

# Personality Traits in Labor Economics

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## Abstract

This thesis analyzes the role of personality traits in the context of labor economics based on the German Socio-Economic Panel (*SOEP*). The second Chapter considers the impact of personality traits on the change of the gender wage gap. The analysis first explores how personality traits affect wage growth rates. Then, a decomposition analysis is performed to analyze the dynamic effects of personality traits on the change of the gender wage gap over time. The empirical results indicate that gender differences in conscientiousness and emotional stability lead to a widening of the wage gap over time. In contrast, gender differences in rewards to extraversion lead to a narrowing of the wage gap over time. The third Chapter analyzes private retirement savings, the amount for German individuals and how these savings are influenced by personality traits. Results indicate a positive effect for extraversion and a negative effect for agreeableness on the probability to have such savings. Extraversion also positively effects the size of retirement related savings as does having a more internal locus of control. Similar to the probability to have retirement savings agreeableness also reduces the expected amount of such savings. Implementing the personality measures as dummies in the analysis returns no significant effects denying the hypothesis of non-linear effects of the traits. Chapter 4 investigates the stability of the Big-Five personality traits for 2005, 2009, and 2013. The results indicate that the population means only show little variance over the eight years. There is no link between age and mean levels, and only minor changes of the mean levels of the Big-Five over time for the working age population (25-64 years of age) in Germany. However, there are intra-individual changes which can partly be explained by adverse life events. They impact the Big-Five traits and thereby contradict the general finding of stability of the traits in the literature. Exploratory fixed effects wage estimations that exploit the intra-individual changes in the Big-Five find no significant effects for men but positive effects of agreeableness and conscientiousness on women's wage.

**Keywords:** personality traits, gender wage gap, private retirement provision

## Zusammenfassung

Diese Dissertation beschäftigt sich mit der Rolle der Persönlichkeitsmerkmale im Kontext der Arbeitsökonomik basierend auf dem Sozio-Ökonomischen Panel (*SOEP*). Das zweite Kapitel behandelt den Einfluss der Persönlichkeitsmerkmale auf den Lohnzuwachs und die Lohnlücke zwischen Frauen und Männern. Die Analyse setzt sich zuerst damit auseinander, wie die Persönlichkeitsmerkmale das Lohnwachstum beeinflussen. Danach wird mit einer Dekompositionsanalyse untersucht, wie die dynamischen Effekte der Persönlichkeitsmerkmale die Veränderung der Lohnlücke zwischen Frauen und Männern beeinflussen. Die empirischen Ergebnisse zeigen, dass Unterschiede in den Persönlichkeitsmerkmalen Gewissenhaftigkeit und emotionale Stabilität zu einer Vergrößerung der Lohnlücke beitragen. Im Kontrast dazu verkleinern Unterschiede in Extraversion die Lohnlücke im Verlauf der Zeit. Im dritten Kapitel setzt sich die Analyse mit der privaten Rentenvorsorge auseinander. Dabei wird untersucht, wie die Persönlichkeitsmerkmale das Vorhandensein von privater Rentenvorsorge und deren Höhe beeinflusst. Die Ergebnisse deuten auf positive Effekte für Extraversion und negative Effekte für Verträglichkeit auf das Vorhandensein privater Vorsorge hin. Extraversion hat genauso wie ein internaler Locus of Control einen positiven Effekt auf die Höhe der privaten Rentenvorsorge. Verträglichkeit reduziert die Höhe der vorhandenen privaten Rentenvorsorge. Die Implementierung der Persönlichkeitsmerkmale als Dummy-Variablen zeigt keine signifikanten Effekte und verneint die Hypothese von nicht linearen Einflüssen der Persönlichkeitsmerkmale auf die Rentenvorsorge. Kapitel 4 untersucht die Stabilität der Big-Five Persönlichkeitsmerkmale anhand der 2005er, der 2009er und der 2013er Welle und erweitert den Zeitraum der Beobachtung der Merkmale auf acht Jahre. Die Ergebnisse zeigen, dass für die beobachtete Stichprobe nur eine geringe Varianz über die acht Jahre vorliegt. Zudem gibt es keinen systematischen Effekt des Alters auf die Durchschnittswerte der Persönlichkeitsmerkmale der Stichprobe für in Deutschland lebende Personen im Alter zwischen 25 und 64. Allerdings gibt es relativ große inter-individuelle Effekte, die einen Einfluss auf die Big-Five haben und somit der Stabilitätshypothese widersprechen. Explorative Fixed-Effects Lohn Regressionen, die sich die inter-individuellen Veränderungen zu Nutze machen, zeigen keine signifikanten Effekte für Männer, aber positive Effekte von Verträglichkeit und Gewissenhaftigkeit auf den Lohn von Frauen.

**Schlagworte:** Persönlichkeitsmerkmale, Lohnlücke, private Rentenvorsorge

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## CHAPTER 1

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# Introduction

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# 1 Introduction

The last decades in economics were marked by the rising popularity of behavioral economics. It adds to the understanding of human behavior in the economic context as it deviates from the general assumption of the homo economicus. It expands the standard utility model by recognizing systematic errors made by the individual. The field was fully recognized through the Nobel Prize in economics for Daniel Kahneman and Vernon L. Smith in 2002. Daniel Kahneman was honored for his work with Amos Tversky incorporating psychological insights into the field of economics. They investigated systematic cognitive biases in decision making and the use of heuristics by individuals. They have established a new model of utility called prospect theory. Their research offered new insights into the market behavior of individuals and helped to explain observed deviations that could not be explained by the standard utility model.

Along with the step-wise acceptance of psychological influences in the field of economics other psychological concepts have been adopted into economic research. This thesis focuses on the concept of personality and its impact on topics generally only related to cognitive indicators. One main concept are the Big-Five personality traits, represented by extraversion, agreeableness, conscientiousness, emotional stability and openness to experience. Going beyond the Big-Five the constructs of the locus of control as well as reciprocity are investigated for their impact in the economic domain. All concepts have been included in the German Socio-economic Panel (SOEP) from 2005 onward (Wagner et al., 2007). Since the inclusion into a representative panel data set for Germany topics like the wage effects of the Big-Five, their influence on the labor force participation, and the wage-mobility of low-wage workers have been analyzed (Heineck and Anger, 2010; Wichert and Pohlmeier, 2010; Schnitzlein and Stephani, 2013). However, there are other topics for which the effect of personality could play an important role that are yet to be explored. This thesis investigates the effect of personality on wage growth, the change of the gender wage gap as well as the effect on private retirement savings concluding with an investigation of the stability of the Big-Five in the panel data set using the latest available SOEP wave.

In Chapter 2 gender differences in wage growth rates are considered and related to differences in personality traits and/or gender differences in rewards to these traits. The first step of analysis is to investigate the effect of personality traits on relative wage changes over time, i.e. wage

growth. An Ordinary Least Squares (OLS) regression and a quantile regression to analyze the impact of personality traits over the conditional wage growth distribution are used. In the second step a Oaxaca-Blinder decomposition is performed to relate personality traits to the change of the gender wage gap. The exact effects attributable to the specific traits are estimated through a detailed decomposition. We find that conscientiousness, extraversion and emotional stability have an impact on wage growth when an OLS regression is used, while the quantile regression results indicate that these effects vary over the conditional wage growth distribution. The decomposition analysis reveals that gender differences in conscientiousness and emotional stability lead to a widening of the wage gap over time. By contrast, gender differences in extraversion lead to a narrowing of the wage gap over time.

Chapter 3 investigates the effect of personality traits on the saving behavior of German individuals with the focus on private retirement savings. The empirical analysis focuses on life and retirement savings and also investigates the effect on different saving types and net wealth. It concentrates on the retirement planning phase with individuals between 30 and 55 years of age. The main focus of this study is to apply the models used to investigate personality in relationship to retirement savings to a German setting. By using the Big-Five personality traits and the locus of control it is investigated how the traits influence the likelihood to have private retirement savings and their influence on the size of these savings. Probit estimations for the participation decision and tobit estimations are implemented to analyze the estimated amounts in a limited dependent variable framework. Results indicate a positive effect for extraversion and a negative effect for agreeableness on the probability to have such savings. Extraversion also positively effects the size of retirement related savings as does having a more internal locus of control. Similar to the probability to have retirement savings agreeableness also reduces the expected amount of such savings. Implementing the personality measures as dummies in the analysis returns no significant effects denying the hypothesis of non-linear effects of the traits.

Chapter 4 investigates the stability of the Big-Five personality traits. By using the latest available SOEP wave of 2013 the time horizon is extended to eight years from 2005 to 2013. Important economic decisions are usually made by individuals in their prime working age and therefore it is worth investigating if the stability hypothesis holds true for individuals between 25 and 65 years of age. For the sample population as a whole the Big-Five seem to be rather stable and independent of age effects. On an individual level the working age sample of the *SOEP* shows a rather large variation on the individual level leaving the stability hypothesis for

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the Big-Five in question. Additionally, possible sources for the intra-individual variation are investigated. Wage effects of the Big-Five are estimated under different assumptions. First is the classical stability assumption following the approach by Heineck and Anger (2010). The second approach uses the observed variation to include the personality traits in a fixed effects wage estimation. In both cases there are only small wage effects of adverse life events through the Big-Five.

## CHAPTER 2

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# The Impact of Personality Traits on Wage Growth and the Gender Wage Gap

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## 2 The Impact of Personality Traits on Wage Growth and the Gender Wage Gap

*Co-authored with Jörg Schwiebert - Accepted for the Bulletin of Economic Research*<sup>1</sup>

### 2.1 Introduction

The last decades have seen an increase in the labor force participation of women and increasing efforts to reduce differences between men and women concerning pay. Although there have been steady improvements towards equal pay between men and women, there is still a sizable wage gap left even after controlling for occupation and other economic characteristics. In recent years the gender wage gap has also been linked to differences in the personality traits between men and women. Several papers have analyzed the impact of personality traits on gender-specific wages and/or the gender wage gap (e.g. Mueller and Plug (2006); Manning and Swaffield (2008); Braakmann (2009); Heineck and Anger (2010)).

While the impact of personality traits on the gender wage gap has already been analyzed (e.g., Mueller and Plug (2006); Braakmann (2009)), the impact of personality traits on the *change* of the gender wage gap has gained less attention. While an analysis of the impact of personality traits on the gender wage gap reveals how much of the male-female wage differential can be explained by gender differences in personality traits and/or gender differences in rewards to these traits, nothing is said about the change of the gender wage gap over time. If, on the other hand, male-female differences in *wage growth rates* are considered and related to differences in personality traits and/or gender differences in rewards to these traits, conclusions about the *change* of the gender wage gap can be drawn. For example, suppose that men earn more on average than women. Suppose further that a specific personality trait has a positive impact on wage growth for men and for women, but the impact for women is larger than for men. This would then lead to a *ceteris paribus* narrowing of the gender wage gap over time.

Since our goal is to relate personality traits to the change of the gender wage gap, the first step

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<sup>1</sup>Schäfer, K.,C. and Schwiebert J., The Impact of Personality Traits on Wage Growth and the Gender Wage Gap, *Bulletin of Economic Research*, Wiley

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of our analysis is to investigate the effect of personality traits on relative wage changes over time, i.e. wage growth. We use ordinary least squares (OLS) regression and quantile regression to analyze the impact of personality traits over the conditional wage growth distribution. In the second step we perform an Oaxaca-Blinder decomposition to relate personality traits to the change of the gender wage gap. We estimate the exact effects attributable to the specific traits by applying a detailed decomposition.

In our study we use data from the German Socioeconomic Panel (SOEP). Our results in brief are as follows: We find that conscientiousness, extraversion and emotional stability (to be defined below) have an impact on wage growth when an OLS regression is used, while quantile regression results indicate that these effects vary over the conditional wage growth distribution. Our decomposition analysis then reveals that gender differences in conscientiousness and emotional stability lead to a widening of the wage gap over time. By contrast, gender differences in extraversion lead to a narrowing of the wage gap over time.

The remainder of the paper is organized as follows. Section 2 considers the economic background. Section 3 describes the data and econometric methods used in the empirical analysis. Section 4 presents and discusses the empirical results. Finally, Section 5 concludes the paper.

## 2.2 Economic Background

Crucial for every empirical analysis of personality traits is the availability of operational measures characterizing these traits. The Five-Factor Model (McCrae and Costa (1996); McCrae and Costa (1999)) identifies five basic personality dimensions which are known as the Big-Five personality traits: openness to experience, conscientiousness, extraversion, agreeableness and emotional stability. These traits can be described as follows (see Table 2.1). Openness to experience (hereafter simply referred to as “openness”) is associated with creative, unconventional thinking. Conscientiousness means to be efficient and well-organized. Extraversion is related to showing positive emotions and being sociable. Agreeableness is mainly associated with getting along with other people, i.e., being consensus-orientated. Emotional stability (the converse of neuroticism) refers to being self-confident, relaxed, not easy to irritate and with no tendencies towards anxieties or depression.

Table 2.1: The Big Five Personality Traits

Dimension	Facet (and correlated trait adjective)
Extraversion vs. Introversion	Gregariousness (sociable)
	Assertiveness (forceful)
	Activity (energetic)
	Excitement-seeking (adventurous)
	Positive emotions (enthusiastic)
Agreeableness vs. Antagonism	Warmth (outgoing)
	Trust (forgiving)
	Straightforwardness (not demanding)
	Altruism (warm)
	Compliance (not stubborn)
Conscientiousness vs. Lack of Direction	Modesty (not showing off)
	Tender-mindedness (sympathetic)
	Competence (efficient)
	Order (organized)
	Dutifulness (not careless)
Neuroticism vs. Emotional Stability	Achievement striving (thorough)
	Self-discipline (not lazy)
	Deliberation (not impulsive)
	Anxiety (tense)
	Angry hostility (irritable)
Openness vs. Closedness to Experience	Depression (not contented)
	Self-consciousness (shy)
	Impulsiveness (moody)
	Vulnerability (not self-confident)
	Ideas (curious)
	Fantasy (imaginative)
	Aesthetics (artistic)
	Actions (wide interest)
	Feelings (excitable)
	Values (unconventional)

Note: This table has been adapted from John and Srivastava (1999, p. 110) and contains Costa and McCrae's (1992) NEO PI-R facets. The table is also included in Mueller and Plug (2006, p. 5).

Further measures of personality traits are an individual's Locus of Control (LoC) and an individual's reciprocity. LoC is associated with an individual's perception that his or her outcomes in life are mainly affected by the actions of other people and are thus beyond their control (see, e.g., Rotter (1966); Schnitzlein and Stephani (2013)). Reciprocity refers to the individual's behavior with respect to friendly/unfriendly actions of other people. Positive reciprocity means that an individual responds friendly to another individual who act friendly towards him or her. Conversely, negative reciprocity means that an individual responds unfriendly to another individual who act unfriendly towards him or her (see, e.g., Fehr and Gächter (2000)).

Mueller and Plug (2006) identify two channels through which personality traits may affect earnings. First, in light of human capital theory personality traits may be considered as a part of productive skills valued in the labor market. Second, personality traits may be correlated with work-related preferences, thus leading to certain occupational choices. Heineck and Anger (2010) review further literature linking personality traits and career success. Based on this review, they expect that LoC and agreeableness should be negatively correlated with wages, openness, conscientiousness, emotional stability and positive reciprocity positively, and extraversion should not be correlated with wages. They also expect that these hypothesized effects may vary by gender.

The studies by Mueller and Plug (2006), Manning and Swaffield (2008), Braakmann (2009) and Heineck and Anger (2010) are in terms of their approach closest to our analysis of the impact of personality traits on earnings. Using US data, Mueller and Plug (2006) find that among men, non-agreeableness, emotional stability and openness have a significant positive impact on wages, while among women, conscientiousness and openness have a significant positive impact on wages. Using German SOEP data, Heineck and Anger (2010) find a robust significant negative impact of LoC on wages, while the effects obtained for the other measures of personality traits are sensitive to the model specification.

Mueller and Plug (2006) also analyze gender differences using a Oaxaca-Blinder decomposition. They find that 3-4% of the gender wage gap are explained by gender differences in Big-Five personality traits and differences in returns to these traits, with agreeableness being the most important trait in this regard. (Braakmann, 2009), who uses German SOEP data, also performs a decomposition analysis and obtains similar results as Mueller and Plug (2006). Using UK data, Manning and Swaffield (2008) find that "gender differences in 'personality'

variables can help to explain at most a few percentage points of the gender pay gap” (Manning and Swaffield, 2008, p. 1017).

However, these studies analyze how personality traits affect the gender gap in wage levels. By contrast, in this paper we investigate how personality traits affect the gender gap in wage growth rates, since our goal is to analyze the change of the gender wage gap over time. Put differently, our study complements the existing literature, which focuses on a static analysis of the gender wage gap, by a dynamic assessment. The dynamic analysis might provide deeper insights into the dynamics of wage inequality than a static analysis could ever do. The reason is that a static analysis focuses on the gender wage gap at a given point in time, while a dynamic analysis tries to identify and explain changes over time.

## **2.3 Data and Econometric Approach**

### **2.3.1 Data and Variables**

This paper exploits data from the German Socio-Economic Panel (SOEP), a representative longitudinal survey of households and individuals including a multitude of demographic and socio-economic items. Most importantly for this paper, three waves (2005, 2009 and 2010) contain information on personality traits. A short version of the Neuroticism Extraversion Openness - Personal Inventory - Revised (NEO-PI-R) is included from which the personality traits can be constructed. While the items associated with the Big-Five personality traits are available for 2005 and 2009, the items associated with LoC and reciprocity are available for 2005 and 2010.

In case of the Big-Five traits, three items related to each trait with responses on a 7-point Likert scale are available. The actual value of a Big-Five trait is then calculated as the average response over the three items. A high value of a trait constructed in this way indicates a high outcome of the respective personality dimension (see Heineck and Anger (2010)). For the construction of LoC, we rely on a procedure suggested by Schnitzlein and Stephani (2013), which is more general than the concept used by Heineck and Anger (2010). Seven items with responses on a 7-point Likert scale are used. The actual value is again calculated as the average over the seven items. A high value of LoC constructed in this way indicates an external LoC, i.e. an individual believes that his or her outcomes in life are mainly affected by the actions of other people. On

the opposite, a low value of LoC is associated with an internal LoC, i.e. an individual believes that his or her outcomes in life are mainly affected by his or her actions. For each positive and negative reciprocity, three items with responses on a 7-point Likert scale are used, and the actual value is again calculated as the average over the three items. A high value again indicates a high degree of positive/negative reciprocity (see Heineck and Anger (2010)). All personality variables have been standardized to have zero mean and a variance of one.

The dependent variable is the individual percentage wage growth from 2005 to 2006 and 2009 to 2010, respectively. We use gross monthly wages deflated to the base year 2005 for the calculation of growth rates. Gross monthly wages have also been used by Heineck and Anger (2010), albeit their focus was on wage levels rather than growth rates. We use monthly wages as reported by individuals instead of calculating hourly wages, since reported working hours may be contaminated by measurement error.

The main explanatory variables of interest are the personality traits described above. Since empirical evidence suggests that these traits are relatively stable over time (e.g., Cobb-Clark and Schurer (2012); Cobb-Clark and Schurer (2013)), we treat them as time-constant variables within the time intervals of the wage changes. More precisely, we assume that the personality traits are constant between 2005 and 2006 and also between 2009 and 2010.

Control variables used in the empirical study include socio-demographic and job-related characteristics. These variables are similar to those used by Heineck and Anger (2010), who study the impact of personality traits on wage levels. The socio-demographic variables are a dummy for being female, age, age squared, years of education, a dummy for being in a relationship, a dummy for having a migration background and a dummy for living in East Germany. Job-related variables are working hours, tenure, tenure squared, a dummy for being a public employee, dummies for firm size, a dummy for being a white-collar worker, a dummy for having a full-time job, a dummy for having a time-limited contract and occupational and industry dummies.

We impose the following sample restrictions. We use individuals between 25 and 54 years of age because in this age period the personality traits can be considered relatively stable over time (Cobb-Clark and Schurer (2012); Cobb-Clark and Schurer (2013)), which justifies treating them as exogenous variables. Additionally, we only include part-time and full-time workers, and exclude individuals being self-employed, working in agriculture or fishing or being in ap-

prenticeship. These sample restrictions apply to both years covering the wage changes, i.e., someone who fulfilled the sample restrictions in 2005 (2009) but not in 2006 (2010), and vice versa, has been excluded.

Summary statistics of the variables are given in Table 2.2 (except for the occupational and industry dummies).

Table 2.2: Descriptive Statistics

Variable Name	Mean	SD	Min	Max
Wage	2652.57	1464.42	93.46	28037.38
Wage growth	0.01	0.17	-1.65	2.11
Female	0.46	0.50	0	1
Age	41.52	7.79	25	54
Education (years)	12.83	2.67	7	18
Relationship	0.79	0.40	0	1
Migration background	0.17	0.37	0	1
East	0.25	0.43	0	1
Tenure	11.39	8.80	0	40
Public employee	0.29	0.45	0	1
Firm size				
... below 20	0.18	0.38	0	1
... over 20 below 100	0.19	0.40	0	1
... over 100 below 200	0.10	0.30	0	1
... over 200 below 2000	0.25	0.43	0	1
... over 2000	0.27	0.44	0	1
White collar	0.64	0.48	0	1
Full Time	0.80	0.40	0	1
Time-limited contract	0.06	0.23	0	1
Working hours	35.73	7.47	3	80
Locus of Control (LoC)	3.16	0.72	1	6.29
Conscientiousness	5.96	0.84	2.33	7
Openness	4.43	1.14	1	7
Extraversion	4.82	1.13	1	7
Agreeableness	5.34	0.96	1.33	7
Emotional stability	4.24	1.18	1	7
Positive reciprocity	5.87	0.86	1	7
Negative reciprocity	3.10	1.38	1	7
Year09	0.48	0.50	0	1

Note: The number of observations is 7,778. Personality variables appear in their original construction, i.e., non-standardized values are reported.

### 2.3.2 Econometric Approach

We begin our econometric analysis of wage growth rates with a Mincer-type specification of the log wage equation, which is quite common in the literature. Since we have panel data, we set up a log wage equation in a panel data context, as in Hunt (2001a,b). Specifically, we assume that for  $t \in \{2005, 2009\}$ ,

$$\begin{aligned}\ln w_{i,t} &= \alpha_0 + q_i' \alpha_1 + z_{i,t}' \alpha_2 + p_i' \alpha_3 + v_i + \eta_i t + \varepsilon_{i,t} \\ \ln w_{i,t+1} &= \alpha_0 + q_i' \alpha_1 + z_{i,t+1}' \alpha_2 + p_i' \alpha_3 + v_i + \eta_i(t+1) + \varepsilon_{i,t+1}\end{aligned}\quad (2.1)$$

where  $w_{i,t}$  denotes the gross monthly wage of individual  $i$  ( $i = 1, \dots, n$ ) at time  $t$ ,  $q_i$  includes the time-invariant variables except for the personality traits,  $z_{i,t}$  contains the time-varying variables,  $p_i$  includes the personality traits,  $v_i$  is an individual-specific fixed effect,  $t$  is a time trend, and  $\varepsilon_{it}$  denotes the error term. Moreover,  $\alpha_0$ ,  $\alpha_1$ ,  $\alpha_2$ ,  $\alpha_3$  and  $\eta_i$  are parameters. As described above, the personality traits are assumed to be constant between  $t$  and  $t+1$ .

