	1.00	-4.00	0.85
Conscientiousness (C, 16)	4200	0.06	0.93	-4.65	0.72	7132	-0.00	1.00	-4.65	0.72
Agreeableness (A, 16)	4200	0.06	0.93	-6.61	0.53	7132	0.00	1.00	-6.61	0.53
Extraversion (E, 16)	4200	0.03	0.96	-4.82	0.96	7132	0.00	1.00	-4.82	0.96
High ES, High C (16)	4200	0.51	0.50	0.00	1.00	7132	0.49	0.50	0.00	1.00
High ES, Low C (16)	4200	0.14	0.35	0.00	1.00	7132	0.14	0.35	0.00	1.00
Low ES, High C (16)	4200	0.16	0.36	0.00	1.00	7132	0.16	0.37	0.00	1.00
Low ES, Low C (16)	4200	0.19	0.39	0.00	1.00	7132	0.21	0.41	0.00	1.00
Cog. Ability z (10)	4200	0.23	0.92	-3.21	2.44	11598	-0.00	1.00	-4.42	2.49
Social Class I or II (0)	4200	0.20	0.40	0.00	1.00	17164	0.18	0.39	0.00	1.00
Region	4200	5.66	2.70	1.00	10.00	17185	5.89	2.70	1.00	11.00
Age Mother (0)	4200	22.65	3.95	14.00	46.00	17067	22.15	4.03	12.00	47.00
Male	4200	0.46	0.50	0.00	1.00	17185	0.52	0.50	0.00	1.00

Source: British Cohort Study (BCS70), own calculations.

Table 15: Descriptives Age 34 : Working, Unrestricted Sample

Variable Names	N	mean	sd	min	max	N	mean	sd	min	max
Malaise Score (Age 34)	3789	-0.04	0.98	-0.88	3.87	8866	0.00	1.00	-0.88	3.87
Emotional Stability (ES, 10)	3789	0.11	0.91	-3.45	1.26	11796	0.00	1.00	-3.51	1.34
Conscientiousness (C, 10)	3789	0.12	0.92	-3.31	1.20	11796	0.00	1.00	-3.35	1.20
Agreeableness (A, 10)	3789	0.10	0.84	-6.37	1.26	11796	0.00	1.00	-6.48	1.38
Extraversion (E, 10)	3789	0.02	0.99	-3.61	1.47	11796	-0.00	1.00	-3.62	1.47
Emotional Stability (ES, 16)	3789	0.07	0.94	-4.00	0.85	7132	-0.00	1.00	-4.00	0.85
Conscientiousness (C, 16)	3789	0.08	0.92	-4.65	0.72	7132	-0.00	1.00	-4.65	0.72
Agreeableness (A, 16)	3789	0.08	0.90	-6.54	0.53	7132	0.00	1.00	-6.61	0.53
Extraversion (E, 16)	3789	0.03	0.97	-4.82	0.96	7132	0.00	1.00	-4.82	0.96
High ES, High C (16)	3789	0.52	0.50	0.00	1.00	7132	0.49	0.50	0.00	1.00
High ES, Low C (16)	3789	0.14	0.35	0.00	1.00	7132	0.14	0.35	0.00	1.00
Low ES, High C (16)	3789	0.16	0.36	0.00	1.00	7132	0.16	0.37	0.00	1.00
Low ES, Low C (16)	3789	0.18	0.39	0.00	1.00	7132	0.21	0.41	0.00	1.00
Cog. Ability z (10)	3789	0.26	0.91	-3.53	2.44	11598	-0.00	1.00	-4.42	2.49
Social Class I or II (0)	3789	0.21	0.41	0.00	1.00	17164	0.18	0.39	0.00	1.00
Region	3789	5.65	2.69	1.00	10.00	17185	5.89	2.70	1.00	11.00
Age Mother (0)	3789	22.76	3.93	14.00	46.00	17067	22.15	4.03	12.00	47.00
Male	3789	0.45	0.50	0.00	1.00	17185	0.52	0.50	0.00	1.00

Source: British Cohort Study (BCS70), own calculations.

*B DESCRIPTIVES WORKING VS. UNRESTRICTED SAMPLE*

Table 16: Descriptives Age 42 : Working, Unrestricted Sample

Variable Names	N	mean	sd	min	max	N	mean	sd	min	max
Malaise Score (Age 42)	3369	-0.04	0.96	-0.93	3.57	7935	0.00	1.00	-0.93	3.57
Emotional Stability (ES, 10)	3369	0.11	0.91	-3.45	1.26	11796	0.00	1.00	-3.51	1.34
Conscientiousness (C, 10)	3369	0.14	0.91	-3.31	1.20	11796	0.00	1.00	-3.35	1.20
Agreeableness (A, 10)	3369	0.12	0.83	-6.37	1.26	11796	0.00	1.00	-6.48	1.38
Extraversion (E, 10)	3369	0.02	0.99	-3.61	1.47	11796	-0.00	1.00	-3.62	1.47
Emotional Stability (ES, 16)	3369	0.06	0.95	-4.00	0.85	7132	-0.00	1.00	-4.00	0.85
Conscientiousness (C, 16)	3369	0.10	0.90	-4.65	0.72	7132	-0.00	1.00	-4.65	0.72
Agreeableness (A, 16)	3369	0.09	0.90	-6.54	0.53	7132	0.00	1.00	-6.61	0.53
Extraversion (E, 16)	3369	0.02	0.96	-4.82	0.96	7132	0.00	1.00	-4.82	0.96
High ES, High C (16)	3369	0.53	0.50	0.00	1.00	7132	0.49	0.50	0.00	1.00
High ES, Low C (16)	3369	0.13	0.34	0.00	1.00	7132	0.14	0.35	0.00	1.00
Low ES, High C (16)	3369	0.16	0.37	0.00	1.00	7132	0.16	0.37	0.00	1.00
Low ES, Low C (16)	3369	0.18	0.38	0.00	1.00	7132	0.21	0.41	0.00	1.00
Cog. Ability z (10)	3369	0.28	0.90	-3.74	2.44	11598	-0.00	1.00	-4.42	2.49
Social Class I or II (0)	3369	0.22	0.41	0.00	1.00	17164	0.18	0.39	0.00	1.00
Region	3369	5.54	2.66	1.00	10.00	17185	5.89	2.70	1.00	11.00
Age Mother (0)	3369	22.77	3.94	14.00	46.00	17067	22.15	4.03	12.00	47.00
Male	3369	0.44	0.50	0.00	1.00	17185	0.52	0.50	0.00	1.00

Source: British Cohort Study (BCS70), own calculations.