For the sake of a clearer exposition we did not index the time-invariant variables with 2005/2006 or 2009/2010. However, the reader should note that the time-invariant variables defined here are only assumed to be constant between 2005 and 2006 and between 2009 and 2010, but not in the whole period 2005-2010. Hence, it is allowed that a time-invariant variable takes values in 2009/2010 being different from those in 2005/2006.

Subtracting both equations in (2.1) yields

$$\ln w_{i,t+1} - \ln w_{i,t} = (z_{i,t+1} - z_{i,t})' \alpha_2 + \eta_i + \varepsilon_{i,t+1} - \varepsilon_{i,t}, \quad (2.2)$$

where the left hand side now contains the wage growth rate. As in Hunt (2001a,b), we assume that the trend in wages,  $\eta_i$ , is related to the time-invariant variables, including the personality traits, by

$$\eta_i = \pi_0 + q_i' \pi_1 + p_i' \pi_2 + \pi_3 T_{i,2009} + \xi_i, \quad (2.3)$$

where  $\xi_i$  denotes an error terms,  $T_{i,2009}$  is a time dummy for 2009/2010 to account for possible structural changes between 2005/2006 and 2009/2010, and  $\pi_0$ ,  $\pi_1$ ,  $\pi_2$  and  $\pi_3$  are parameters. Hence, personality traits are assumed to affect wage growth rates through their effect on the

trend in wages. Inserting Eq. (2.3) into Eq. (2.2) yields

$$\ln w_{i,t+1} - \ln w_{i,t} = \pi_0 + q'_i \pi_1 + p'_i \pi_2 + \pi_3 T_{i,2009} + (z_{i,t+1} - z_{i,t})' \alpha_2 + \varepsilon_{i,t+1} - \varepsilon_{i,t} + \xi_i. \quad (2.4)$$

This equation constitutes our estimating equation.

Since generating first differences in  $(z_{i,t+1} - z_{i,t})$  is not sensible for all time-varying variables listed in the last section, we assume more generally that  $(z_{i,t+1} - z_{i,t})$  includes *changes* of time-varying variables when first differences are not sensible. For example, we have five dummy variables for different firm sizes; generating first differences for each of these dummy variables does not seem to be sensible. Instead, we construct two dummy variables capturing the change in firm size from period  $t$  to period  $t + 1$ . The first dummy variable is equal to one if the firm size has increased and zero otherwise, while the second dummy variable is equal to one if the firm size has decreased and zero otherwise. We also construct two dummy variables equal to one if the industry or occupation, respectively, has been changed.

Since the goal of this paper is to analyze gender differences in wage growth rates, using an estimating equation involving the first difference of log wages seems natural. However, the first difference specification has even more advantages, since problems encountered with the estimation of the log wage equation introduced at the beginning are partly removed. First, the difference specification removes some omitted variable bias, at least when the omitted variables are captured by the fixed effects  $v_i$  in the log wage equation. These omitted variables cancel out due to taking differences.

Second, sample selectivity issues are mitigated, at least when the variables governing selection into the labor market are time-constant. Sample selectivity is often considered a problem when wage equations for women shall be estimated: since not all women are working, a wage regression using the sample of working women only might lead to a selection bias. However, when selection is only affected by time-invariant variables like education, the selection effects will also be captured by the fixed effects  $v_i$  and thus will cancel out when differences are taken. To see this, suppose that selection effects can be represented by a selectivity term in the log wage equation. For instance, this selectivity term might be given by an inverse Mills ratio term depending on a linear combination of variables  $l_i$  and parameters  $\omega$ . If the variables  $l_i$  are time



constant, the fixed effects  $v_i$  could be written as

$$v_i = \lambda \frac{\phi(l'_i \omega)}{\Phi(l'_i \omega)} + \zeta_i, \quad (2.5)$$

where  $\phi(l'_i \omega)/\Phi(l'_i \omega)$  is the inverse Mills ratio term with associated parameter  $\lambda$ , with  $\phi(\cdot)$  and  $\Phi(\cdot)$  being the standard normal density and distribution function, respectively, and  $\zeta_i$  captures the remaining factors affecting the fixed effects. Since the selectivity term is a part of the fixed effect  $v_i$ , it cancels out when first differences are taken.

Indeed, in our analysis we make the assumption that selectivity effects are time-constant and, thus, cancel out. If this was not the case, a clear interpretation of the decomposition results below would be difficult, since there would be a direct effect of personality traits on wage growth and an indirect effect through the selection term.

To better justify this assumption, we exclude all individuals from the sample who changed their full-time/part-time status in  $[t, t + 1]$ . It might be argued that for people who did not change their labor supply status between  $t$  and  $t + 1$  the selection into the labor force is indeed dependent on time-invariant variables – or, more precisely, dependent on variable which are stable between  $t$  and  $t + 1$ .

The most convenient way to estimate Eq. (2.4) is to apply ordinary least squares (OLS) regression. Besides OLS, we also estimate Eq. (2.4) using a quantile regression approach, as done by Hunt (2001a,b). We estimate quantile regressions at the 10th, 25th, 50th, 75th and 90th percentile in order to analyze whether the personality effects vary over the conditional wage growth distribution. Hunt (2001a,b) motivates her use of quantile regression by the conjecture that wage growth rates might contain outliers, and that quantile regression is more robust against outliers than OLS. Our main motivation to conduct a quantile regression analysis is that we are able to get a more complete picture of how personality traits affect wage growth rates, since we focus on the full conditional wage growth distribution and not only on the mean.

The second step of our analysis is to relate personality traits to the change of the gender wage gap. To do this, we consider gender differences in wage growth rates and analyze how these differences can be related to gender differences in personality traits and/or gender differences in rewards to these traits. We use a standard Oaxaca-Blinder decomposition approach (Oaxaca

(1973); Blinder (1973)). To simplify the notation, we rewrite Eq. (2.4) as

$$y_{i,t} = x'_{i,t}\beta + u_{i,t}, \quad (2.6)$$

where

$$\begin{aligned} y_{i,t} &\equiv \ln w_{i,t+1} - \ln w_{i,t}, \\ x'_{i,t} &\equiv (1, q'_i, p'_i, T_{i,2009}, (z_{i,t+1} - z_{i,t})'), \\ \beta &\equiv (\pi_0, \pi'_1, \pi'_2, \pi_3, \alpha'_2)' \end{aligned}$$

and

$$u_{i,t} \equiv \varepsilon_{i,t+1} - \varepsilon_{i,t} + \xi_i.$$

Let  $m$  denote male and  $f$  female individuals. Then a Oaxaca-Blinder decomposition is given by

$$\bar{y}^m - \bar{y}^f = (\bar{x}^m - \bar{x}^f)' \hat{\beta}^p + [(\bar{x}^m)'(\hat{\beta}^m - \hat{\beta}^p) - (\bar{x}^f)'(\hat{\beta}^f - \hat{\beta}^p)], \quad (2.7)$$

where a “bar” over a variable denotes the mean over individuals and over time, e.g.,

$$\bar{y} = \frac{1}{2n} \sum_{i=1}^n \sum_t y_{i,t}.$$

Hence,  $\bar{y}^m$  denotes the average male wage growth,  $\bar{y}^f$  the average female wage growth, and so on. The estimated parameter vector  $\hat{\beta}^m$  is obtained from a regression based on the sub-sample of men only,  $\hat{\beta}^f$  from a regression based on the sub-sample of women only and  $\hat{\beta}^p$  from a regression based on the pooled sample of men and women.

The left hand side of Eq. (2.7) measures the average gender difference in wage growth rates. This overall differential is decomposed on the right hand side into an explained part (the first term of the sum) and an unexplained part (the second term). The explained part relates the overall differential to differences in the characteristics  $x$  and may thus be considered a “justified” part of the overall differential. The unexplained part, on the other hand, relates the overall differential to differences in rewards (i.e., coefficients) to the variables  $x$ . Such differences in rewards have often been attributed to discriminatory behavior on the labor market. However,

these differences in rewards might also have been caused by unobserved variables omitted in Eq. (2.4), like skills and/or preferences, and thus need not be solely due to discrimination.

Note that the explained part of the differential is evaluated at the estimated parameter vector from the pooled sample of men and women,  $\hat{\beta}^p$ . In the context of discrimination, this parameter vector is often assumed to represent the non-discriminatory wage structure (Oaxaca and Ransom, 1994). Mueller and Plug (2006) also use the pooled parameter vector for their decomposition of the male-female wage differential, and we also follow this strategy for our decomposition.

Finally, it should be noted that a decomposition of the gender gap in wage growth rates is something different than a decomposition of the gender gap in wage levels. This can be seen from Eqs. (2.1) and (2.4). First, while the wage level equation is also based on level explanatory variables, the first differenced equation is based on time-invariant level explanatory variables as well as on first differences of time-varying explanatory variables. Second, as explained above, there are conceptual differences between a level decomposition and a decomposition based on first differences: a wage level decomposition provides a rather static view of the gender wage gap, while a decomposition of wage growth rates allows to analyze the dynamics of the gender wage gap. Third, some econometric problems related to the decomposition based on a wage level model, such as endogeneity of covariates and sample selectivity, are mitigated in a decomposition based on a first differenced model, as described above.

## 2.4 Results

### 2.4.1 Impact of Personality Traits on Wage Growth

First, we consider the impact of personality traits on wage growth. Table 2.3 shows estimates from an OLS regression and five quantile regressions. As mentioned above, the quantiles used are the 10th, 25th, 50th, 75th and 90th percentiles. For brevity and clarity, only the coefficients associated with the personality traits are reported. Full regression results can be found in the appendix of this paper (Table A2.1).

Table 2.3: Wage Growth Regressions

Variable	OLS	QREG 10	QREG 25	QREG 50	QREG 75	QREG 90
Locus of control	-0.0025 (0.0021)	-0.0101*** (0.0038)	-0.0067*** (0.0016)	-0.0022*** (0.0008)	0.0000 (0.0021)	0.0007 (0.0040)
Conscientiousness	-0.0043** (0.0021)	-0.0129*** (0.0031)	-0.0036** (0.0015)	-0.0014 (0.0009)	0.0011 (0.0019)	0.0036 (0.0042)
Openness	-0.0004 (0.0021)	-0.0029 (0.0040)	-0.0013 (0.0014)	0.0001 (0.0008)	-0.0006 (0.0019)	0.0052 (0.0037)
Extraversion	0.0034* (0.0020)	-0.0031 (0.0036)	-0.0018 (0.0014)	0.0000 (0.0009)	0.0049*** (0.0018)	0.0099* (0.0055)
Agreeableness	0.0007 (0.0020)	0.0007 (0.0037)	-0.0003 (0.0015)	-0.0004 (0.0008)	0.0002 (0.0020)	-0.0032 (0.0043)
Emotional stability	0.0043** (0.0019)	0.0066* (0.0037)	0.0015 (0.0017)	0.0005 (0.0008)	0.0010 (0.0018)	0.0037 (0.0038)
Positive reciprocity	-0.0025 (0.0021)	-0.0013 (0.0040)	-0.0018 (0.0015)	-0.0008 (0.0008)	-0.0022 (0.0020)	-0.0007 (0.0053)
Negative reciprocity	0.0007 (0.0021)	0.0054 (0.0034)	0.0009 (0.0017)	0.0000 (0.0008)	0.0004 (0.0020)	0.0022 (0.0044)
$R^2$	0.04	0.01	0.02	0.03	0.02	0.01
F-test (p-value)	0.04	0.00	0.00	0.20	0.19	0.00

Note: Standard errors appear in parentheses. Clustered standard errors were calculated to account for possible intra-individual correlation of error terms. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. The sample size in each regression is  $N = 7,778$ . QREG X refers to a quantile regression at the X-th quantile. F-test (p-value) denotes the p-value associated with an F-test of joint significance of the personality traits.

The first column of Table 2.3 contains the OLS regression estimates. At conventional significance levels, conscientiousness and emotional stability are significant at the 5% level, while extraversion is significant at the 10% level. While the coefficient of emotional stability is positive as one would have expected, the coefficient of conscientiousness has a negative sign, which is quite surprising. The latter result has also been found by Heineck and Anger (2010) in some of their wage regressions. An explanation for this result could be that the underlying true relationship is non-linear, and that our linear specification captures some kind of average effect.

The remaining traits do not seem to have an impact on wage growth, at least from a statistical point of view. The whole set of personality variables is jointly significant at the 5% level, as indicated by the p-value associated with an F-test of joint significance of the personality traits.

The quantile regression results show a more differentiated picture of the impact of personality traits on wage growth. For instance, while locus of control has not been found significant in the OLS regression, it is highly significant in the quantile regressions up to the median. The

sign of this variable is in line with the expectations. Conscientiousness is significant at the lower quantiles of the conditional wage growth distribution, while extraversion is significant at higher quantiles. While emotional stability is significant at the 5% level in the OLS regression, it is only significant at the 10% level at the 10th percentile and insignificant at the remaining quantiles. The p-values associated with the F-test of joint significance of the personality traits indicate that the traits have their largest impact at lower and higher quantiles. This suggests that personality traits are most important at moderate or even negative levels of wage growth on the one hand and very strong levels of wage growth on the other hand.

#### **2.4.2 Impact of Personality Traits on the Change of the Gender Wage Gap**

The next and primary issue to be investigated is the impact of personality traits on the change of the gender wage gap. In particular, we seek to analyze whether personality traits have a widening or a narrowing impact on the gender wage gap over time.

To address this issue, we begin with a comparison of wages, wage growth rates and personality traits between men and women. Table 2.4 contains means and standard deviations of wages, wage growth rates and personality traits by gender. In addition, the p-value associated with a t-test of equality of means is given, indicating whether the gender differences in means are statistically significant. Table 2.4 shows that men earn more than women in absolute wages, but that wage growth is stronger for women than for men. Nonetheless, the difference in wage growth is not significant at conventional significance levels. The p-values indicate that gender mean differences in conscientiousness, openness, extraversion, agreeableness, emotional stability, LoC and negative reciprocity are significant, while the mean difference in positive reciprocity is not significant at conventional significance levels.

Although the mean difference in wage growth rates is not significant at conventional levels, this does not imply that a decomposition analysis is pointless. It is still possible that some personality traits have a significant widening impact on the gender wage gap, while others have a significant narrowing effect. The fact that the mean difference is insignificant at conventional levels might just indicate that these widening and narrowing effects cancel out each other.

Table 2.5 shows estimates from two separate OLS regressions of wage growth on personality

Table 2.4: Descriptive Statistics by Gender

Variable	Male	Female	p-value
Wage	3119.30 (1456.44)	2100.43 (1268.85)	0.00
Wage growth	0.0051 (0.15)	0.0081 (0.18)	0.43
Locus of control	3.18 (0.72)	3.13 (0.72)	0.00
Conscientiousness	5.89 (0.86)	6.04 (0.80)	0.00
Openness	4.33 (1.10)	4.56 (1.17)	0.00
Extraversion	4.68 (1.11)	4.98 (1.12)	0.00
Agreeableness	5.20 (0.97)	5.51 (0.92)	0.00
Emotional stability	4.45 (1.13)	3.99 (1.19)	0.00
Positive reciprocity	5.88 (0.84)	5.86 (0.89)	0.40
Negative reciprocity	3.30 (1.39)	2.87 (1.34)	0.00
N	4,215	3,563	

Note: Standard deviations appear in parentheses. The p-value is associated with a t-test of equality of means. Personality variables appear in their original construction, i.e., non-standardized values are reported.

traits (and other control variables). These regressions are the same as in the last subsection, but now separately performed for each gender. For men, LoC is significant at the 5% level. For women, conscientiousness and emotional stability are each significant at the 5% and 10% level, respectively. The coefficients vary to some extent between men and women, but it is not clear from visual inspection whether these differences might be significant from a statistical point of view.

Table 2.5: Wage Growth Regressions by Gender

Variable	Male	Female
Locus of control	-0.0054** (0.0026)	0.0003 (0.0034)
Conscientiousness	-0.0020 (0.0026)	-0.0075** (0.0035)
Openness	-0.0019 (0.0027)	0.0025 (0.0030)
Extraversion	0.0032 (0.0026)	0.0029 (0.0030)
Agreeableness	-0.0020 (0.0025)	0.0047 (0.0032)
Emotional stability	0.0033 (0.0026)	0.0057* (0.0029)
Positive reciprocity	-0.0007 (0.0025)	-0.0046 (0.0033)
Negative reciprocity	-0.0007 (0.0027)	0.0031 (0.0032)
N	4,215	3,563
$R^2$	0.02	0.09
F-test (p-value)	0.23	0.06

Note: Standard errors appear in parentheses. Clustered standard errors were calculated to account for possible intra-individual correlation of error terms. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. F-test (p-value) denotes the p-value associated with an F-test of joint significance of the personality traits.

To answer this and further questions, we now provide the results of a Oaxaca-Blinder decomposition of the gender differences in wage growth. The results of the decomposition are shown in Table 2.6. The first part of Table 2.6 gives the average gender differential in wage growth. Since female wage growth is larger than male wage growth, the differential is negative. The next two parts of Table 2.6 show a detailed decomposition of the explained and unexplained part of the wage growth differential. We focus on the signs and significances of the contributions associated with the personality traits.

Table 2.6: Decomposition Results

<i>Total differential</i>		
Av. male wage growth	0.0051	
Av. female wage growth	0.0081	
Differential	-0.0030	
<i>Detailed decomposition</i>	Contribution	SE
<i>Explained part (differences in characteristics)</i>		
Controls	-0.0026	(0.0025)
Locus of control	-0.0002	(0.0002)
Conscientiousness	0.0008**	(0.0004)
Openness	0.0001	(0.0004)
Extraversion	-0.0009*	(0.0005)
Agreeableness	-0.0002	(0.0007)
Emotional stability	0.0017**	(0.0008)
Positive reciprocity	-0.0000	(0.0001)
Negative reciprocity	0.0002	(0.0007)
Total	-0.0011	(0.0028)
<i>Unexplained part (differences in rewards)</i>		
Controls	0.0063	(0.0358)
Locus of control	0.0000	(0.0001)
Conscientiousness	0.0001	(0.0001)
Openness	-0.0002	(0.0001)
Extraversion	0.0001	(0.0001)
Agreeableness	-0.0003	(0.0002)
Emotional stability	0.0001	(0.0002)
Positive reciprocity	-0.0000	(0.0000)
Negative reciprocity	0.0002	(0.0002)
Constant	-0.0082	(0.0363)
Total	-0.0018	(0.0040)

Note: Clustered standard errors were calculated to account for possible intra-individual correlation of error terms. "Controls" refers to the joint contribution of the control variables (without the constant term). "Total" refers to the total contribution of the explained and unexplained part, respectively. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively.

Since the overall differential is negative, only differences in traits/rewards to these traits with a negative contribution indeed explain the negative differential. To give an example, consider the variable extraversion in the explained part of the differential. As formalized in the last section, in the explained part differences in traits are evaluated at the coefficient vector from the pooled sample including both men and women. Since the coefficient of extraversion in the pooled regression is positive (see Table 2.3), and since women have a higher average level of extraversion than men (see Table 2.4), women have a larger wage growth than men if both are



evaluated at the same coefficient vector from the pooled sample. Hence, gender differences in extraversion explain the overall negative differential, which is expressed by the negative sign of extraversion in the “explained part” of Table 2.6.

Following this logic, gender differences in LoC, extraversion, agreeableness and positive reciprocity (explained part) as well as differences in rewards to openness, agreeableness and positive reciprocity (unexplained part) explain the wage growth differential. Since these gender differences in personality traits and/or rewards to these traits explain a negative wage growth differential, one may also conclude that they lead to a reduction of wage inequality over time. For example, one may conclude that since women have a higher level of extraversion than men, wage inequality is reduced. Turning to significances, from Table 2.6 it can be seen that only gender differences in extraversion provide a significant (at the 10% level) and negative contribution to the overall differential.

The remaining gender differences in traits and/or rewards are associated with positive signs and thus lead to an increase of the wage gap over time. In particular, gender differences in emotional stability and conscientiousness provide a significant (at the 5% level) and positive contribution to the wage growth differential, hence differences in these traits lead to an increase in wage inequality.

In summary, the decomposition analysis reveals that gender differences in conscientiousness and emotional stability lead to a widening of the wage gap over time, while gender differences in extraversion lead to a narrowing of the wage gap over time.

### 2.4.3 Robustness Check

As a robustness check, we also perform the regressions and decomposition above *without* the job-related variables in  $q_i$  and  $(z_{i,t+1} - z_{i,t})$ . The motivation is that changes in job-related variables could also be attributed to the impact of personality traits. For example, an achievement-oriented person might be more likely to switch to a better-paid position than a shy person with low self-confidence. Hence, we exclude the job-related variables to get a full picture of the impact of personality traits.

We thus use a reduced form model excluding the job-related variables to perform the same regressions and decomposition as in the last subsections. The results are given in the appendix

of this paper (Tables A2.2-A2.4). From the tables it can be seen that most results are robust with respect to this alternative specification. The results with respect to personality traits from the wage growth regressions (Tables A2.2 and A2.3) are similar to those given above, both quantitatively and qualitatively. Furthermore, the decomposition results (Table A2.4) and their interpretation are also qualitatively the same as above.

## 2.5 Conclusions

This paper considered the impact of personality traits on the change of the gender wage gap. In a first step, the impact of personality traits on wage growth was analyzed. An OLS regression showed that the Big-Five personality traits conscientiousness, emotional stability and extraversion have a statistically significant impact on wage growth. Quantile regression results suggest that the impact of personality traits is strongest in the lower and higher quantiles of the conditional wage growth distribution. In a second step, a decomposition analysis of the gender differential in wage growth was performed. This analysis revealed that gender differences in conscientiousness and emotional stability lead to a widening of the wage gap over time, while gender differences in extraversion lead to a narrowing of the gender wage gap over time.

The bulk of the wage gap literature still focuses on decompositions of gender differences in wage levels. However, the dynamic development of the gender wage gap should not be neglected. In this paper we provided a dynamic assessment of the gender wage gap by investigating how personality traits affect the change of the wage gap over time. Specifically, we used the standard Oaxaca-Blinder decomposition approach for analyzing mean differences in wage growth rates. A possible extension of this work would be to consider decompositions at different quantiles of the wage distribution rather than only at the mean. Quantile decomposition methods as developed by Melly (2005) could be used for this purpose. Such an analysis might provide even deeper insights into the dynamics of the gender wage gap and thus might be a promising path for future research.

## 2.6 Appendix to Chapter 2

Table A2.1: Full Regression Results (Supplement to Table 3)

	OLS	QREG 10	QREG 25	QREG 50	QREG 75	QREG 90
Time-constant variables ( $q_i$ )						
Female	0.0018 (0.0039)	0.0244*** (0.0081)	0.0075** (0.0031)	-0.0006 (0.0017)	-0.0123*** (0.0039)	-0.0138 (0.0113)
Education	0.0033*** (0.0008)	0.0096*** (0.0014)	0.0040*** (0.0005)	0.0019*** (0.0003)	0.0011 (0.0007)	-0.0010 (0.0015)
Migration background	0.0026 (0.0051)	-0.0044 (0.0114)	-0.0021 (0.0043)	-0.0004 (0.0019)	-0.0012 (0.0051)	0.0083 (0.0099)
Full time	-0.0016 (0.0058)	0.0596*** (0.0111)	0.0138*** (0.0047)	0.0020 (0.0019)	-0.0150*** (0.0063)	-0.0485*** (0.0156)
Changes in time-varying variables ( $z_{i,t+1} - z_{i,t}$ )						
$\Delta$ Age squared	-0.0004*** (0.0001)	-0.0007*** (0.0002)	-0.0003** (0.0001)	-0.0002*** (0.0001)	-0.0004*** (0.0002)	-0.0005** (0.0003)
$\Delta$ Relationship	0.0033 (0.0100)	0.0079 (0.0141)	0.0012 (0.0063)	0.0042 (0.0056)	0.0015 (0.0096)	-0.0184 (0.0220)
$\Delta$ East	-0.0073 (0.0323)	0.0267 (0.0299)	-0.0176 (0.0147)	-0.0085 (0.0163)	0.0395 (0.0577)	-0.0044 (0.0611)
$\Delta$ Tenure	0.0070* (0.0043)	0.0278*** (0.0059)	0.0068* (0.0041)	0.0042** (0.0021)	0.0000 (0.0083)	-0.0132** (0.0066)
$\Delta$ Tenure squared	-0.0001 (0.0001)	-0.0001 (0.0003)	0.0000 (0.0001)	0.0000 (0.0001)	0.0000 (0.0001)	-0.0001 (0.0003)
$\Delta$ Public employee	0.0330 (0.0493)	0.0387 (0.0267)	0.0288 (0.0503)	0.0081 (0.0299)	0.0125 (0.0263)	0.0143 (0.0829)
$\Delta$ White collar	0.0007 (0.0088)	-0.0319 (0.0196)	-0.0108 (0.0057)	-0.0024 (0.0035)	0.0014 (0.0101)	0.0091 (0.0166)
$\Delta$ Time-limited contract	0.0002 (0.0149)	-0.0022 (0.0172)	-0.0119 (0.0075)	-0.0036 (0.0064)	-0.0020 (0.0170)	0.0213 (0.0486)
$\Delta$ Working hours	0.0090** (0.0014)	0.0052*** (0.0013)	0.0037*** (0.0008)	0.0025*** (0.0005)	0.0046** (0.0020)	0.0071*** (0.0016)
$\Delta$ Industry	0.0247 (0.0294)	-0.0678** (0.0340)	-0.0232 (0.0167)	0.0109 (0.0199)	0.0402* (0.0225)	0.1144 (0.0768)
$\Delta$ Occupation	0.0461** (0.0232)	0.0279 (0.0229)	0.0187* (0.0108)	0.0126 (0.0121)	0.0377* (0.0217)	0.0416 (0.1443)
Lower Firm Size	-0.0194 (0.0338)	-0.1833*** (0.0360)	-0.0107 (0.0243)	0.0266* (0.0154)	0.0299 (0.0249)	0.1019 (0.1365)
Larger Firm Size	0.0043 (0.0352)	-0.0697 (0.0562)	-0.0117 (0.0208)	0.0299 (0.0269)	0.0440** (0.0214)	0.1659*** (0.0534)
Personality traits ( $p_i$ )						
Locus of control	-0.0025 (0.0021)	-0.0101*** (0.0038)	-0.0067*** (0.0016)	-0.0022*** (0.0008)	0.0000 (0.0021)	0.0007 (0.0040)
Conscientiousness	-0.0043** (0.0021)	-0.0129*** (0.0031)	-0.0036** (0.0015)	-0.0014 (0.0009)	0.0011 (0.0019)	0.0036 (0.0042)
Openness	-0.0004 (0.0021)	-0.0029 (0.0040)	-0.0013 (0.0014)	0.0001 (0.0008)	-0.0006 (0.0019)	0.0052 (0.0037)
Extraversion	0.0034* (0.0020)	-0.0031 (0.0036)	-0.0018 (0.0014)	0.0000 (0.0009)	0.0049*** (0.0018)	0.0099* (0.0055)
Agreeableness	0.0007 (0.0020)	0.0007 (0.0037)	-0.0003 (0.0015)	-0.0004 (0.0008)	0.0002 (0.0020)	-0.0032 (0.0043)
Emotional stability	0.0043** (0.0019)	0.0066* (0.0037)	0.0015 (0.0017)	0.0005 (0.0008)	0.0010 (0.0018)	0.0037 (0.0038)
Positive reciprocity	-0.0025 (0.0021)	-0.0013 (0.0040)	-0.0018 (0.0015)	-0.0008 (0.0008)	-0.0022 (0.0020)	-0.0007 (0.0053)
Negative reciprocity	0.0007 (0.0021)	0.0054 (0.0034)	0.0009 (0.0017)	0.0000 (0.0008)	0.0004 (0.0020)	0.0022 (0.0044)
Year09	0.0158*** (0.0037)	0.0138* (0.0080)	0.0101*** (0.0026)	0.0120*** (0.0016)	0.0190*** (0.0038)	0.0279*** (0.0083)
Constant	-0.0135 (0.0168)	-0.2904 (0.0277)	-0.0960 (0.0124)	-0.0240*** (0.0071)	0.0890*** (0.0171)	0.2572*** (0.0290)
N	7,778	7,778	7,778	7,778	7,778	7,778

Note: Standard errors appear in parentheses. Clustered standard errors were calculated to account for possible intra-individual correlation of error terms. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. QREG X refers to a quantile regression at the X-th quantile.

Table A2.2: Wage Growth Regressions without Job-related Variables

	OLS	QREG 10	QREG 25	QREG 50	QREG 75	QREG 90
Time-constant variables ( $q_i$ )						
Female	0.0038 (0.0040)	0.0072 (0.0093)	0.0054* (0.0032)	-0.0023 (0.0015)	-0.0081** (0.0041)	0.0029 (0.0070)
Education	0.0038*** (0.0008)	0.0109*** (0.0015)	0.0044*** (0.0005)	0.0021*** (0.0003)	0.0021** (0.0009)	-0.0007 (0.0012)
Migration background	0.0026 (0.0051)	-0.0040 (0.0118)	-0.0006 (0.0045)	-0.0004 (0.0018)	0.0012 (0.0053)	0.0073 (0.0099)
Changes in time-varying variables ( $z_{i,t+1} - z_{i,t}$ )						
$\Delta$ Age squared	-0.0006*** (0.0001)	-0.0007*** (0.0003)	-0.0003*** (0.0001)	-0.0002*** (0.0001)	-0.0006*** (0.0001)	-0.0009*** (0.0002)
$\Delta$ Relationship	0.0010 (0.0101)	0.0197 (0.0253)	0.0031 (0.0065)	0.0028 (0.0051)	-0.0053 (0.0078)	-0.0231 (0.0164)
$\Delta$ East	-0.0030 (0.0312)	-0.0116 (0.0745)	0.0047 (0.0295)	0.0046 (0.0108)	0.0550*** (0.0144)	0.0301 (0.0535)
Personality traits ( $p_i$ )						
Locus of control	-0.0020 (0.0022)	-0.0086** (0.0043)	-0.0067*** (0.0018)	-0.0014* (0.0007)	0.0011 (0.0022)	0.0010 (0.0043)
Conscientiousness	-0.0044** (0.0021)	-0.0128*** (0.0043)	-0.0033** (0.0015)	-0.0013 (0.0009)	0.0024 (0.0022)	0.0045 (0.0034)
Openness	-0.0009 (0.0021)	-0.0051 (0.0043)	-0.0017 (0.0014)	-0.0002 (0.0008)	0.0002 (0.0019)	0.0077* (0.0040)
Extraversion	0.0035* (0.0020)	-0.0016 (0.0047)	-0.0012 (0.0015)	0.0004 (0.0008)	0.0052*** (0.0019)	0.0113*** (0.0036)
Agreeableness	0.0010 (0.0020)	0.0005 (0.0043)	-0.0004 (0.0016)	-0.0002 (0.0008)	0.0002 (0.0020)	-0.0035 (0.0037)
Emotional stability	0.0044** (0.0019)	0.0036 (0.0040)	0.0017 (0.0018)	0.0004 (0.0008)	0.0009 (0.0018)	0.0032 (0.0034)
Positive reciprocity	-0.0027 (0.0021)	-0.0024 (0.0041)	-0.0014 (0.0013)	-0.0007 (0.0007)	-0.0024 (0.0018)	-0.0034 (0.0039)
Negative reciprocity	0.0003 (0.0021)	0.0024 (0.0033)	0.0006 (0.0017)	-0.0003 (0.0007)	0.0003 (0.0019)	0.0013 (0.0038)
Year09	0.0168*** (0.0038)	0.0099 (0.0083)	0.0096*** (0.0027)	0.0122*** (0.0015)	0.0216*** (0.0039)	0.0377*** (0.0066)
Constant	-0.0049 (0.0148)	-0.2256*** (0.0303)	-0.0819*** (0.0111)	-0.0216*** (0.0065)	0.0746*** (0.0166)	0.2225*** (0.0259)
$R^2$	0.01	0.01	0.01	0.01	0.01	0.00
F-test (p-value)	0.05	0.00	0.01	0.46	0.04	0.00
N	7,778	7,778	7,778	7,778	7,778	7,778

Note: Standard errors appear in parentheses. Clustered standard errors were calculated to account for possible intra-individual correlation of error terms. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. The sample size in each regression is  $N = 7,778$ . QREG X refers to a quantile regression at the X-th quantile. F-test (p-value) denotes the p-value associated with an F-test of joint significance of the personality traits.

Table A2.3: Wage Growth Regressions by Gender without Job-related Variables

Variable	Male	Female
Locus of control	-0.0051** (0.0026)	0.0017 (0.0036)
Conscientiousness	-0.0018 (0.0026)	-0.0083** (0.0036)
Openness	-0.0021 (0.0027)	0.0005 (0.0032)
Extraversion	0.0033 (0.0025)	0.0037 (0.0032)
Agreeableness	-0.0021 (0.0025)	0.0052 (0.0033)
Emotional stability	0.0034 (0.0025)	0.0054* (0.0030)
Positive reciprocity	-0.0007 (0.0025)	-0.0046 (0.0034)
Negative reciprocity	-0.0008 (0.0027)	0.0016 (0.0034)
N	4,215	3,563
$R^2$	0.01	0.01
F-test (p-value)	0.24	0.08

Note: Standard errors appear in parentheses. Clustered standard errors were calculated to account for possible intra-individual correlation of error terms. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. F-test (p-value) denotes the p-value associated with an F-test of joint significance of the personality traits.

Table A2.4: Decomposition Results without Job-related Variables

<i>Total differential</i>		
Av. male wage growth	0.0051	
Av. female wage growth	0.0081	
Differential	-0.0030	
<i>Detailed decomposition</i>	Contribution	SE
<i>Explained part (differences in characteristics)</i>		
Controls	-0.0005	(0.0005)
Locus of control	-0.0001	(0.0002)
Conscientiousness	0.0008**	(0.0004)
Openness	0.0002	(0.0004)
Extraversion	-0.0010*	(0.0006)
Agreeableness	-0.0003	(0.0007)
Emotional stability	0.0017**	(0.0008)
Positive reciprocity	-0.0001	(0.0001)
Negative reciprocity	0.0001	(0.0007)
Total	0.0009	(0.0015)
<i>Unexplained part (differences in rewards)</i>		
Controls	0.0148	(0.0293)
Locus of control	0.0000	(0.0001)
Conscientiousness	0.0002	(0.0001)
Openness	-0.0001	(0.0001)
Extraversion	0.0000	(0.0001)
Agreeableness	-0.0003	(0.0002)
Emotional stability	0.0000	(0.0001)
Positive reciprocity	0.0000	(0.0000)
Negative reciprocity	0.0000	(0.0001)
Constant	-0.0186	(0.0300)
Total	-0.0038	(0.0040)

Note: Clustered standard errors were calculated to account for possible intra-individual correlation of error terms. "Controls" refers to the joint contribution of the control variables (without the constant term). "Total" refers to the total contribution of the explained and unexplained part, respectively. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively.

## CHAPTER 3

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# The Influence of Personality Traits on Private Retirement Savings in Germany

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## 3 The Influence of Personality Traits on Private Retirement Savings in Germany

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### 3.1 Introduction

This paper investigates the effect of personality traits on the saving behavior of German individuals. The focus is on private retirement savings while different types of savings are also considered that could be relevant for retirement. The 2002, 2004, 2005, 2007 and 2009 cross sections of the Socio-Economic Panel for Germany (SOEP) are used to investigate how personality traits, income, education, and other characteristics influence the decision to save for retirement. The focus on the private retirement savings is due to the demographic change and the decrease in the demographic dividend over the last decade (Góra, 2014), which is one reason for the small increases in the public pensions, which fell short behind inflation (Linderkamp and Zuchandke, 2012). This results in a change in Germany's public pension system and attendant changes in old age provision. Although the Germany's public pension system offers almost everybody a sizable retirement income, private savings for retirement or retirement insurance have increased in their significance over the past years.

Personality traits have been proven to significantly effect economic decision making. They are well established in the psychological literature and are slowly being recognized as a factor in the economic literature, especially in behavioral economics (Borghans et al., 2008, p.1035). Wichert and Pohlmeier (2010) have investigated female labor force participation in relation to the Big-Five. They have shown that personality traits play an important role in the labor force participation decision. Not only the participation decision but also career paths and earnings are influenced by personality traits with gender specific effects (Judge et al., 1999; Duckworth and Seligman, 2005; Mueller and Plug, 2006). Another potential area of economic decision making, which is likely to be influenced by personality traits, are decisions related to retirement, including everything from the allocation of assets to the amount one saves for retirement



as well as the timing of retirement itself (Hershey and Mowen, 2000; Robinson et al., 2010; Sunden and Surette, 1998). Wang and Shi (2014, p. 14) review evidence that the Big-Five influence the timing of retirement behavior and the type of retirement. A study by Blekesaune and Skirbekk (2012) shows a gender difference in a Norwegian register sample for the likelihood of disability-related retirement based on neuroticism. Brown and Taylor (2011) find effects of extraversion and openness to experience on the amount of debt as well as large inverse effects of extraversion on the amount of financial assets held. Furthermore, they do not find effects of conscientiousness and neuroticism on either debt or asset holdings. Duckworth and Weir (2010) find positive effects for conscientiousness on the amount of retirement savings by 14% per standard deviation for people living as couples with equal effects for both partners. Their estimate is in the same range as the husband's numeric ability which they identify as the largest cognitive effect. This puts the estimated effect in the same range as effects for cognitive skills that are mainly used in the investigation of retirement savings indicating the importance the non-cognitive skills can have. Going beyond the Big-Five, Cobb-Clark et al. (2013) investigate how another personality trait, the locus of control, influences the household saving behavior, which in essence relates to the ability to finance retirement consumption. They also include the personality traits and find positive effects on pension savings for agreeableness and openness to experience while the partner's measures do not seem to have an influence. Therefore, the question needs to be answered if the exclusion of the personality traits from regressions on retirement savings induces an omitted variable bias on the other coefficients implemented in the model or if they can be ignored.

This empirical analysis focuses on life and retirement savings and also investigates the effect on different saving types and net wealth. It concentrates on the retirement planning phase with individuals between 30 and 55 years of age. The main focus of this study is to adopt the models used to investigate personality in relationship to retirement savings to a German setting. The Big-Five and the locus of control are used to investigate how the traits influence the likelihood to have private retirement savings and their influence on the size of these savings.

The SOEP includes information on savings as well as several commonly used control variables. This data is used to estimate two regression models, one predicting the participation decision and the other estimating the effect of personality on the amount saved. The analysis also includes control variables for other saving types collected in the SOEP like house ownership or other financial assets. Probit estimations for the participation decision and tobit estimations are

implemented to analyze the estimated amounts in a limited dependent variable framework.

The paper is structured as follows. Section 2 will discuss the general determinants for retirement savings. Section 3 introduces the personality traits and will give an overview over the effects on the economic domain. Section 4 describes the data and gives an overview over the model specification while Section 5 will discuss the results of the analysis. Finally, Section 6 will conclude the paper.

### **3.2 General Determinants of Retirement Savings**

Besides the compulsory public pension, the German pension system has two additional pillars: the company and the private pension. The main goal of the additional pillars is to complement to the public pension which has come under increasing financial pressure due to the change in Germany's demographic structure. Caused by a high life expectancy and a low birth rate, the relation of contributors to receivers in the public pension system has deteriorated and has thereby increased the required amount of additional funds from the government. In order to balance this effect the legal retirement age and the contribution rate of the public pension system can be and has been raised. Both measures can be controlled and adjusted by the government via legislation. Other measures like increasing the labor force participation or an increase in private old age provision can only be encouraged but are not directly controllable. The labor force participation mainly depends on the world economy in general and on the German economy in particular. Hence, even the best policy can fall short of influencing the labor force participation rate. Old age provision by individuals is similarly difficult to influence by politics, since it has to change the mind-set and behavior of the individual from depending on the government for old age provision to additionally acquiring private savings for the retirement.

So far the implicit assumption has been that people put money into a fund, that is especially dedicated to retirement, on which they earn interest. Yet, there are also several other ways to ensure that a certain living standard for the retirement is accomplished. Some people may not even have special accounts that are solely dedicated to retirement but instead just have their general checking and savings accounts in which they might build up their wealth. Building and owning a house can act as a substitute for retirement savings in order to save rent. Also owning other real estates that can be rented out, can serve as a steady stream of income.

There are four general savings motives in life-cycle theory which mainly captures the old-age provision model (Modigliani, 1988). Based on this framework Carroll et al. (1992) enhance the model to include precautionary saving motives that can exist if individuals face a risky labor income path. Yet, there is mixed evidence for this extension in the literature (Caballero (1991); Carroll (1997); Gourinchas and Parker (2002); Skinner (1988); Guiso et al. (1992); Bartzsch (2008)). Fuchs-Schündeln and Schündeln (2005) consider precautionary savings in Germany arguing that former studies fail to address self-selection problems and risk attitudes. Another extension to the basic life-cycle model tries to incorporate the housing motive into the model. This extension has been analyzed by Artle and Varaiya (1978) and by Hayashi et al. (1988) who bring up the theory that in a world with down payment restraints the housing motive leads to increased savings. Empirical findings for Italian, Japanese and German data show an impact of the housing motive on the general savings and consumption pattern of younger households (Schunk, 2007). The last of the main savings motives is the bequest motive in which parents not only care about their own well being but also about that of their offspring (Hurd, 1987). Again Schunk (2007) points out that there is mixed evidence in the literature. There are difficulties discriminating between accidental and intentional bequest motives as it remains uncertain whether assets were saved for later consumption or for the offspring's benefit.

Most likely multiple of the saving motives may manifest simultaneously, making it necessary to control for possible other types of saving using multivariate regressions. The present paper uses a classical reduced form, derived from the life-cycle model. The analysis investigates the different potential saving types present in the data set and uses different specifications considering the possible sensitivity of the model in relation to possible endogeneity of measures for household wealth.

### **3.3 The Personality Traits**

The following analysis will use the psychological five factor model of personality, to account for the differences in personality of the individuals and to identify the influence of certain personality traits on the private retirement savings. In their article McCrae and Costa (1987) present a validation of the five factors which serve as one of the foundations for the application in psychological as well as economic research. The general Big-Five model postulates that the personality of an individual can be mapped onto five dimensions where each dimension contains six facets

that shape each dimension. Table 4.1 gives a short overview over the Big-Five personality traits and their respective facets.

Table 3.1: Description of the Big-Five personality traits

Big 5	Facets
Conscientiousness:	Self-Efficacy, Orderliness, Dutifulness Achievement-Striving, Self-Discipline, Cautiousness
Openness:	Imagination, Artistic Interest, Emotionality Adventurousness, Intellect, Liberalism
Extraversion:	Friendliness, Gregariousness, Assertiveness Activity Level, Excitement-Seeking, Cheerfulness
Agreeableness:	Trust, Morality, Altruism, Cooperation Modesty, Sympathy
Neuroticism/ Emotional Stability:	Anxiety, Anger, Depression, Self-Consciousness Immoderation, Vulnerability

*Source:* Wichert and Pohlmeier (2010)

Wichert and Pohlmeier (2010) generally distinguish two types of traits: "Extraversion and Agreeableness describe the inter-individual behavior, meaning that these traits describe how an individual interacts with others. On the other hand, Conscientiousness, Neuroticism, and Openness to Experience deal with the intra-individual habitude of a person. These traits characterize how an individual deals with intellectual and emotional tasks" (p. 3).

Conscientiousness "[...] represents the drive to accomplish something, and it contains the characteristics necessary in such a pursuit: being organized, systematic, efficient, practical, and steady" (Fernández-Ballesteros, 2002, p. 139). Duckworth and Weir (2010) find a positive effect of conscientiousness on pension savings for both husband and wife while Brown and Taylor (2011) find no evidence for an effect of conscientiousness on assets held or dept. Cobb-Clark et al. (2013) find evidence that conscientiousness positively effects financial wealth in general and negative effects on the real estate value and no effect on pensions. They also estimate negative effects of the partner's conscientiousness on the households net wealth at the mean and the 75th quantile. Conscientiousness shows a large overlap with general measurements of IQ, which is also suggested by the fact that Duckworth and Weir (2010) find similar effect sizes for numeracy and conscientiousness. In general we would therefore expect a positive effect on retirement savings through higher intelligence and likely a positive correlation with numeracy.

Openness to experience seems to be ambiguous and it is difficult to make an educated guess on

how it might effect retirement savings. Cobb-Clark et al. (2013) find a positive effect on pension savings but at the same time a negative effect on the real estate holdings. They also observe a negative effect of the partner's openness on the vehicle value of the household. Furthermore, they show ambiguous results for openness depending on the quantile under investigation, with negative effects for the 25th quantile and positive effects for the 75th quantile. Duckworth and Weir (2010) find positive effects of openness on both the amount of debt and asset holdings, although the effects vary somewhat by age group and change for specific saving types. Individuals attracted by constant novelty might have less clear career paths and therefore might frequently switch jobs and relocate. If they are driven and have a greater goal, this could enhance their career and also their potential earnings, but there is also the possibility that these changes are inconsequential and harmful, leaving less money to save.

“Extraversion is denoted by habitual outgoingness, venturing forth with careless confidence into the unknown, and being particularly interested in people and events in the external world. Introversion is reflected by a keen interest in one's own psyche, and often preferring to be alone” (Fernández-Ballesteros, 2002, p. 139). Brown and Taylor (2011) find positive effects of extraversion on the amount of unsecured debt and negative effects on financial asset accumulation. On the other hand neither Cobb-Clark et al. (2013) nor Duckworth and Weir (2010) find any effects for extraversion on pension savings. Yet, Cobb-Clark et al. (2013) find a negative effect on financial wealth and positive effect on real estate value. Therefore, effects for the net wealth in the mentioned direction can assumed to be found. Given the different savings investigated mixed effects with a tendency to decrease the overall savings might be observed.

Agreeableness can be defined as “[...] constructs as love and hate, solidarity, conflict, cooperation, kindness.[...] [ The desire of ] being part of a spiritual or social community” (Fernández-Ballesteros, 2002, p. 139). Cobb-Clark et al. (2013) find a positive effect of agreeableness on pensions but not on other wealth types. They find strong negative effects of the partner's Agreeableness on the overall financial wealth. Duckworth and Weir (2010) find that agreeableness of both husband and wife tend to lower savings and attribute this to the softhearted aspect of more agreeable people. Therefore, agreeableness could have positive effects on retirement savings on both ends of the scale: on the higher end through the bequest motive and on the lower end through egoistic motives. Given the effect at the extreme values of agreeableness there can be a u-shaped relationship for this trait. If there is an effect in the linear implementation, it might only be due to that fact that the positive effect at one end of the scale is even larger than the one

on the other end.

Neuroticism, sometimes referred to as Anxiety or its counterpart emotional stability, describes the way individuals are able to handle stress in general, how likely they are prone to depression or anxiety and anger as well as general vulnerability. Cobb-Clark et al. (2013) invert the scale of neuroticism to get the measure of emotional stability. The only effect that Cobb-Clark et al. (2013) find for emotional stability is a slightly positive effect on the savings rate. Besides emotional stability seems to only play a small role in household finances. If there was an effect, it could have been expected to go along the line that the more emotionally stable a person is, the better she is likely to be prepared for retirement in the economic domain and beyond, which in turn would result in higher accumulated savings.

Beyond the Big-Five there is also the locus of control (LoC) scale that describes how people react or interact with their environment. The LoC scale also shows some correlation with the Big-Five traits and is found to have a significant effect on saving decisions (Cobb-Clark et al., 2013) which is why the LoC is included in this paper.

The concept was first developed by Rotter (1966) and is widely applied within psychological research. Individuals are characterized depending on how they personally judge how much they are in control of their life and the events that happen around them. On the one end of the scale there are individuals who believe their influence on their own life is limited and that what happens to them is not caused by their decisions but is mainly the result of faith or luck. They are characterized as having an external LoC. The opposite is defined as an internal LoC. Individuals strongly believe that the events in their life are due to their own actions and their behavior. The differentiation between thinking one is in control of the circumstances versus them being predetermined is likely to have a significant effect for an individual's decision-making and saving behavior.

Schnitzlein and Stephani (2013) find that a more internal LoC leads to a significantly higher probability of being in a high wage compared to a low wage job and individuals with a more internal LoC also have a higher probability to move to a higher paid job. Caliendo et al. (2010) analyze the role of the LoC for the job search behavior of unemployed individuals. They find that having a more internal LoC is associated with higher search intensity, a higher job offer rate and a higher reservation wage. In addition, Caliendo et al. (2010) note that an internal LoC is likely related to positive labor market outcomes and economic success in general. Therefore,

positive effects on retirement savings for individuals with a more internal LoC are expected.

## 3.4 Methods and Data

### 3.4.1 Data

The SOEP, which is a representative sample of the German population collected since 1984 is the data source of this paper. The SOEP includes information on the estimated surrender value of the retirement policies as well as several other saving types. The SOEP also includes a generated variable for net wealth, combining all savings and debt information gathered in the questionnaire. The individual saving information are all collected in the following manner within the SOEP: first, "Do you have a life insurance policy or private retirement insurance policy, purchased either by you or by your employer for you?" as the binary dependent variable and second, "How high do you estimate the current cash surrender value of these policies to be?" as the continuous dependent variable. For all saving types it is first asked if an individual has assets in that category and in a follow up how high the estimated value of these assets are.

In order to obtain a larger sample for the tobit estimation (Section 3.4.2) missing values of the estimated surrender value are coded as zeros if the previous question was answered with *no*. The estimated surrender value serves as a proxy for the amount actually saved. Recoding the missing values as zeros acknowledges the fact that there are no specific savings in that category given that the individual answered with *no* in the previous question.

The way the questions are phrased poses two limitations to the investigation. The question for the binary variable does not allow to distinguish between the employer pension and private pension schemes. It also relates to both life insurance and retirement insurances. Although both can be used for general retirement savings, the motivation for a life insurance can also be non-retirement related. It is therefore not possible to state that all savings, bundled under the question, are fully retirement related. Furthermore, asked for the surrender value, some may report the amount of savings already accumulated and others might also consider the costs related to prematurely terminating the policy.

For the first time the 2005 wave and later on the 2009 wave of the SOEP has included information on the Big-Five personality traits. In 2005 and 2009 the SOEP has administered a

self-completion questionnaire of the Big-Five personality inventory. Instead of applying the Revised NEO Personality Inventory<sup>1</sup> (*NEOPI – R*) used in psychology, with 240 items, the SOEP administered a short version of the original long questionnaire for the elicitation of the Big-Five. The Big-Five Inventory Short (*BFI – S*) is a short item scale with 15 instead of 44 items using the original *BFI*-scale developed by Gerlitz and Schupp (2005). The 15 questions are phrased like “I am somebody, who ...” and can be answered on a 7 item Likert-scale with 1 as “does not apply at all” and 7 as “totally applies”. Before the addition to the SOEP questionnaire, the pretests conducted with the *BFI – S* have shown a high middle inter-item correlation between 0.28 and 0.40 and fairly high Cronbach’s  $\alpha$  coefficients<sup>2</sup> ranging between 0.51 and 0.66. Despite being below the threshold of 0.7 for being seen as sufficient, and the low number of items and the high item heterogeneity given, the *BFI-S* can be considered as being reliable nonetheless (Dehne and Schupp, 2007, p. 33). Unfortunately, the SOEP has collected the Big-Five in a 5 year interval. This paper use the average of the 2005 and 2009 Big-Five values to construct an averaged Big-Five measure that is used to analyze the 2007 cross-section wealth information of the SOEP.

Additionally, a measure for the locus of control is also included. It came into the focus as a psychological factor impacting economic decision making in a paper by Cobb-Clark and Tan (2011). Similar to the Big-Five the question pertaining to locus of control is also measured on a 7 item Likert-scale. This paper applies the coding suggested by Schnitzlein and Stephani (2013) who use the SOEP data as well. They implement a measure of 3 internal locus of control questions and 4 external locus of control questions that are combined in a single index from 1 to 7, with 1 indicating a more external locus and 7 as indicating a more internal locus<sup>3</sup>.

The final sample has 2760 observations. For the sample individuals who work as farmers, participating in military service or alternative military service, people in apprenticeship training, attend school or pensioners have been excluded. Besides that, the sample is limited to individuals between 30 and 55 years of age. This is done to avoid changing personality traits for younger and older individuals as found by Specht et al. (2011) and Cobb-Clark and Schurer (2012). Additionally the age span starts when individuals are most likely to start planning for retirement and ends before the major part of the population might start cashing in their retire-

<sup>1</sup>For further information see McCrae and Costa Jr (2010).

<sup>2</sup>Cronbach’s  $\alpha$  is a coefficient of internal consistency of a scale and it is commonly used as an estimate of the reliability of psychometric tests.

<sup>3</sup>A list with the questions can be found in Table A3.2 in the appendix.



ment savings. As mentioned above there are several ways to save for retirement. Therefore, control variables for other investment objects like housing related savings which includes owning a house or having a building loan contract have been included. Additionally, a control for other savings which includes having other tangible assets, owning other real estates or having other types of savings not directly dedicated to retirement has been implemented. Similar to the retirement savings variables there is a binary and a continuous variable reporting the individual participation decision and the estimated values of the savings for the other saving types. All of these continuous variables face the problem that their question in the questionnaire asks for the estimated amount of these savings, i.e. the values are not the precise asset values.

For the model central controls discussed in Lusardi (1998) like gender, age, schooling, the number of kids, being a state employee, being self employed, dummy for former east and west Germany, being a couple, migration background, cumulative work experience as well as unemployment and income on the individual and household level are used. The control variables are included in the estimation as follows. The logarithms of the individual net income and the combined net household income are included to control for income effects. Education is included as a continuous variable counting the years of education the person has acquired. The number of kids per individual which could effect savings through the bequest motive are also added. Moreover, work experience is included as a combination of years of part time work multiplied by 0.5 and full time work. Unemployment is coded in a similar way with the total number of months a person has experienced unemployment until 2007. Both variables influence the amount an individual receives from the public pension scheme. This in return influences the necessity to acquire private pension savings but also reduces the possibility of the individual to acquire such savings. The relationship indicator "couple" takes the value of 1 for individuals who are either married or have a partner and zero otherwise. Additional controls include variables that might indicate the attitude towards retirement. Smoking is included since the risks of smoking are well known and therefore it can be assumed that the choice to smoke indicates time preference with a present day orientation putting a higher value on present consumption than on future risks, like an early death. The variable for the responsibility of old age provision is based on the question: "Who do you think has to take care of the financial provision during retirement?" with a scale from one to five. One indicates that the government should provide all of the funds, while five indicates that the individual has to take care of it on her own. Additionally, a dummy coded variable is included which indicates if the individual expects possible future inheritance

taking the value one if that is the case and zero otherwise. Henceforth, if people expect future windfall gains they might save less than optimal due to their expectations. The question here is not if the windfall gains are later realized because the pure expectation is likely to change the savings behavior. As the last variable that might have an influence on the attitude towards retirement a measure for financial risk aversion is included. It is based on the question of how risk averse the individual judges herself to be on a scale from zero to ten with zero indicating high risk aversion and ten as being fully prepared to take risks. The interested reader is referred to the appendix for the table with the descriptive statistics of the control variables.

### 3.4.2 Method

The econometric analysis is started by estimating a standard ordinary least squares regression for net wealth as the dependent variable of the form,

$$y_i = P_i' \beta + x_i' \beta + u_i \quad i = 1, \dots, N$$

where  $u_i = N(0, \sigma^2)$ , and  $P_i$  denotes the  $(J \times 1)$  vector of the personality traits and  $x_i$  the  $(K \times 1)$  vector for exogenous and fully observed regressors.

Furthermore, two other types of dependent variables are considered. The first dependent variable is binary with a value of one if an individual has a certain type of savings and zero otherwise. The second dependent variable is the estimated surrender or resale value of a certain savings type. This second variable is censored at zero, since the estimated surrender or resale value cannot be negative. This paper uses a probit model for the binary dependent variable and a tobit model for the censored dependent variable. Both the probit and tobit model can be represented in a latent dependent variable framework.

Following Cameron and Trivedi (2009) the analysis assumes the following underlying latent variable model, with  $y_i^*$  being the probability to have a certain savings type, determined by

$$y_i^* = P_i' \beta + x_i' \beta + u_i, \quad i = 1, \dots, N$$

Although  $y^*$  is not observed the data gives

$$y = \begin{cases} 1 & \text{if } y^* > 0 \\ 0 & \text{if } y^* \leq 0 \end{cases}$$

Given the models specified above, there is

$$\begin{aligned} Pr(y = 1) &= Pr(P'\beta + x'\beta + u > 0) \\ &= Pr(-u < P'\beta + x'\beta) \\ &= F(P'\beta + x'\beta + u) \end{aligned}$$

where  $F(\cdot)$  is the c.d.f. of  $-u$ . In the probit case  $u$  is standard normally distributed. For the identification of the latent-variable model its scale is fixed by placing a restriction on the variance of  $u$ . Therefore,  $\beta/\sigma$  can only identify, with  $\sigma$  as the standard deviation for  $u$ .

Based on Cameron and Trivedi (2009) the tobit model regression of interest is also specified as an unobserved latent variable  $y^*$ . The estimated surrender value is given by

$$y_i^* = P_i'\beta + x_i'\beta + u_i, \quad i = 1, \dots, N$$

As in the probit case the observed variable  $y_i$  is related to the latent variable  $y_i^*$  through the observation rule with the lower bound  $L$

$$y = \begin{cases} 1 & \text{if } y^* > L \\ 0 & \text{if } y^* \leq L \end{cases}$$

The censored mean is determined by

$$E(y_i | x_i, y_i > L) = x_i'\beta + \sigma \frac{\phi\{(x_i'\beta - L)/\sigma\}}{\Phi\{(L - x_i'\beta)/\sigma\}}.$$

$x_i'\beta$  now includes the personality traits to simplify the notation,  $\phi(\cdot)$  is the standard normal density function and  $\Phi(\cdot)$  is the cumulative distribution function. The parameters of both models can be conveniently estimated by maximum likelihood, with log-likelihood functions given by

$$\log L_{probit}^1 = \sum_{i=1}^n y_i \log \Phi(x_i'\beta) + (1 - y_i) \log(1 - \Phi(x_i'\beta))$$

and

$$\log L_{Tobit}^2 = \sum_{y_i=0} \log \left[ 1 - \Phi \left( \frac{x_i' \beta}{\sigma} \right) \right] + \sum_{y_i>0} \log \left[ \frac{1}{\sigma} \phi \left( \frac{y_i - x_i' \beta}{\sigma} \right) \right]$$

where  $\Phi(\cdot)$  is the cumulative distribution function of the standard normal distribution,  $\phi(\cdot)$  is the corresponding standard normal density function, and  $x_i' \beta$  denoting all explanatory variables. After the estimation average marginal effects are calculated for the probit and tobit model which are reported in the tables below.

## 3.5 Results

### 3.5.1 Descriptive Statistics

Table 3.2 shows the mean, standard deviation, median as well as the minimum and maximum values. The average individual in our sample has a net wealth of €74,378. The gross wealth is split into €105,454 of house related savings, the second place takes other savings with an average value of €39,271 followed by the surrender value for the life and retirement policy with €9,847. All reported values are the sample averages also including the zeros in each category. All the reported dependent variables show a high variance as can be seen from the minimum and maximum values. The standard deviations are larger than the sample averages for all dependent variables.

Table 3.2: Descriptive Statistics for Net Wealth and Savings Types

	Mean	SD	Median	Min	Max
House	105,474.93	(142,171.09)	11,000	0	1,500,000
Other Savings	39,270.56	(157,089.89)	2,000	0	3,150,000
Life/ Retirement Policy	9,846.53	(22,202.87)	2,000	0	350,000
Net Wealth	74,377.90	(160,849.60)	30000	-1,000,000	3,221,500

Note: Numbers of observation: 2,760. House: Surrender value of a building loan contract and the estimate value of owner occupied housing. Other savings: Business ventures, tangible assets, other housing/property and other savings. Life/ Retirement Policy: Estimated surrender value of the policy held privately or by the employer. Source: SOEP 2007

Figure 3.1 offers a quick view of the participation rates.

The most common type are the house related savings. 63 % of the individuals have either a building loan contract or own a house. Interesting to note is a switch related to housing and building loan contracts between the young and old individuals. A building loan contract is a

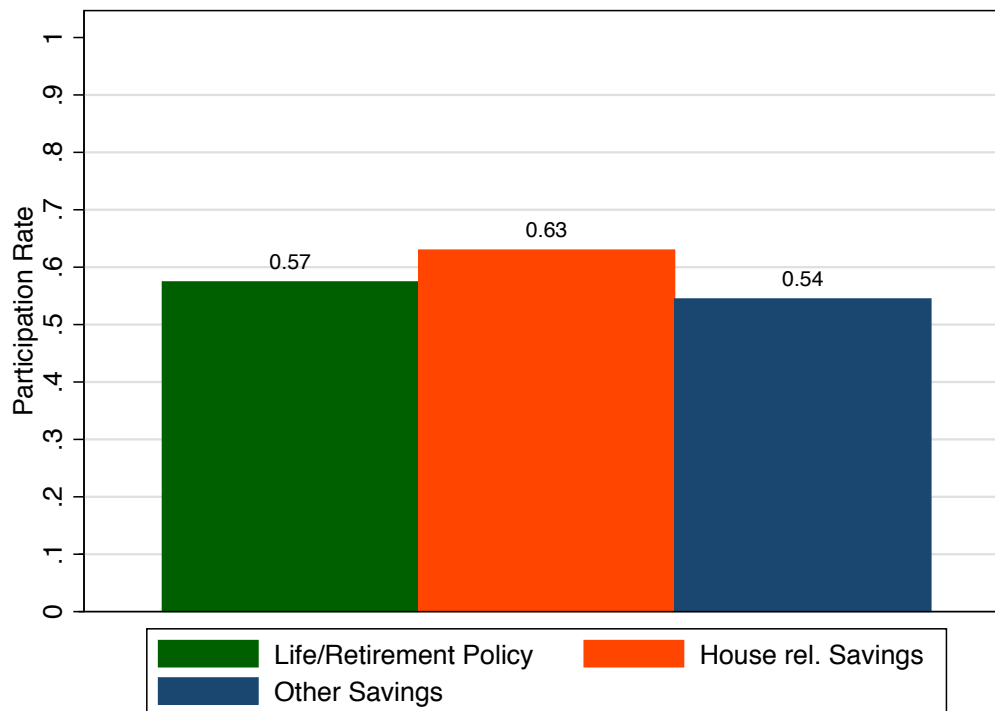


Figure 3.1: Participation Rate for the Different Saving Types

Source: SOEP 2007 with 2,760 numbers of observation

more common savings type for young adults followed by house ownership. This relationship turns around for older adults when house ownership overtakes building loan contracts, indicating that the contracts used as savings vehicles are later converted to actually build or buy a house. The second most common type of savings are life and retirement policies with 57 % of the individuals reporting to have a private or employer based life and retirement policy. 54% of the individuals report to have other types of savings.

The savings decision over the different personality traits are similar for the higher trait values and the ones close to the mean. Larger deviations from the overall mean can only be observed for the lower values of the personality traits (Figure A3.1 in the appendix). This is most likely due to the low number of observations in these categories. The distribution of observations over the different categories of the personality traits is mostly skewed to the right for all traits. This is most pronounced for conscientiousness which has the highest number of observations in the last category and no observations in the first and only two observations in the second category. This changes for agreeableness and extraversion with the most observations in category 5, while openness to experience and emotional stability show a bell shaped distribution with the largest numbers of observation split between 3 and 4. All the traits have a tendency for higher scores.

Note that emotional stability is the inverted scale of neuroticism.

Table 3.3 displays the mean and standard deviations for the averaged personality traits of the 2005 and 2009 waves. The regression analyses use the standardized values with a mean of zero and a standard deviation of one. The standard deviations for the non-standardized trait measures range between 0.7 and 1. This means a one standard deviation change approximately results in a change of one on the actual trait scale.

Table 3.3: Descriptive Statistics for the Personality Traits

	Mean	SD	Min	Max
Conscientiousness	5.992	(0.729)	2.833	7
Openness	4.430	(1.034)	1.000	7
Extraversion	4.810	(1.000)	1.167	7
Agreeableness	5.356	(0.847)	1.667	7
Emotional Stability	4.176	(1.060)	1.000	7
Locus of Control	4.792	(0.744)	1.000	6.857

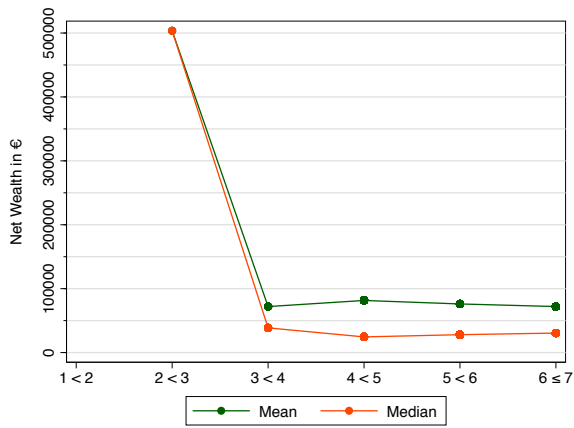
Note: Numbers of observation: 2760. Individual Big 5 measures are the average of the 3 question per trait included in the *SOEP* averaged over the wave 2005 and 2009. Individual Locus of Control measures are the average of 7 questions included in the *SOEP* in 2007 following Schnitzlein and Stephani (2013). Source: *SOEP* 2005,2007 and 2009

The descriptive statistics for the control variables can be found in Table A3.1 in the appendix.

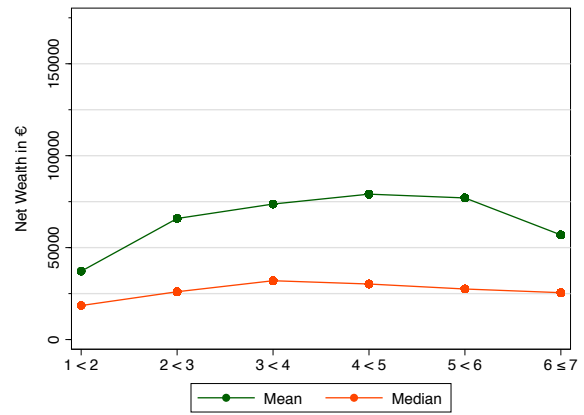
### 3.5.2 Net Wealth and Saving Types over Personality Traits

Figure 3.2 shows an increase in net wealth for emotional stability and locus of control while there seems to be an inverted u-shape pattern in the openness to experience categories. In Figure 3.3b the inverted u-shape relationship observed for net-wealth and openness to experience is prevalent for the three types of savings, although less pronounced for the surrender value of the life and retirement policies. The increasing relationship for emotional stability and locus of control can also be observed for the saving types. There are no clear trends or patterns for conscientiousness, extraversion and agreeableness. Figure 3.2 shows the mean values of net wealth for the different categories of the personality traits.

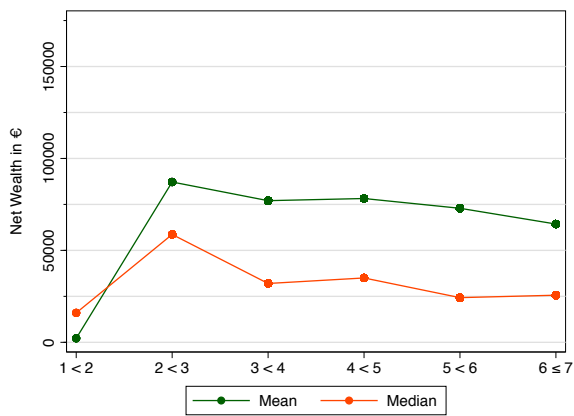
In case of conscientiousness there are no observations in the lowest category and only 2 in the second lowest. The fact that one of the two observations in this category is an relative outlier results in a different scale for Figure 3.2a and all following sub figures of conscientiousness. Within each category over all traits there is a left skewed distribution for net wealth indicated



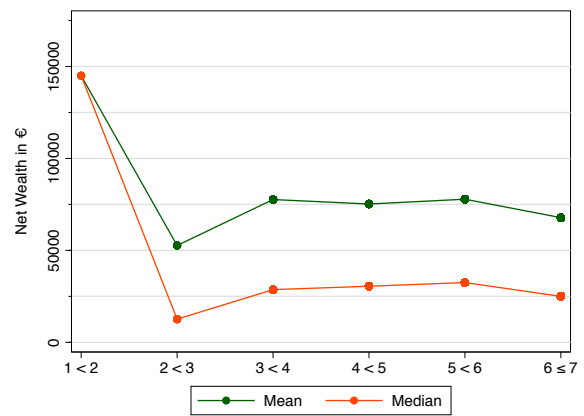
(a) Conscientiousness



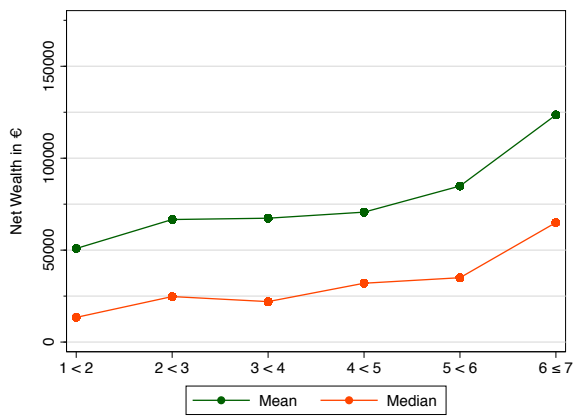
(b) Openness to Experience



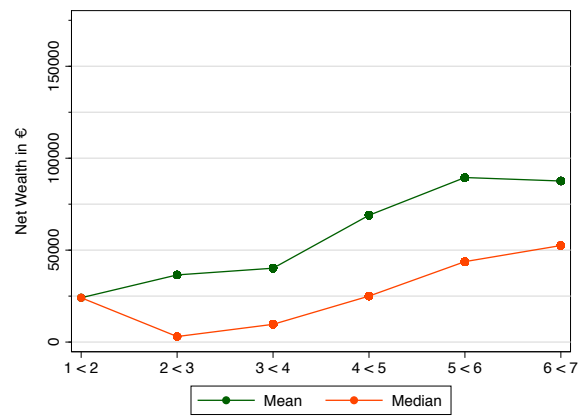
(c) Extraversion



(d) Agreeableness



(e) Emotional Stability



(f) Locus of Control

Note: The x-axis has 6 categories which are coded for one equals everything from 1 to below 2, two from 2 to below 3, and so forth for the other categories while six as the last category is coded as 6 and above including 7.  
 Source: SOEP 2007 with 2760 observations.

Figure 3.2: Mean Net Wealth over the Personality Traits

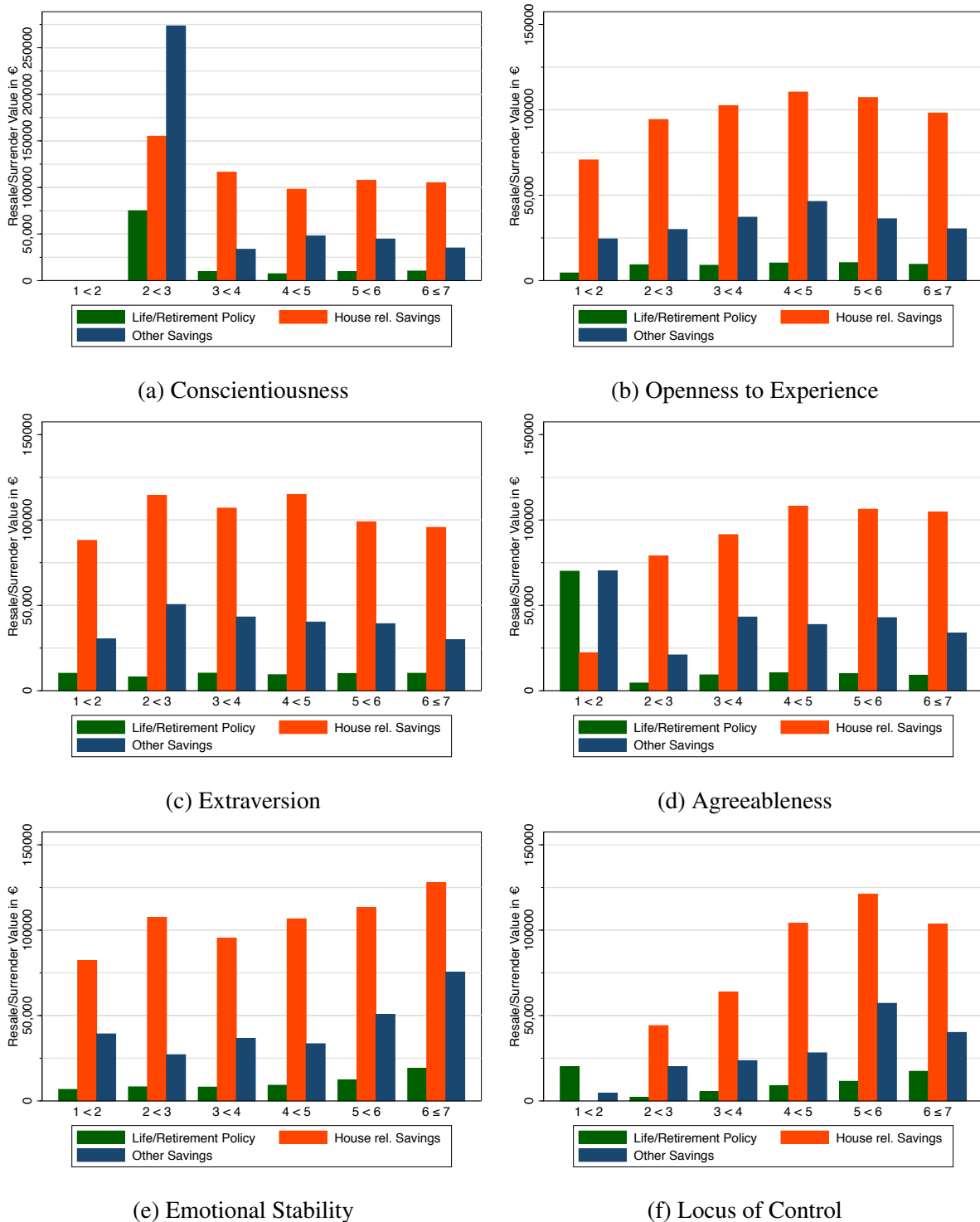
by the fact that the median is always below the mean. This mirrors the distribution of incomes usually observed for the general population. Although there is some variation over the different traits only three seem to indicate some kind of pattern. For openness to experience the net

wealth is highest for moderate values and seems to fall at the upper and lower end of the scale, while an increasing pattern for emotional stability and locus of control can be observed. The more emotional stable an individual is or the more she feels she has control over her life, the higher the net wealth. The other traits show no clear pattern besides some large deviations from the norm in the lower categories which is due to the low number of observations in these categories.

For emotional stability it makes sense that a more settled and stable person is able to acquire more wealth than a neurotic person who is less self-conscious, more prone to depressions and might have anxieties. All of the facets that characterize emotional stability have a negative loading. Therefore, having less of everything is better in this case. It is also sensible that individuals who feel more in control of their life have a higher net wealth compared to individuals who think that everything is predetermined or beyond their control. Looking at the facets for openness to experience the picture looks different. Besides intellect for which one would assume more is better, all facets are likely to be most desirable on a middle level. Both for a general career path perspective as well as for regular social interactions the total lack of emotions or imagination is just as undesirable as the opposite. There are likely to be exceptions at the extremes but over the full population a good mixture of the facets seems to optimize net wealth. The mean values for the different saving types over trait categories are shown in Figure 3.3.

Conscientiousness, agreeableness and extraversion show no clear pattern. Only for extraversion and house related saving an increase over the first four categories with an approximately similar value for the last two categories can be observed. The saving types and openness to experience, although less pronounced for the surrender value of the life and retirement policies, have a similar u-shape relationship. There is an increasing trend for the mean values and the level of emotional stability. Although the trend is not monotone it could be argued that more stable individuals also have more assets. In case of locus of control there is also a similar increasing trend. For high internal locus of control values the levels of house related savings and other savings show a lower value. It is also notable that individuals with an external locus of control have hardly any assets. The assets they do have are attributable to life and retirement policies which have a similar level as for the individuals with an internal locus of control. Due to a drastic change from category one to two this can also be a small sample issue like in the other low categories. Figure A3.2 in the appendix shows stacked bar graphs to give an overview over all savings confirming the discussed patterns. Figure A3.3 in the appendix only plots the life





Note: The x-axis has 6 categories which are coded for one equals everything from 1 to below 2, two from 2 to below 3, and so forth for the other categories while six as the last category is coded as 6 and above including 7.  
 Source: SOEP 2007 with 2760 observations.

Figure 3.3: Surrender Value of the Saving Types over Personality Traits

and retirement values for a closer inspection.

The patterns seem to fit the results discussed in the literature. For instance the consistent pattern for emotional stability and locus of control indicate that there might be a significant effect on

the saving decision. To see if these patterns translate into statistically significant effects a probit regression to investigate the participation decision for the savings types is estimated before using a tobit regression to estimate the effects of the personality traits on the amount of savings.

### 3.5.3 Allocation of Savings - Probit Estimates

Given the patterns observed in the figures and the significant estimated effects differentiated effects of personality on the allocation of savings can be observed. The effects vary with each savings type, indicating that there are different mechanisms at play for each type of savings. Taken the effects found and focusing on the life and retirement policies individuals that score on the upper end of the scale of extraversion have a higher probability to have such a policy. Yet it reduces the likelihood to have house related savings. At the same time there is a negative effect of agreeableness on the likelihood to have a life and retirement policy while conscientiousness increases likelihood to have other savings.

For the probit model the response to the question: "Do you have a [insert savings type]?" is used. The individuals had the possibility to answer with either *yes* or *no*. The binary response variable is used as the dependent variable in the following models. Table 3.4 shows the average marginal effects for the probit model for the different saving types<sup>4</sup>. Given the small variation observed for the participation rates based on the graphs rather small effects if some at all can be expected. The F-Test for the joint significance of the personality traits does not reject the null hypothesis of all traits being equal to zero. The only significant effects on having a life and retirement policy can be found for extraversion and agreeableness. Having a higher level of extraversion increases the likelihood to have such a policy by 1.9 percentage points per standard deviation. Therefore, the difference is around 11.1 percentage points from the lowest trait score to the highest<sup>5</sup>. Being more agreeable decreases the likelihood to have a policy by 1.6 percentage points per standard deviation amounting to a total difference of around 10.6 percentage points.

For house related savings higher levels of extraversion decrease the likelihood to have such savings by 1.8 percentage points (10.7 in total). No other trait seems to have a significant impact on house related savings. The only trait that has an impact on other savings is conscientiousness with higher levels of this trait increasing the likelihood to have other savings by 2.4 percentage

<sup>4</sup>The full regression results can be found in the appendix in Table A3.3.

<sup>5</sup>The total difference is calculated by the difference between the maximum and minimum values for each trait divided by the standard deviation times the average marginal effect.

Table 3.4: Average Marginal Effects for the Probit Regression

Variable	RS	HS	OS
Conscientiousness	0.0014 (0.0098)	0.0066 (0.0094)	0.0243*** (0.0093)
Openness	-0.0081 (0.0098)	0.0077 (0.0095)	-0.0048 (0.0095)
Extraversion	0.0191* (0.0098)	-0.0185* (0.0095)	-0.0126 (0.0096)
Agreeableness	-0.0168* (0.0097)	0.0096 (0.0093)	-0.0101 (0.0091)
Emotional stability	-0.0014 (0.0096)	-0.0043 (0.0093)	-0.0042 (0.0093)
LoC	0.0095 (0.0096)	0.0066 (0.0094)	-0.0004 (0.0090)
N	2760	2760	2760
F-test (p-value)	0.24	0.36	0.16

Note: RS: Life/retirement policies; HS: House related savings; OS: Other savings. Standard errors appear in parentheses. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. F-test (p-value) denotes the p-value associated with an F-test of joint significance of the personality traits. Source: Own estimations based on *SOEP* 2002, 2004, 2005, 2007 and 2009

points for each standard deviation. Therefore, the total difference from the lowest trait score to the highest is around 13.9 percentage points.

It could be the case that the more extroverted individuals talk more about money and in return might also get or seek better financial advice. This could lead to the fact that they decrease their house related savings, which might yield lower returns, and invest instead into better saving types like life and retirement policies. Although there is an increasing trend for almost all saving types, there are no significantly estimated effects for emotional stability and locus of control. The general positive effect of conscientiousness on having other savings aligns with the findings by Duckworth and Seligman (2005) and Cobb-Clark et al. (2013).

### 3.5.4 Effects on the Amount of Savings - Tobit Estimates

There are positive effects of extraversion and locus of control and negative effects of agreeableness on retirement related savings. As people get more extroverted they also decrease their house related savings. Locus of control also has a positive impact on net wealth and in contrast openness to experience decreases net wealth. These results indicate that the personality traits

effect the amount of savings and the allocation to certain saving types.

For the tobit model the followup question to the one used for the probit model is used. Therefore, after the individuals have been asked about their ownership of certain kinds of savings they are asked about the estimated amount or surrender value of the savings they own. One issue is that some answer the first question with *no* and still answer the followup question reporting a zero. Others skipped the estimated value question leaving a missing value in the data. I coded everyone who answers the first question with *no* as having a value of zero for the estimated amount of that savings type. In doing so the available information which is carried by the answer *no* is used. The individual has no investments or savings in that category and instead of dropping the observation due to the "does not apply"-value in the data the zero coding preserves that information. In order to handle the large amount of zero records in the data a left censored tobit model is used for the estimation. Furthermore, the same model specifications for the probit model are applied. The average marginal effects for the tobit estimations are reported in Table 3.5. Additionally to the tobit estimations for the saving types a standard ordinary least squares regression for net wealth as dependent variable permits negative values and thereby does not suffer from the truncation restrictions.

Table 3.5: Average Marginal Effects for the Tobit Regression

Variable	Tobit			OLS
	RS	HS	OS	NW
Conscientiousness	398.02 (329.80)	1718.89 (2438.62)	481.92 (1976.29)	-1599.02 (3662.51)
Openness	-210.77 (334.82)	1176.50 (2471.66)	-1799.18 (2013.20)	-5956.50** (2838.17)
Extraversion	580.60* (333.53)	-5259.64** (2464.14)	-2270.41 (1995.22)	-787.25 (3267.68)
Agreeableness	-692.95** (324.77)	2632.36 (2411.50)	-1087.53 (1961.01)	-1742.96 (3115.80)
Emotional stability	323.46 (327.39)	-388.28 (2413.64)	-248.77 (1976.22)	1441.01 (3515.87)
LoC	808.85** (330.43)	2003.25 (2458.30)	1305.59 (1993.08)	3900.45* (2316.59)
N	2760	2760	2760	2760
F-test (p-value)	0.00	0.29	0.68	0.05

Note: RS: Life/retirement policies; HS: House related savings; OS: Other savings. Standard errors appear in parentheses. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. F-test (p-value) denotes the p-value associated with an F-test of joint significance of the personality traits. Source: Own estimations based on *SOEP* 2002, 2004, 2005, 2007 and 2009

Looking at the average marginal effects for the tobit estimates one can see that all significant estimates show the same direction as in the probit model. Furthermore, the personality variables are jointly significant for the estimates on the surrender value of the life and retirement policies and for the net wealth estimates. A one standard deviation increase in extraversion raises the estimated surrender value by € 580.60 and a one standard deviation increase in agreeableness decreases the estimated surrender value by € 692.95. The total differences over the full trait scales are € 3,386.64 for extraversion and € 4,363.05 for agreeableness. Additional to the significant estimates in the probit model there is also a significant effect of locus of control on the estimated surrender value of the life and retirement policies. An increase of one standard deviation on the locus of control scale increases the estimated value by € 808.85 indicating a total difference between an individual with an external locus of control and an internal locus of control of € 6,367.52.

As in the probit model extraversion is estimated to have a negative impact. It decreases house related savings by € 5,259.64 with each standard deviation increase up to a total difference of € 30,679.48. Therefore, as one moves along the extraversion scale the individuals seem to substitute house related savings with life and retirement policies although on different levels. Again, if more extroverted individuals get more into contact with other people they also might be aware of different investment decisions. In this case investing more money in specific old age provision. There seems to be no significant effect of personality on other savings but openness to experience and locus of control significantly effect net wealth. Openness decreases the net wealth by € 5,956.50 for each standard deviation increase and locus of control increases the net wealth by € 3,900.45 for each standard deviation move from an external focus to an internal focus. The total difference amounts to € 52,433.33 and € 30,705.56 respectively. Given that openness to experience has no impact on the saving types and given the negative effect on net wealth the effect is most likely related to its effect on debt as discussed by Brown and Taylor (2011).

### 3.5.5 Non-Linear Effects

In order to also check for possible non-linear effects of the personality traits additional dummy variables have been generated for each trait. This is done by splitting the full scale into three different parts based on the mean values and standard deviations for each trait. The base or

middle category is then defined via as mean +/- one standard deviation. The low category includes everything below the threshold and the higher category includes everything above the threshold of the base category. The results for the probit estimates are presented in Table 3.6

Table 3.6: Average Marginal Effects for the Probit Regression - Dummies

Variable	RS	HS	OS
Low Conscientiousness	-0.0324 (0.0250)	0.0236 (0.0244)	-0.0210 (0.0243)
High Conscientiousness	-0.0286 (0.0254)	0.0041 (0.0247)	0.0409* (0.0243)
Low Openness	-0.0116 (0.0244)	-0.0444* (0.0239)	0.0146 (0.0235)
High Openness	-0.0020 (0.0246)	-0.0186 (0.0238)	-0.0117 (0.0244)
Low Extraversion	-0.0278 (0.0259)	0.0308 (0.0258)	0.0280 (0.0251)
High Extraversion	0.0146 (0.0238)	-0.0196 (0.0227)	0.0044 (0.0235)
Low Agreeableness	0.0638*** (0.0235)	-0.0177 (0.0228)	-0.0214 (0.0222)
High Agreeableness	-0.0087 (0.0262)	0.0321 (0.0258)	-0.0278 (0.0254)
Low Emotional stability	0.0049 (0.0252)	0.0437* (0.0245)	-0.0013 (0.0246)
High Emotional stability	0.0146 (0.0258)	0.0214 (0.0251)	-0.0067 (0.0246)
External LoC	-0.0378 (0.0243)	-0.0391* (0.0237)	0.0228 (0.0237)
Internal LoC	-0.0027 (0.0242)	-0.0128 (0.0233)	0.0085 (0.0228)
N	2760	2760	2760
F-test (p-value)	0.27	0.21	0.78

Note: RS: Life/retirement policies; HS: House related savings; OS: Other savings. Standard errors appear in parentheses. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. F-test (p-value) denotes the p-value associated with an F-test of joint significance of the personality traits. Source: Own estimations based on *SOEP* 2002, 2004, 2005, 2007 and 2009

To indicate non-linear relationships in a u-shape or inverted u-shape, the included low and high category dummies would need to be simultaneously significant in the estimation. Table 3.6 shows no instance of such a relationship for the participation decision. For the retirement savings only the low dummy for agreeableness is estimated to be significant with an average marginal effect of 6.38 percentage points increase in the likelihood to have such a policy if one falls into that low category. For the other saving types there are negative effects of low openness

to experience and an external locus of control, and a positive effect for low emotional stability on house related savings. Additionally there is a positive effect of high conscientiousness on other savings. Table 3.7 reports the average marginal effects for the tobit estimations.

Table 3.7: Average Marginal Effects for the Tobit Regression - Dummies

Variable	Tobit			OLS
	RS	HS	OS	NW
Low Conscientiousness	-2004.74** (849.96)	232.14 (6258.90)	-7043.97 (5093.44)	-5819.05 (8811.03)
High Conscientiousness	-702.86 (884.28)	396.62 (6498.47)	-2883.09 (5308.94)	-5547.76 (6237.69)
Low Openness	-445.86 (844.65)	-7733.98 (6242.72)	4729.41 (5112.05)	7624.01 (8029.47)
High Openness	-283.80 (832.06)	-5784.00 (6199.55)	-3334.47 (4948.33)	-12600.16 (8485.35)
Low Extraversion	-1179.95 (889.30)	666.22 (6509.06)	2008.18 (5272.91)	-7567.27 (7474.94)
High Extraversion	633.51 (808.51)	-10779.92* (6054.76)	-398.59 (4885.82)	-2255.37 (9120.10)
Low Agreeableness	1831.11** (781.03)	-1408.69 (5880.53)	-1231.18 (4786.64)	6603.64 (9278.42)
High Agreeableness	-812.09 (918.24)	4646.69 (6655.22)	-5841.81 (5516.00)	-7487.49 (6403.63)
Low Emotional stability	989.63 (873.52)	10721.63* (6375.60)	6133.33 (5238.93)	14335.23 (9010.09)
High Emotional stability	2620.00*** (844.24)	5297.88 (6331.42)	3508.60 (5108.23)	14261.18 (9230.64)
External LoC	-2259.21** (883.26)	-15016.03** (6471.03)	1665.00 (5313.45)	-12035.03** (5328.90)
Internal LoC	-383.74 (797.88)	-4507.74 (5957.59)	-1452.97 (4795.20)	-5390.52 (8236.40)
N	2760	2760	2760	2760
F-test (p-value)	0.00	0.27	0.86	0.18

Note: RS: Life/retirement policies; HS: House related savings; OS: Other savings. Standard errors appear in parentheses. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. F-test (p-value) denotes the p-value associated with an F-test of joint significance of the personality traits. Source: Own estimations based on *SOEP* 2002, 2004, 2005, 2007 and 2009

Again there is no instance where both dummy variables are jointly significant but there are some interesting results. First of all there is a negative effect of low values of conscientiousness and a positive effect of high values of emotional stability on the estimated surrender value of the life and retirement policy. This confirms the trends which can be observed in Figure 3.3e. Both traits are not estimated to have a significant impact in the continuous implementation of the

traits indicating a larger effect as one deviates further from the average. The positive effect of a low agreeableness and the negative effect of an external locus of control confirm the effects estimated above. Only extraversion which is significant in the continuous implementation shows no effect for the dummy implementation.

For house related savings the estimates confirm a negative effect of high values of extraversion. Additionally, the positive effect found for low values of emotional stability on the likelihood to have house related savings also positively affects the estimated amount of these savings. Furthermore, there is a negative effect of an external locus of control on the estimated amount of house related savings. Again there are no significant estimates for other savings and for net wealth only an external locus of control has a negative impact.

### 3.5.6 Robustness Check

In order to check how sensitive the estimates are to different specifications Table 3.8 reports the average marginal effects for the personality traits with variations in the added control variables. The full results can be found in the appendix.

The estimates for agreeableness and locus of control are significant in all specifications and only decrease in size as more control variables are added. The coefficient for extraversion only becomes significant as the controls for other saving types are added. It is insignificant in all previous specifications. Emotional stability is only estimated to be significant in the first two specifications. As more controls are added the effect decreases at first in size and then becomes insignificant from specification M3 onward. Also in specification M2, which only contains the general controls, there is a significant effect of conscientiousness but no insignificant effect in all other specifications. Therefore, the effect of extraversion on life and retirement savings could be debatable and is open to more research. The effects of agreeableness and locus of control are consistently estimated with all specifications.

Omitting the personality traits in specification M6 slightly increases the AIC value but also changes the size of the average marginal effects for some of the control variables. The effects of having a migration background or being self employed increase in the specification without the personality traits. The same holds true for the effects of the income variables and the attitude about who should take care of old age provision. Without the personality traits the coefficients



Table 3.8: Model Selection based on Life/Retirement as Dependent Variable

	M1	M2	M3	M4	M5	M6
Conscientiousness	190.57 (347.09)	593.30* (339.43)	410.37 (330.69)	531.64 (331.39)	398.02 (329.80)	-
Openness	500.37 (351.12)	-14.26 (345.37)	-183.45 (337.91)	-203.59 (336.84)	-210.77 (334.82)	-
Extraversion	-233.34 (353.67)	494.06 (342.87)	432.25 (334.51)	484.42 (335.26)	580.60 * (333.53)	-
Agreeableness	-1669.58** (343.50)	-1299.14** (333.06)	-727.52** (327.00)	-704.10** (326.73)	-692.95 ** (324.77)	-
Emotional Stability	1571.39 *** (339.40)	614.49* (337.97)	346.96 (329.20)	291.37 (329.42)	323.46 (327.39)	-
Locus of Control	1994.86 *** (346.41)	1667.41*** (336.00)	962.91*** (331.91)	808.83** (332.17)	808.85** (330.43)	-
General Controls	-	X	X	X	X	X
Labor Controls	-	-	X	X	X	X
Attitude	-	-	-	X	X	X
Savings Controls	-	-	-	-	X	X
N	2760.00	2760.00	2760.00	2760.00	2760.00	2760.00
AIC	38300.20	38087.03	37924.14	37909.63	37866.46	37872.72

Note: Numbers of observation: 2760. General: female, age, education, number of kids, east, couple, migration. Labor: self employed, public sector, work experience, unemployment spell, log net income, log household income. Attitude: smoking, responsibility for old age provision, expected inheritance, financial risk taking. Saving: house related savings , other savings. Source: *SOEP* 2002, 2004, 2005, 2007 and 2009

for unemployment spells is estimated to have a significant impact. Therefore, estimating without personality traits introduces additional omitted variable bias.

### 3.6 Conclusion

This paper gives insight to the question if the money people save for retirement is influenced by their personality traits. Expanding the understanding of preference heterogeneity, and consequently of the heterogeneity of individual's temporal decision making is important to fully comprehend how and why people save for retirement. More accurate data about the actual amounts saved can lead to more precise estimations.

A personality type that is likely to have more retirement savings than the average individual can be constructed. This individual would be characterized by an average to high level of conscientiousness being striving for achievement, orderly and self disciplined. High levels of extraversion

sion as in being assertive and friendly as well as low levels of agreeableness meaning lower than average levels of altruism, sympathy and modesty lead to higher savings for retirement. Additionally high levels of emotional stability as in being self conscious, less prone to depression or anxiety as well as a rather internal locus of control as in thinking that one is the maker of his own success and less dependent on external circumstances result in higher retirement savings.

Also a negative effect of extraversion on house related savings is found. This indicates a shift away from house related savings to more dedicated saving products for individuals with higher levels of extraversion. While openness to experience does not seem to have an effect on retirement savings the negative effects of agreeableness contradict the positive effects found in the literature. But the negative estimates of agreeableness are stable over all model specifications.

Although it is possible to identify a combination of characteristics that would maximize the amount of private retirement savings, it is difficult to draw any policy conclusion from the results. One way would be childhood intervention to groom the specific traits, as they seem to be malleable before 25. But this carries the controversial thought of indoctrination and conformity. A better way to approach the issue would be an informational campaign. Motivating individuals to take part in private assessments of their personality and afterwards providing them with informational material concerning their results and how these may affect their savings decision.

To really be able to provide reliable information further research into the development of the personality and the combination of personality inventories with better data on investment decisions is needed. Still the findings in this paper suggest that when investigating how people save for retirement personality should be considered in addition to general economic determinants.

### 3.7 Appendix to Chapter 3

Table A3.1: Descriptive Statistics for the Control Variables

	Mean	SD	Min	Max
Female	0.4815	(0.500)	0	1
Age	43.5170	(6.804)	30	55
Education	12.6009	(2.661)	7	18
Number of Kids	1.6333	(1.127)	0	12
Self Employed	0.0688	(0.253)	0	1
Public Sector	0.0656	(0.248)	0	1
East	0.2707	(0.444)	0	1
Couple	0.8149	(0.388)	0	1
Migration	0.1772	(0.382)	0	1
Work Exp	18.1600	(8.233)	0	40.2
Unemployment	0.7617	(1.709)	0	15.9
Log Net Income	7.1584	(0.739)	3.8712	9.6803
Log H Net Income	7.8955	(0.447)	5.4681	9.8201
House rel. Savings	0.6301	(0.483)	0	1
Other Savings	0.5449	(0.498)	0	1
Ret. Savings	0.5746	(0.494)	0	1
Smoking	0.2964	(0.457)	0	1
Res. Old Age	2.6051	(0.821)	1	5
Inheritance	0.2565	(0.437)	0	1
Financial Risk	2.7293	(2.250)	0	10

Note: Numbers of observation: 2760. Source: *SOEP* 2002,2004,2005,2007 and 2009

Table A3.2: Used Measurement of Locus of Control from the SOEP questionnaire

Locus of Control	
How my life goes depends on me.	Internal LoC
If a person is socially or politically active, he/she can have an effect on social conditions.	Internal LoCs
One has to work hard in order to succeed.	Internal LoC
Compared to other people, I have not achieved what I deserved.	External LoC
I frequently have the experience that other people have a controlling influence over my life.	External LoC
The opportunities that I have in life are determined by the social conditions.	External LoC
I have little control over the things that happen in my life.	External LoC

Source: SOEP questionnaire, wave 2010

Table A3.3: Average Marginal Effects for the Probit Regression

Variable	RS	HS	OS
Conscientiousness	0.0014 (0.0098)	0.0066 (0.0094)	0.0243*** (0.0093)
Openness	-0.0081 (0.0098)	0.0077 (0.0095)	-0.0048 (0.0095)
Extraversion	0.0191* (0.0098)	-0.0185* (0.0095)	-0.0126 (0.0096)
Agreeableness	-0.0168* (0.0097)	0.0096 (0.0093)	-0.0101 (0.0091)
Emotional stability	-0.0014 (0.0096)	-0.0043 (0.0093)	-0.0042 (0.0093)
LoC	0.0095 (0.0096)	0.0066 (0.0094)	-0.0004 (0.0090)
Female	-0.0079 (0.0231)	0.0186 (0.0229)	0.0098 (0.0224)
Age	-0.0069*** (0.0024)	-0.0011 (0.0022)	0.0080*** (0.0022)
Education	0.0057 (0.0043)	-0.0009 (0.0043)	0.0083*** (0.0041)
Number of Kids	-0.0052 (0.0086)	0.0309*** (0.0086)	-0.0370*** (0.0086)
Self Employed	0.0224 (0.0356)	-0.0795** (0.0338)	0.2390*** (0.0390)
Public Sector	-0.0635* (0.0370)	0.1327*** (0.0408)	0.0259 (0.0375)
East	0.0909*** (0.0219)	0.0202 (0.0213)	0.0670*** (0.0209)
Couple	-0.0538** (0.0269)	0.1081*** (0.0261)	-0.0622** (0.0263)
Migration	-0.0810*** (0.0234)	0.0038 (0.0231)	-0.0307 (0.0233)
Work Exp	0.0076*** (0.0022)	0.0046** (0.0021)	-0.0068*** (0.0020)
Unemployment	-0.0043 (0.0061)	-0.0315*** (0.0061)	-0.0285*** (0.0065)
Log Net Income	0.0717*** (0.0190)	0.0214 (0.0187)	0.0683*** (0.0187)
Log H Net Income	0.1298*** (0.0277)	0.0956*** (0.0271)	0.2228*** (0.0262)
Smoking	0.0050 (0.0200)	-0.0819*** (0.0187)	-0.0769*** (0.0187)
Res. Old Age	0.0254** (0.0109)	0.0068 (0.0106)	0.0107 (0.0105)
Exp Inheritance	0.0197 (0.0213)	0.0782*** (0.0210)	0.0643*** (0.0206)
Financial Risk	0.0067 (0.0042)	0.0034 (0.0041)	0.0225*** (0.0039)
House rel. savings	0.1110*** (0.0187)		0.0794*** (0.0179)
Other savings	0.0948*** (0.0190)	0.0802*** (0.0182)	
Ret. rel. savings		0.1036*** (0.0176)	0.0903*** (0.0176)
N	2760	2760	2760
F-test (p-value)	0.24	0.36	0.16

Note: RS: Life/retirement policies; HS: House related savings; OS: Other savings. Standard errors appear in parentheses. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. F-test (p-value) denotes the p-value associated with an F-test of joint significance of the personality traits. Source: Based on SOEP 2002, 2004, 2005, 2007 and 2009

Table A3.4: Average Marginal Effects for the Tobit Regression

Variable	Tobit			OLS
	RS	HS	OS	NW
Conscientiousness	398.02 (329.80)	1718.89 (2438.62)	481.92 (1976.29)	-1599.02 (3662.51)
Openness	-210.77 (334.82)	1176.50 (2471.66)	-1799.18 (2013.20)	-5956.50** (2838.17)
Extraversion	580.60* (333.53)	-5259.64** (2464.14)	-2270.41 (1995.22)	-787.25 (3267.68)
Agreeableness	-692.95** (324.77)	2632.36 (2411.50)	-1087.53 (1961.01)	-1742.96 (3115.80)
Emotional stability	323.46 (327.39)	-388.28 (2413.64)	-248.77 (1976.22)	1441.01 (3515.87)
LoC	808.85** (330.43)	2003.25 (2458.30)	1305.59 (1993.08)	3900.45* (2316.59)
Female	-1658.22** (788.43)	167.83 (5922.87)	3071.53 (4757.72)	-6123.02 (8908.48)
Age	114.41 (82.98)	893.17 (598.02)	2092.19*** (487.52)	3822.87*** (729.80)
Education	360.37** (147.55)	528.64 (1087.09)	538.67 (867.69)	566.51 (1730.13)
Number of Kids	-430.57 (300.08)	12093.25*** (2181.30)	-5222.37*** (1802.15)	36.84 (2485.95)
Self Employed	5059.79*** (1156.46)	2969.43 (8888.59)	61885.11*** (6633.28)	93402.91*** (26674.57)
Public Sector	-3791.02*** (1203.28)	18552.44** (8801.33)	3657.57 (6929.94)	987.22 (16259.43)
East	-924.11 (738.09)	-21595.38*** (5560.08)	3087.01 (4470.97)	-25533.81*** (5494.60)
Couple	-1611.19* (933.01)	34649.88*** (7122.63)	-8968.63 (5675.20)	-1026.59 (6455.34)
Migration	-2122.63** (854.17)	-16833.82*** (6160.48)	-11382.57** (5161.16)	-26134.42*** (5377.45)
Work Exp	216.21*** (77.22)	948.60* (557.39)	-1484.56*** (454.87)	-837.45 (556.97)
Unemployment	-352.02 (235.87)	-9698.81*** (1795.04)	-5580.34*** (1571.27)	-2654.67** (1219.21)
Log Net Income	2694.33*** (678.07)	631.52 (4902.97)	14810.65*** (4049.57)	14091.32** (7018.49)
Log H Net Income	4358.81*** (955.96)	57034.01*** (7149.18)	48401.07*** (5763.82)	52790.06*** (8969.31)
Smoking	-1208.64* (694.13)	-23760.36*** (5139.67)	-13824.78*** (4263.96)	-20639.45*** (5268.53)
Res. Old Age	943.65** (371.88)	977.84 (2751.53)	3652.47 (2241.06)	4355.39 (3781.57)
Exp Inheritance	776.75 (703.35)	19586.93*** (5203.79)	8389.14** (4160.65)	16621.44** (7972.04)
Financial Risk	106.53 (139.74)	497.53 (1045.78)	3662.76*** (843.46)	2472.93** (1221.83)
House rel. savings	2930.93*** (666.36)		15881.92*** (4052.97)	
Other savings	3240.48*** (663.10)	18183.06*** (4869.18)		
Ret. rel. savings		18010.66*** (4740.49)	14139.53*** (3893.35)	
N	2760	2760	2760	2760
F-test (p-value)	0.00	0.29	0.68	0.05

Note: RS: Life/retirement policies; HS: House related savings; OS: Other savings. Standard errors appear in parentheses. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. F-test (p-value) denotes the p-value associated with an F-test of joint significance of the personality traits. Source: Based on SOEP 2002, 2004, 2005, 2007 and 2009

Table A3.5: Average Marginal Effects for the Probit Regression - Dummies

Variable	RS	HS	OS
Female	-0.0040 (0.0229)	0.0151 (0.0226)	0.0086 (0.0224)
Age	-0.0073*** (0.0024)	-0.0013 (0.0022)	0.0082*** (0.0022)
Education	0.0051 (0.0043)	-0.0010 (0.0042)	0.0075* (0.0041)
Number of Kids	-0.0048 (0.0086)	0.0316*** (0.0086)	-0.0376*** (0.0086)
Self Employed	0.0241 (0.0356)	-0.0818** (0.0335)	0.2350*** (0.0390)
Public Sector	-0.0657* (0.0370)	0.1278*** (0.0408)	0.0260 (0.0376)
East	0.0901*** (0.0219)	0.0218 (0.0213)	0.0684*** (0.0209)
Couple	-0.0514* (0.0268)	0.1098*** (0.0259)	-0.0619** (0.0263)
Migration	-0.0821*** (0.0233)	0.0053 (0.0231)	-0.0304 (0.0233)
Work Exp	0.0079*** (0.0022)	0.0048** (0.0021)	-0.0068*** (0.0020)
Unemployment	-0.0034 (0.0061)	-0.0322*** (0.0061)	-0.0291*** (0.0066)
Log Net Income	0.0719*** (0.0190)	0.0201 (0.0186)	0.0689*** (0.0187)
Log H Net Income	0.1258*** (0.0276)	0.0916*** (0.0271)	0.2250*** (0.0262)
Smoking	0.0062 (0.0200)	-0.0849*** (0.0186)	-0.0777*** (0.0186)
Res. Old Age	0.0252** (0.0109)	0.0077 (0.0106)	0.0107 (0.0105)
Exp Inheritance	0.0201 (0.0213)	0.0755*** (0.0210)	0.0626*** (0.0206)
Financial Risk	0.0064 (0.0042)	0.0031 (0.0040)	0.0223*** (0.0039)
House rel. savings	0.1097*** (0.0187)		0.0816*** (0.0180)
Other savings	0.0964*** (0.0189)	0.0823*** (0.0181)	
Ret. rel. savings		0.1023*** (0.0176)	0.0920*** (0.0176)
N	2760	2760	2760
F-test (p-value)	0.27	0.21	0.77

Note: RS: Life/retirement policies; HS: House related savings; OS: Other savings. Standard errors appear in parentheses. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. F-test (p-value) denotes the p-value associated with an F-test of joint significance of the personality traits. Source: Based on SOEP 2002, 2004, 2005, 2007 and 2009

Table A3.6: Average Marginal Effects for the Tobit Regression - Dummies

Variable	Tobit			OLS
	RS	HS	OS	NW
Female	-1618.38** (781.17)	-760.49 (5882.62)	2363.83 (4725.22)	-7852.23 (8401.09)
Age	96.22 (82.62)	915.19 (596.98)	2077.74*** (486.47)	3765.57*** (714.82)
Education	332.10** (145.94)	577.58 (1078.28)	543.52 (861.01)	646.35 (1698.68)
Number of Kids	-416.34 (299.95)	12292.50*** (2183.85)	-5339.79*** (1805.29)	179.02 (2457.72)
Self Employed	5100.85*** (1154.54)	2754.10 (8885.11)	61878.60*** (6635.65)	93159.40*** (26268.47)
Public Sector	-4012.66*** (1201.04)	17595.77** (8804.88)	3408.14 (6935.06)	-457.65 (16188.71)
East	-873.98 (736.08)	-21132.35*** (5559.27)	2946.18 (4469.13)	-25656.93*** (5532.43)
Couple	-1527.72* (927.83)	34811.62*** (7104.93)	-8915.64 (5652.92)	-691.48 (6512.69)
Migration	-2176.36** (852.02)	-16239.40*** (6157.88)	-11402.20** (5157.64)	-26023.08*** (5386.21)
Work Exp	226.83*** (76.94)	941.54* (556.73)	-1491.54*** (454.04)	-811.32 (549.03)
Unemployment	-341.61 (235.82)	-9686.87*** (1796.64)	-5682.11*** (1570.65)	-2559.80** (1204.18)
Log Net Income	2687.20*** (676.31)	397.72 (4904.99)	14711.13*** (4048.54)	13531.34* (7045.42)
Log H Net Income	4321.61*** (952.99)	55775.87*** (7144.64)	48968.94*** (5746.49)	52989.55*** (8961.75)
Smoking	-1224.12* (692.41)	-24906.43*** (5133.08)	-14182.70*** (4259.75)	-21720.34*** (5345.63)
Res. Old Age	990.07*** (370.57)	1116.96 (2745.66)	3846.45* (2237.33)	4791.19 (3888.16)
Exp Inheritance	787.17 (702.35)	19336.50*** (5206.10)	8328.90** (4162.56)	16793.91** (7967.55)
Financial Risk	99.70 (139.01)	350.47 (1042.39)	3677.87*** (840.82)	2459.42** (1207.89)
House rel. savings	2868.51*** (665.56)		16159.52*** (4055.89)	
Other savings	3334.75*** (661.02)	18801.38*** (4862.01)		
Ret. rel. savings		17389.21*** (4739.55)	14070.53*** (3894.39)	
N	2,760	2,760	2,760	2,760
F-test (p-value)	0.00	0.27	0.75	0.18

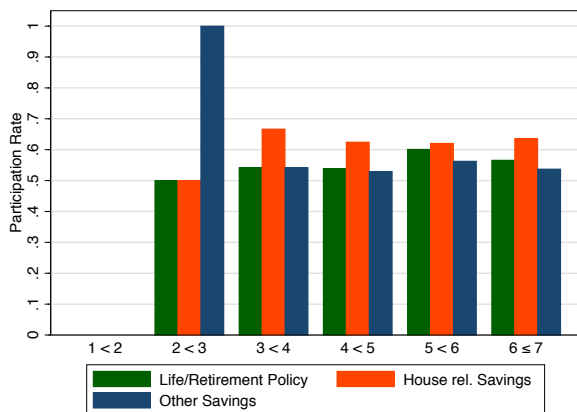
Note: RS: Life/retirement policies; HS: House related savings; OS: Other savings. Standard errors appear in parentheses. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. F-test (p-value) denotes the p-value associated with an F-test of joint significance of the personality traits. Source: Based on SOEP 2002, 2004, 2005, 2007 and 2009

Table A3.7: Model Selection based on Life/Retirement as Dependent Variable

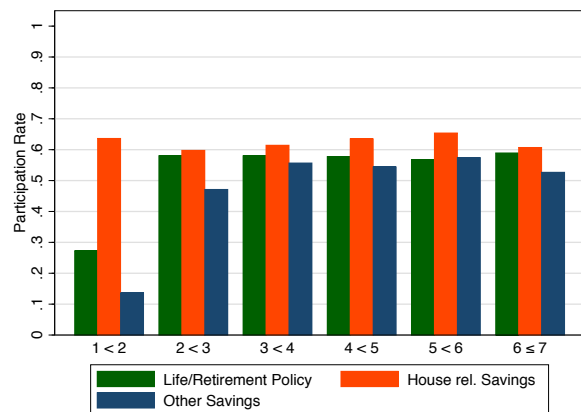
	M1	M2	M3	M4	M5	M6
Conscientiousness	190.57 (347.09)	593.30* (339.43)	410.37 (330.69)	531.64 (331.39)	398.02 (329.80)	-
Openness	500.37 (351.12)	-14.26 (345.37)	-183.45 (337.91)	-203.59 (336.84)	-210.77 (334.82)	-
Extraversion	-233.34 (353.67)	494.06 (342.87)	432.25 (334.51)	484.42 (335.26)	580.60 * (333.53)	-
Agreeableness	-1669.58** (343.50)	-1299.14** (333.06)	-727.52** (327.00)	-704.10** (326.73)	-692.95 ** (324.77)	-
Emotional Stability	1571.39 *** (339.40)	614.49* (337.97)	346.96 (329.20)	291.37 (329.42)	323.46 (327.39)	-
Locus of Control	1994.86 *** (346.41)	1667.41*** (336.00)	962.91*** (331.91)	808.83** (332.17)	808.85** (330.43)	-
Female		-5186.80 ** (656.22)	-1881.95 ** (787.24)	-1639.30** (793.14)	-1658.22** (788.43)	-1557.28** (766.76)
Age		375.60 *** (47.32)	154.40* (83.43)	136.84* (83.14)	114.41 (82.98)	81.76 (82.49)
Education		1052.22*** (121.77)	503.88*** (145.85)	384.81*** (148.23)	360.37** (147.55)	312.69** (145.49)
Number of Kids		-752.79** (301.00)	-539.22* (300.45)	-490.01 (300.25)	-430.57 (300.08)	-427.83 (300.54)
East		-2249.892** (704.94)	-627.9247 (737.61)	-514.2151 (740.08)	-924.11 (738.09)	-921.2242 (739.61)
Couple		1683.107*** (845.99)	-1390.729 (936.52)	-1420.465 (933.32)	-1611.193* (933.01)	-1614.853 * (929.50)
Migration		-3226.994** (872.88)	-2461.746** (858.34)	-2280.424** (857.80)	-2122.634** (854.17)	-2203.98*** (855.49)
Self Employed			5673.872*** (1161.83)	5464.665*** (1157.7)	5059.786*** (1156.46)	5214.531*** (1152.13)
Public Sector			-3310.286** (1213.33)	-3326.032** (1210.42)	-3791.022** (1203.28)	-3789.78*** (1206.53)
Work Exp			182.52** (77.43)	209.75 *** (77.32)	216.21*** (77.22)	238.58*** (77.02)
Unemployment			-643.52*** (236.71)	-560.64** (235.62)	-352.02 (235.87)	-401.25* (236.08)
Log Net Income			3089.72*** (682.91)	3031.34*** (680.44)	2694.33*** (678.07)	2870.59*** (678.93)
Log H Net Income			5847.34*** (949.65)	5419.06*** (948.44)	4358.81*** (955.96)	4744.77*** (951.70)
Smoking				-1803.43** (692.60)	-1208.64* (694.13)	-1074.73 (692.45)
Res. Old Age				1048.70*** (374.14)	943.65** (371.88)	1010.27*** (371.93)
Inheritance				1261.06* (704.83)	776.75 (703.35)	905.40 (703.26)
Financial Risk				193.69 (139.71)	106.53 (139.74)	140.79 (138.46)
House rel. Savings					2930.93*** (666.36)	2896.49*** (668.11)
Other Savings					3240.48*** (663.10)	3259.12*** (664.04)
N	2,760	2,760	2,760	2,760	2,760	2,760
AIC	38,300.20	38,087.03	37,924.14	37,909.63	37,866.46	37,872.72

Note: Numbers of observation: 2,760. Source: Based on *SOEP* 2002, 2004, 2005, 2007 and 2009

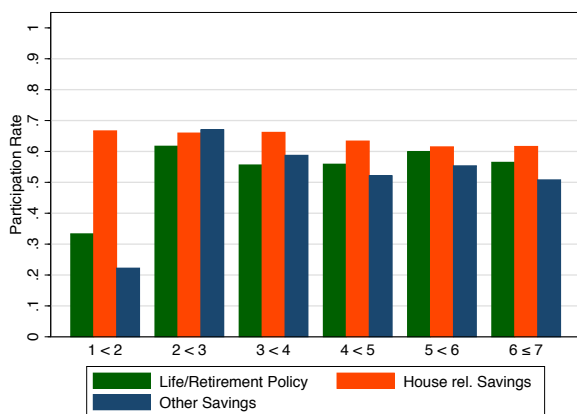




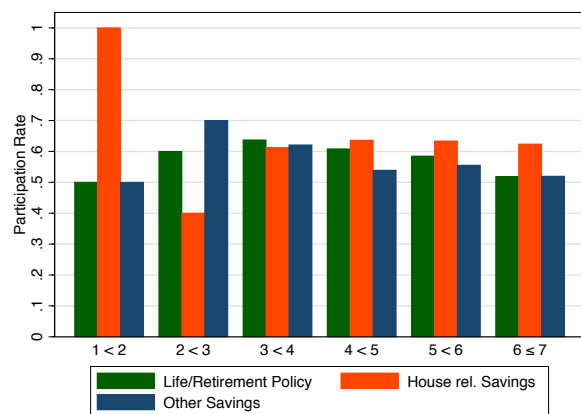
(a) Conscientiousness



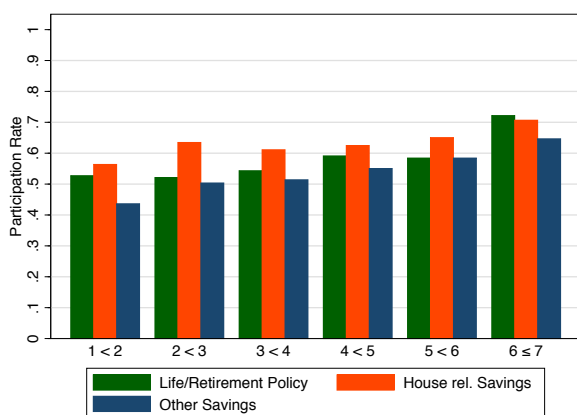
(b) Openness to Experience



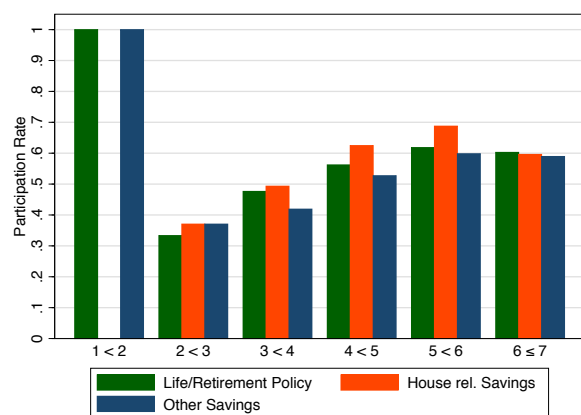
(c) Extraversion



(d) Agreeableness



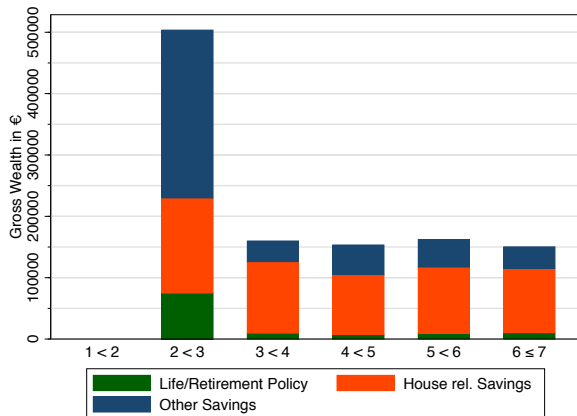
(e) Emotional Stability



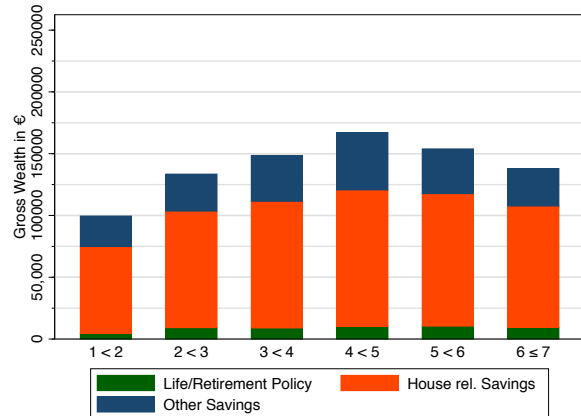
(f) Locus of Control

Note: The x-axis has 6 categories which are coded for one equals everything from 1 to below 2, two from 2 to below 3, and so forth for the other categories while six as the last category is coded as 6 and above including 7.  
 Source: SOEP 2007 with 2760 observations.

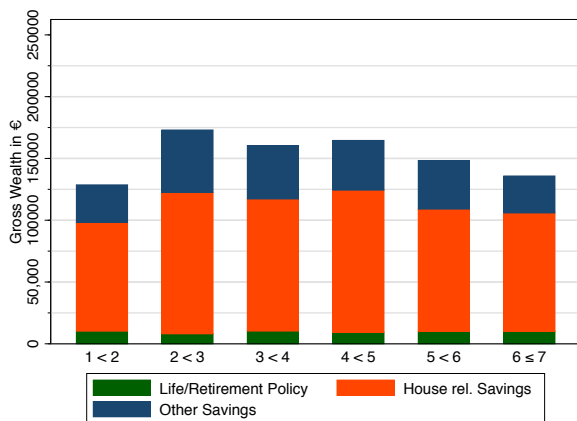
Figure A3.1: Participation Rate over the Personality Traits



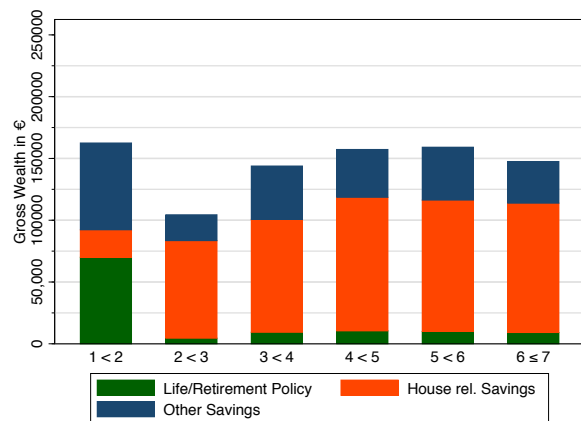
(a) Conscientiousness



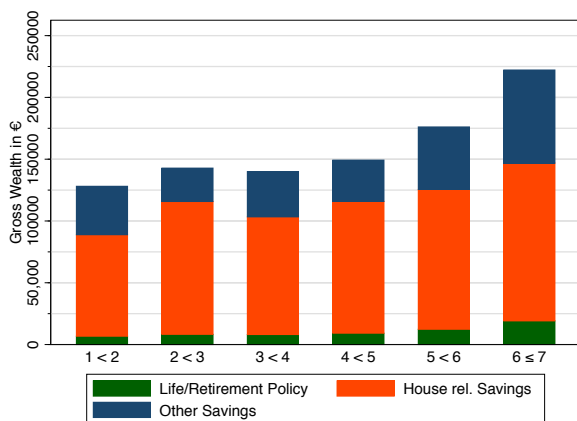
(b) Openness to Experience



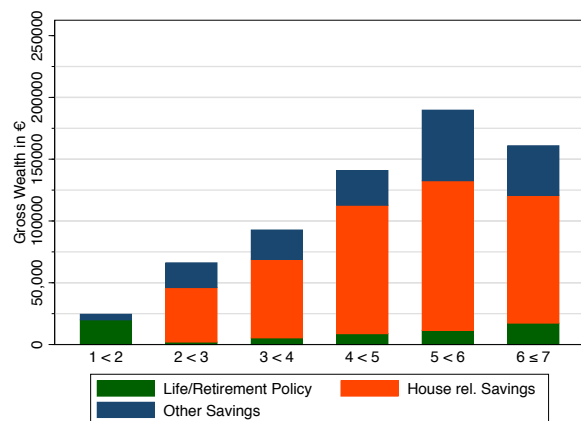
(c) Extraversion



(d) Agreeableness



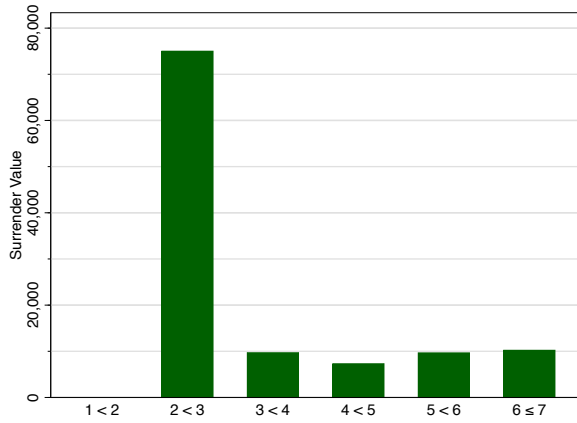
(e) Emotional Stability



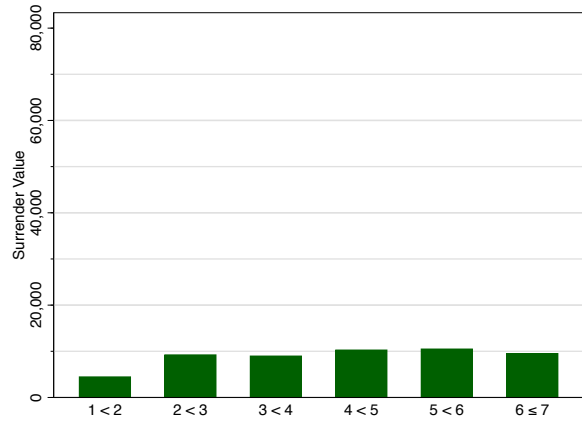
(f) Locus of Control

Note: The x-axis has 6 categories which are coded for one equals everything from 1 to below 2, two from 2 to below 3, and so forth for the other categories while six as the last category is coded as 6 and above including 7.  
 Source: SOEP 2007 with 2760 observations.

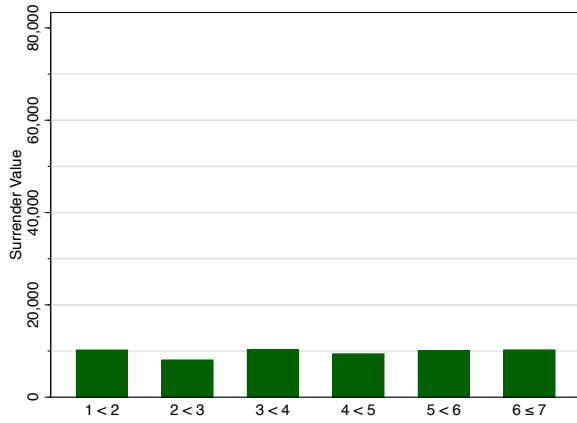
Figure A3.2: Combined Surrender Value of the Saving Types over Personality Traits



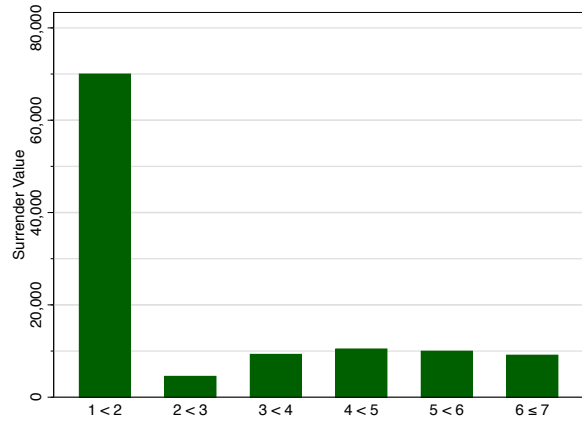
(a) Conscientiousness



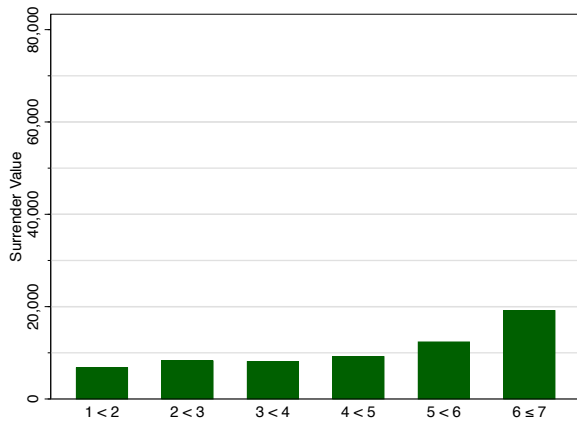
(b) Openness to Experience



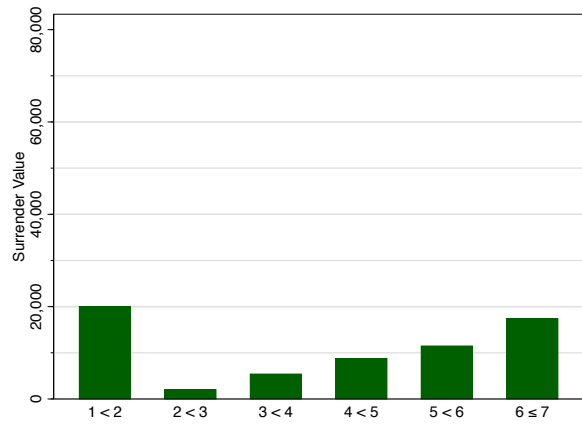
(c) Extraversion



(d) Agreeableness



(e) Emotional Stability



(f) Locus of Control

Note: The x-axis has 6 categories which are coded for one equals everything from 1 to below 2, two from 2 to below 3, and so forth for the other categories while six as the last category is coded as 6 and above including 7.  
 Source: SOEP 2007 with 2760 observations.

Figure A3.3: Surrender Value of the Life/Retirement Policy over Personality Traits

## CHAPTER 4

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# An Investigation Into the Stability of the Big-Five in Germany

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## 4 An Investigation Into the Stability of the Big-Five in Germany

*This project was partly supported by the Narodowe Centrum Nauki (NCN) and Deutsche Forschungsgemeinschaft (DFG) under the joint project: Modelling Retirement Decisions with Incomplete Rationality - Insights for Policy Design. Project number: PU307-10-1*

### 4.1 Introduction

The Big-Five personality traits are a long established measure for personality in the psychological literature dating back to the validation by McCrae and Costa (1987). Similar constructs have been discussed even before. Along the increasing popularity of behavioral economics, economic researchers start to include personality traits into economic models and like to assume that these personality traits are somehow stable over time. Stable in the sense that the measures do not react like a stock index to rumors, but are stable in a certain bandwidth around a specific value. That value might be determined during adolescent years with a higher volatility until it is fixed during adulthood. If this hypothesis holds, the Big-Five traits can be included as variables into empirical analysis like place of birth or gender as a pre-determined variable. They might include factors of growing up that are not as easily observable as parent's education or the neighborhood and could be able to add explanatory power to models that consider decisions later in life.

If the Big-Five were to be highly volatile they would be reduced to be a descriptive feature used for post change analysis. The additional practical benefit of the stability of the Big-Five would be the possibility to generalize the traits to different points in time as big panel data surveys only collect the traits every few years. An empirical validation that these measures are stable over time would strengthen the validity of economic findings based on these panel data.

Specht et al. (2011) investigate a sample population from 17 to over 80 years of age. They find that especially in the early years up to an age around 25 and for individuals over 65 there is considerable fluctuation in the traits. This is also supported by Cobb-Clark and Schurer (2012). Important economic decisions are usually made by individuals in their prime working age and

therefore it is worth investigating if the stability hypothesis holds true for individuals between 25 and 65 years of age.

This paper investigates possible sources for the found intra-individual variation. Furthermore, this paper extends the time horizon by including the 2013 wave into the analysis increasing the time frame by 4 years (2005 to 2013). Adverse life events and their effect on the Big-Five are investigated concluding with the estimation of wage effects of the Big-Five under different assumptions. First is the classical stability assumption following the approach by Heineck and Anger (2010). The second approach uses the observed variation to include the personality traits in a fixed effects wage estimation.

The German Socio-Economic Panel (*SOEP*) collects a representative sample of the German population since 1984. It also includes a self-completion questionnaire for the Big-Five in 2005, 2009, and most recently 2013 wave. Based on the *SOEP* data it will be investigated if the results found by Cobb-Clark and Schurer (2012) that the Big-Five traits are stable for a working age population holds for the German data set and can further support the stability assumption. Results for the Big-Five of the working age sample of the *SOEP* show a rather large variation on the individual level leaving the stability hypothesis in question. For the sample population as a whole the Big-Five seem to be rather stable and independent of age effects.

This paper is structured as follows: Section 2 briefly describes the data while Section 3 presents detailed results. Section 4 concludes the paper.

## 4.2 Data

The data used for the analysis comes from the *SOEP* which is a representative panel study for Germany collected since 1984 with over 10,000 households. In 2005, 2009, and 2013 the *SOEP* used a self-completion questionnaire of the Big-Five personality inventory with each trait scored from one to seven with a higher score indicating a better fit. Instead of applying the Revised Neuroticism, Extraversion, Openness to Experience Personality Inventory<sup>1</sup> (*NEOPI – R*) with 240 items, the *SOEP* administered a shortened version of the original long questionnaire to elicit the Big-Five. The Big-Five Inventory Short (*BFI – S*) is a short item scale with 15 instead of 44 items in the original BFI-scale developed by Gerlitz and Schupp (2005) to be included in

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<sup>1</sup>For further information see McCrae and Costa Jr (2010).

the standard *SOEP* questionnaire. The 15 questions are phrased in the way “I am somebody, who ...” and can be answered on a 7 item Likert-scale with 1 as “does not apply at all” and 7 as “totally applies”. The pre-test for the *BFI – S*, which has been conducted before the addition to the *SOEP* questionnaire, shows a high middle inter-item correlation between 0.28 and 0.40 for the respective traits. Given the low number of items and the high item heterogeneity, high Cronbach’s  $\alpha$  coefficients<sup>2</sup> between 0.51 and 0.66 have been achieved (Dehne and Schupp, 2007, p. 33). A test for external validity has shown that the *BFI – S* is generally able to capture the Big-Five dimensions (Dehne and Schupp, 2007, p.40).

Given the argumentation above it can be assumed that the Big-Five measures in the *SOEP* are able to capture the five traits. This makes it possible to investigate if the stability of the Big-Five found by Cobb-Clark and Schurer (2012) based on the Australian *HILDA*<sup>3</sup> data can be observed for the German *SOEP*.

The summary of some descriptive statistics for the Big-Five measures in the *SOEP* are displayed in Table 4.1. The pooled sample contains 17,028 individuals aged 25-64 who answered the *BFI – S* in 2005, 2009, and 2013, with 5,676 individuals per year. The first column presents the pooled sample average while column two reports the respective standard deviation. Columns three to nine show descriptive statistics for the individual changes between 2005 and 2013. Additionally, the lower part of Table 4.1 shows descriptive statistics for the absolute values of the individual changes. The sample consist of 46.7% women and 53.3% men. The means and standard deviations (*SD*) are similar to the Australian data used by Cobb-Clark and Schurer (2012) but differ for certain traits of the Big-Five<sup>4</sup>. Germans score on average 0.42 points higher on the extraversion scale compared to the average Australian. Furthermore, the score for conscientiousness is about 0.77 points higher for Germans, making them more detail oriented than Australians. At the same time their emotional stability is over one point lower compared to Australians. There is also an observed difference between men and women in the *SOEP* as women show a lower average score in emotional stability<sup>5</sup>. Over all, the scores for women and men look fairly similar in terms of mean values and distributions.

<sup>2</sup>Cronbach’s  $\alpha$  is a coefficient of internal consistency of a scale and is commonly used as an estimate of the reliability of a psychometric tests, with 0.7 being seen as sufficient.

<sup>3</sup>Household, Income and Labour Dynamics in Australia data set. The *HILDA* data set contains a self-completion questionnaire on the Big-Five for their 2005 and 2009 wave.

<sup>4</sup>Table A4.1 in the appendix contains a direct comparison with the Cobb-Clark and Schurer (2012) paper.

<sup>5</sup>See appendix for gender separated mean tables.

Table 4.1: Descriptive Statistics of Personality Traits and their Change between 2005 and 2013

	Level		Individual Change between 2005 and 2013						
	Mean	SD	Mean	SD	1st	25th	50th	75th	99th
					Percentile of distribution				
Extraversion	4.821	1.134	-0.064	0.993	-2.667	-0.667	0.000	0.667	2.333
Agreeableness	5.346	0.965	-0.095	0.965	-2.667	-0.667	0.000	0.333	2.333
Conscientiousness	5.925	0.872	-0.091	0.873	-2.333	-0.667	0.000	0.333	2.333
Emotional Stability	4.161	1.207	0.172	1.158	-2.667	-0.667	0.000	1.000	3.000
Openness to Experience	4.490	1.169	-0.033	1.079	-3.000	-0.667	0.000	0.667	2.667
Absolute changes			Mean	SD	1st	25th	50th	75th	99th
Extraversion			0.750	0.653	0.000	0.333	0.667	1.000	2.667
Agreeableness			0.733	0.635	0.000	0.333	0.667	1.000	2.667
Conscientiousness			0.632	0.610	0.000	0.333	0.333	1.000	2.667
Emotional Stability			0.900	0.748	0.000	0.333	0.667	1.333	3.333
Openness to Experience			0.823	0.700	0.000	0.333	0.667	1.333	3.000

Notes: Data taken from *SOEP* waves 2005, 2009 and 2013. The pooled sample consists of 17,028 individual observations. Level reports the pooled average for the full sample. SD = standard deviation

## 4.3 Results

### 4.3.1 Mean-level Consistency

#### Population Means

The first aim of the analysis is to check if there are larger variations in mean-levels of the Big-Five traits indicating a change for the sample population as a whole. The investigation focuses at first on mean-level consistency to check if there are systematic changes in the levels of the trait dimensions for the investigated population. The variable for the change in the reported Big-Five traits for each individual is constructed by subtracting individual specific 2005 values from the individual specific 2013 values<sup>6</sup>.

$$\Delta^j = T_{2013}^j - T_{2005}^j$$

with  $j \in \{\text{extraversion, agreeableness, conscientiousness, emotional stability, openness to experience}\}$ . This results in negative values if the trait is less salient in 2013 and positive values if trait score increases over time. The information about the mean-level changes are provided in columns 3-9 in Table 4.1. The table shows that the observed changes are almost symmetrically distributed around zero. Compared to the findings by Cobb-Clark and Schurer (2012) the tails of the distribution are heavier. The means are close to zero and a standard deviation ranges from

<sup>6</sup>Change variables are also constructed for the 2005-2009 and 2009-2013 time frame.



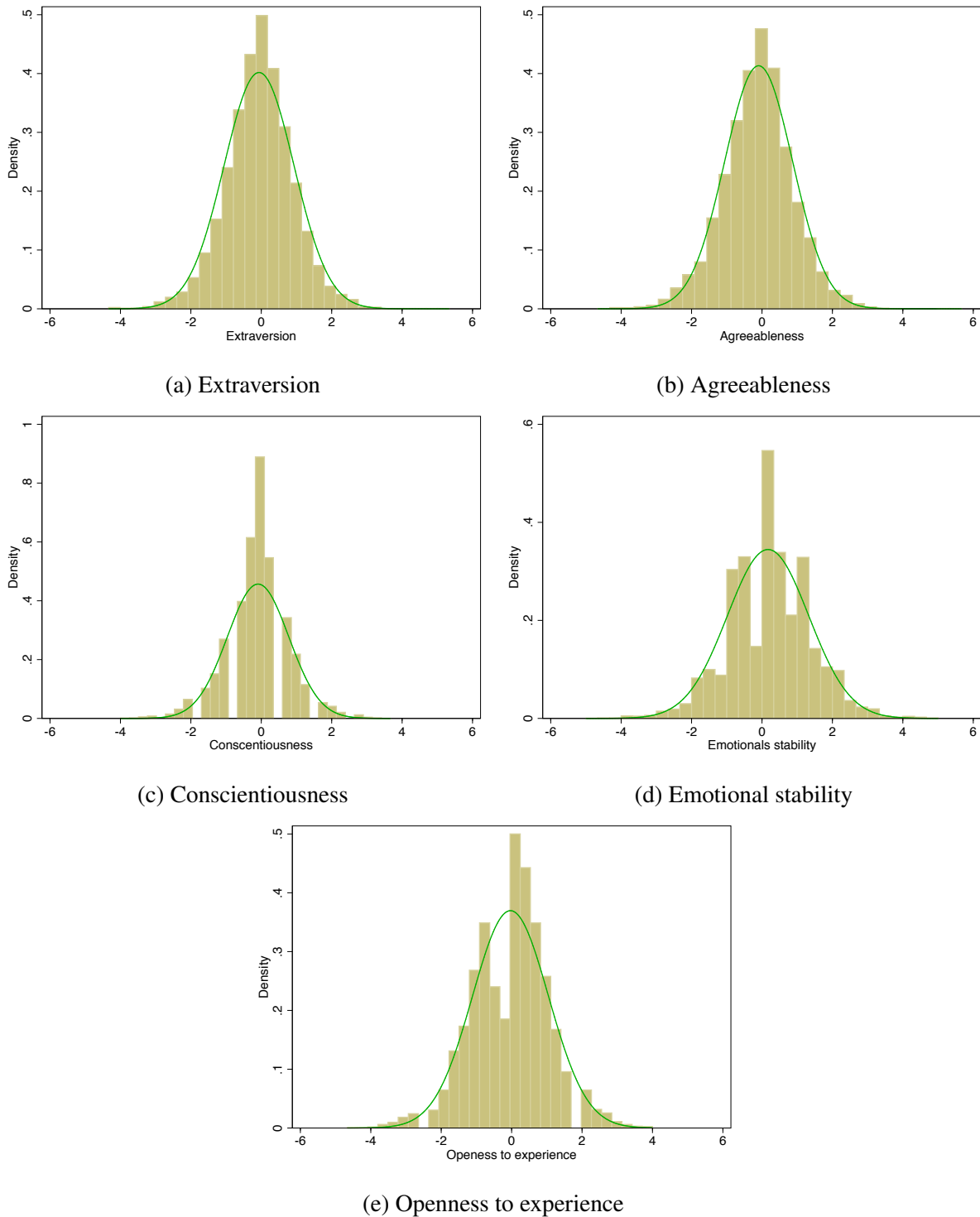
0.87 to 1.11 which indicates a wider distribution of the changes in the Big-Five traits for the *SOEP*. The distributions are also not as symmetrical, since the change in median for agreeableness and conscientiousness is zero. The distribution is slightly skewed to the left with a value of -0.666 at the 25<sup>th</sup> percentile and only 0.333 at the 75<sup>th</sup> percentile. Therefore, the depreciation that individuals experience is slightly higher compared to the increases that are experienced by the individuals. This observation is confirmed by the 1<sup>st</sup> percentile of the distributions which shows lower absolute values compared to the 99<sup>th</sup> percentile. For extraversion and openness to experience the distribution is close to being symmetrical, with only small differences between the 1<sup>st</sup> and 99<sup>th</sup> percentile.

Figure 4.1 shows the histograms for the Big-Five traits indicating that the observed individual changes are approximately symmetrically distributed around zero.<sup>7</sup> The extremes of the distributions for the *SOEP* data show high absolute values in both directions indicating intra-individual changes for a large share of the population. Given the large changes in both directions Table 4.1 also reports the average absolute mean-level changes to give a better overview of the actual movement in the traits. The absolute mean-level changes are usually above two thirds of the respective standard deviation indicating a significant variation for the individuals. Additionally more than 20% of the sample population experience a trait change of at least one point on the seven point Likert-scale. In general there is more volatility in the changes of the Big-Five in the German data compared to the Australian data. This is an indicator for less stability. Further down the intra-individual analysis will focus on these changes.

There is a general trend in the data. All Big-Five measures show a decrease in their mean values from 2005 to 2013<sup>8</sup>. First Figure A4.1 in the appendix shows a decrease in all trait values in the time period from 2005 to 2009. This is followed by an increase in the trait values of extraversion, agreeableness and openness to experience from 2009 to 2013 which is slightly lower in absolute values compared to the decrease from 2005 to 2009. Conscientiousness remains at the 2009 level even in 2013 and emotional stability shows a increase between 2009 and 2013. These could either be due to external circumstances or changes in placement of the questions. One explanation for the drop in 2009 could be that all individuals scored lower in the questionnaires in general due to external circumstances like the financial crises from 2008. Given more uncertain times and a troubled environment it would make little sense that emo-

<sup>7</sup>The Shapiro-Wilk test for normal data rejects that the changes are normally distributed for all traits.

<sup>8</sup>Emotional stability is the inverted scale of neuroticism elicited in the *SOEP*.



Note: The green line plots standard normal density function with (0,1).

Figure 4.1: Histograms for the Individual Changes of the Big-Five between 2005 and 2013

tional stability would increase in such a time. The other explanation could be the changes in the elicitation of the traits. In 2005 the questions directly follow after the health questions. In 2009 there are attitude and risk questions before the elicitation of the Big-Five. In 2013 the Big-Five inventory is moved to another section with different questions just before the elicitation. The

different questions just before the elicitation can prime the individuals in different ways inducing an additional measurement bias (Rasinski et al., 2005). It will be interesting to see how the population means change over time once additional waves are collected. All changes in the population mean levels from 2005-2013 are significantly different from zero at the one percent level. The only change that is not significant is the mean level change in conscientiousness from 2009 to 2013. Although the changes in the mean levels are significant the size is only around a tenth of a standard deviation for the average Big-Five trait.

### **Age Group Means**

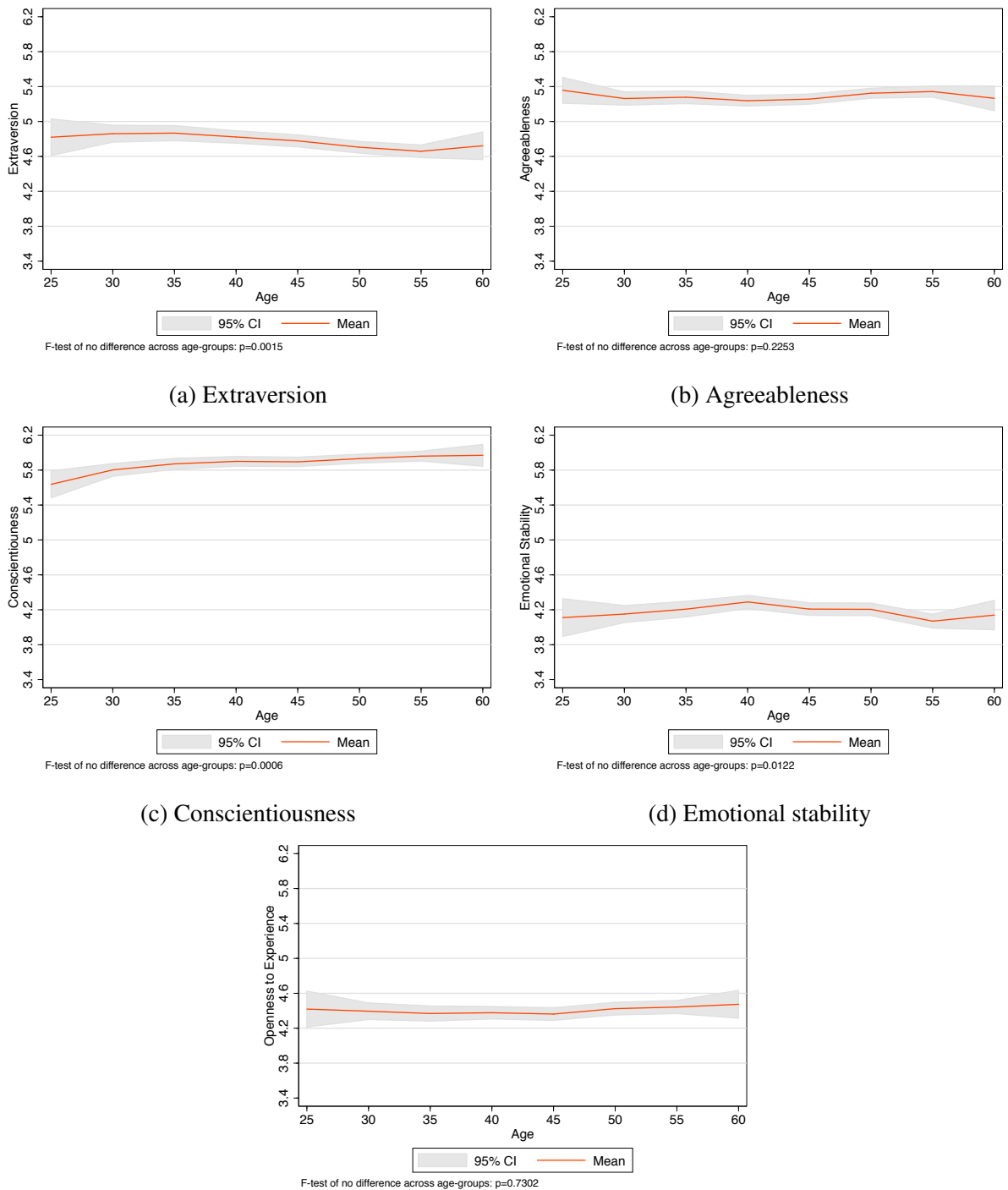
The next step investigates how mean-levels and mean-level changes vary over the life cycle. The sample is split into age groups of five year intervals<sup>9</sup>. Figure 4.2 shows the mean-levels for the different age groups in 2009<sup>10</sup>:

The construction of the age groups and the necessity that all individuals need to be observed at all three points in time results in lower observation numbers in the first and the last age group which in turn warrants larger confidence intervals. The F-test used to check for significant differences between age groups is based on an ANOVA with  $H_0$  being that all group means are equal and  $H_1$  that at least one mean differs. Unfortunately, Bartlett's test for equal variances rejects the null hypothesis on for several traits, which violates a central assumption of the standard ANOVA and entails invalid results. Therefore, the Bonferroni multiple-comparison test is implemented to circumvent the problem of unequal variances between the age groups and in order to identify the exact groups that deviate from each other.

In all observational years there is no statistically significant difference between the age groups for the traits agreeableness and openness to experience. However, there are significant differences between some of the age groups for the other traits. The comparison of all three years leads to the conclusion that differences between the various age groups are not related to the actual age. To the contrary, they seem to be related to the different cohorts dragging their respective higher or lower values with them as they get older. The groups that are statistically different from each other move almost simultaneously to the right as we switch from the year 2005 to 2013. Therefore, the differences are not due to a certain age but rather are caused by the different cohorts. It is observable that younger individuals in the sample are less conscientious

<sup>9</sup>Age groups: 25-29; 30-34; 35-39; 40-44; 45-49; 50-54; 55-59; 60-64.

<sup>10</sup>The graphs for the years 2005 and 2013 are included in the appendix.



(a) Extraversion

(b) Agreeableness

(c) Conscientiousness

(d) Emotional stability

(e) Openness to experience

Note: Age groups are defined as 25 = 25-29; 30 = 30-34; 35 = 35-39; 40 = 40-44; 45 = 45-49; 50 = 50-54; 55 = 55-59; 60 = 60-64

Figure 4.2: Mean Values for the Big-Five Personality Traits over Age Groups for 2009

and show higher scores of extraversion.

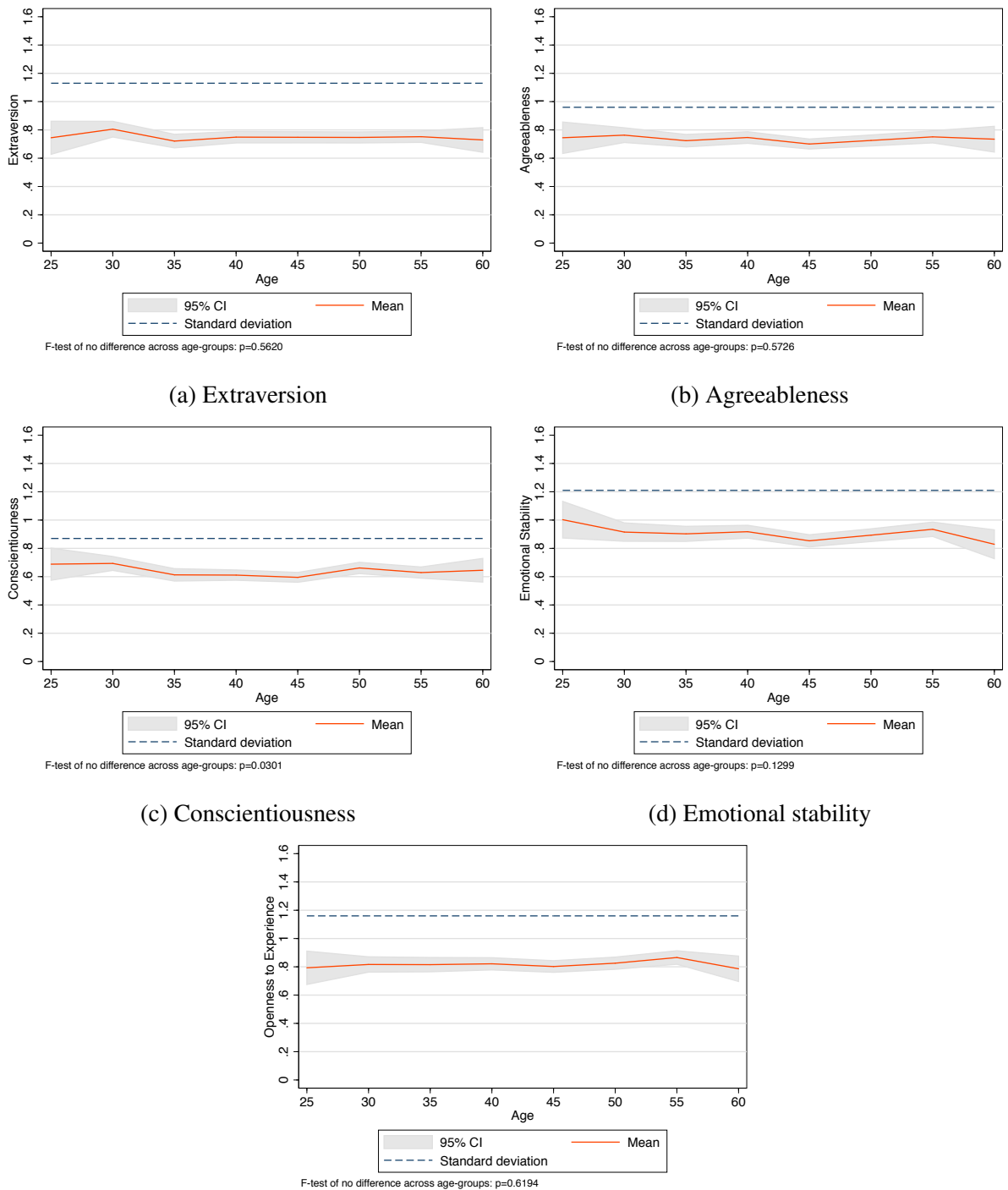
For conscientiousness there is a significant difference between the youngest age group and most other groups in 2005 and 2009 but only between the youngest and the 55-59 year old in 2013. For extraversion it starts in 2005 with a significant difference between the individuals aged 25-

34 and the individuals between 55-59 years of age. In 2009 the differences are between the 30-44 and again the 55-59 year olds and in 2013 only between the individuals aged 40 to 44 and the 50-64 year old individuals. All differences range between 0.13 and 0.33 points on the 7 point Likert-scale. Taking for example individuals who are 55-59 years old in 2009 it can be shown that they are significantly less emotional stable by 0.22 points on the 7 point Likert-scale compared to individuals who are between 40 and 45 years old. While the latter group grew up and was socialized during the 80's, a more or less safe and stable time period, the other group was socialized during the late 60's and early 70's which was the time of the students riots in 68, the Vietnam war and the terror of the RAF (Red Army Fraction), possibly leading to greater anxiety. The difference between the specific cohorts is also observable in 2005 but no longer in 2013 which could be due to the mixing of the age groups over time. A closer investigation of this hypothesis is out of the scope of this paper. The important aspect is that the difference in means between the age groups is not caused by age, but it is rather a cohort effect.

The next part presents the analysis for the average absolute change in mean-levels on the combined sample of women and men between 2005 to 2013. The graphs for the average absolute changes are based on the age in 2009 (see Figure 4.3). The absolute change is used as the presented data above shows large variation in each direction. The interested reader is referred to the appendix for the graphs related to the changes of 2005-2009 and 2009-2013.

The figures show the average absolute change between 2005 and 2013 across age groups for all Big-Five traits. Additionally, the dashed line represents the sample standard deviation of each trait. The average absolute change is between 0.6 and 1 point on the 7 point Likert-scale. Emotional stability shows the largest absolute changes of all traits. The only trait that indicates a significant difference across the age groups is conscientiousness, while Cobb-Clark and Schurer (2012) also find differences for agreeableness. The ANOVA to check for significant differences between the age groups only reports significant differences for conscientiousness supported by the Bonferroni multiple-comparison test which reveals that 30-34 year old individuals have a significantly different average absolute change compared to the 45-49 year old individuals. For the absolute changes from 2005 to 2009 only emotional stability shows a difference between the last two age groups. The absolute changes from 2009 to 2013 show no significant difference between the age groups.

In general there are significant absolute changes in the population and in each age group. The



(c) Conscientiousness

(d) Emotional stability

(e) Openness to experience

Note: Age groups are defined as 25 = 25-29; 30 = 30-34; 35 = 35-39; 40 = 40-44; 45 = 45-49; 50 = 50-54; 55 = 55-59; 60 = 60-64

Figure 4.3: Absolute Changes in the Big-Five Personality Traits between 2005 and 2013

size of the average absolute difference is between 0.66 and 0.82 standard deviations indicating considerable movement of the individuals. The significant differences in age groups do not recur for the different time frames and the Bonferroni multiple-comparison test results confirm that there are no systematic age effects. Therefore, there is no larger or smaller variation in the

traits over age for the investigated age frame.

### 4.3.2 Intra-individual Consistency

This subsection investigates how the traits change for each individual. For a better understanding of the observed changes, it is considered if certain adverse events have a significant impact on the change in the Big-Five traits. The analysis considers adverse life events in the family and health domain between 2005 and 2013. The analysis finds significant effects for the adverse life events as a whole indicating that people who experience such events have larger changes in their Big-Five scores. Splitting the sample between genders and discriminating between health and family events reveals that men are less effected by the events and show lower changes compared to women. Finally, discriminating between different events for each domain reveals more pronounced effects for the different life events.

The analysis uses a similar approach to Cobb-Clark and Schurer (2012) creating the following adverse life events for the family domain: death of a spouse, death of the mother, death of the father, death of a child, and death of another household member<sup>11</sup>. It would also be interesting to include property crimes but unfortunately the data is not available in the *SOEP*. The health domain includes five conditions: having a stroke, high blood pressure, being diabetic, having cancer and getting disabled<sup>12</sup>. The status change for disabled individuals is counted if the change was within the observational time frame. The *SOEP* provides data on disability for the full time frame while the other health data have only been collected in 2009, 2011, and 2013. Furthermore, while disability is coded as an actual status change the other health questions asked if the diagnosis has been made at any point in time regardless of the survey year. Adverse employment measures are not included as they most likely suffer from endogeneity as they are more influenced by changes in personality traits of the individual compared to the death of someone close. The problem is that the causality cannot be determined, especially in the case of wage drops or being fired. It might be the case that a person experienced these events because she had the change in personality and not the other way around.

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<sup>11</sup>Death of a child has been included in the *SOEP* from 2007 onward and death of another household member from 2008 onward.

<sup>12</sup>Additional health markers available in the *SOEP* have been excluded either because of endogeneity concerns, e.g. psychiatric disorders or because they only have been observed in 2011 and 2013, and are therefore not available in the time frame from 2005 to 2009.

Before discriminating between gender it is worth investigating if the individuals who have been effected by adverse life events either in health or family domain show larger differences compared to the individuals who have not experience such events. The dependent variable is the standardized (i.e., mean = 0, standard deviation = 1) intra-individual change in the respective trait. The control variables include dummy indicators which are equal to one if an individual has experienced events in the respective domain and zero otherwise. Furthermore, following Cobb-Clark and Schurer (2012) additional controls for age, marital status, immigrant status, education, income and employment status measured in the respective base year are added.

In general one would assume that the adverse life events occur at random and that the groups are therefore assigned randomly. For the health domain the assumption is stronger as certain behavioral patterns are likely to increase events like diabetes and high blood pressure, such as higher sugar intakes (Malik et al., 2010). But there are also genetic markers increasing the risk to be effected which are not influenced by the individuals (Collins, 2010). The measure of the Big-Five is four years apart increasing the likelihood that there are other events that have an effect on the traits. If the additional events occur randomly in both groups there would be no problem with this approach. If they occur mainly in the control group there might be no significant difference left. On the other hand if they occur mainly in the treatment group the effects will be biased upwards.

Table 4.2 shows the estimated effects for the standardized intra-individual changes for three different time frames. Column one and two in Table 4.2 report significant negative effects on emotional stability if one experienced adverse health events between 2005 and 2009 decreasing the score by 0.114 standard deviations (*SD*). All other traits seem to be unaffected in the time frame from 2005 to 2009 and there is no effect for the family events. Column three and four give the estimates for the time frame from 2009 to 2013 indicating significant effects for emotional stability if one experiences adverse health events and again no significant effects for the adverse family events. The last four columns represent the effects for the time horizon from 2005 to 2013 using the indicator variables for both event domains and the two time frames. For the full time horizon individuals who experience adverse health events between 2005 and 2009 show significant negative effects on emotional stability and openness to experience decreasing the score by 0.097 *SD* and 0.082 *SD* respectively. If individuals experience adverse life events in both domains between 2009 and 2013 they show lower scores of openness to experience decreasing the score by 0.169 *SD*. If one experiences only adverse family events between 2009



and 2013 the score of openness to experiences decreases by 0.121 *SD* between 2005 and 2013. Emotional stability is effected in all time frames although for the full time frame the effect seems to be related to the events between 2005 and 2009. There is only one significant effect for the family events which seems odd as one would expect a severe impact of the death of someone close.

Table 4.2: Intra-Individual Change Estimates for the Different Time Frames

	2005-2009		2009-2013		2005-2013			
					2005-2009		2009-2013	
	Health	Family	Health	Family	Health	Family	Health	Family
Extraversion	0.019 (0.036)	-0.022 (0.064)	-0.001 (0.033)	0.058 (0.074)	0.023 (0.043)	-0.022 (0.064)	0.006 (0.041)	0.083 (0.072)
Combined	-0.106 (0.104)		-0.089 (0.097)		-0.106 (0.104)		-0.114 (0.098)	
Agreeableness	0.017 (0.037)	-0.018 (0.063)	0.016 (0.033)	-0.034 (0.064)	0.008 (0.045)	-0.018 (0.063)	0.016 (0.041)	-0.020 (0.065)
Combined	-0.105 (0.102)		-0.031 (0.093)		-0.107 (0.102)		-0.016 (0.096)	
Conscientiousness	-0.004 (0.035)	0.028 (0.061)	0.040 (0.033)	-0.066 (0.064)	-0.048 (0.045)	0.026 (0.061)	0.068 (0.042)	-0.051 (0.064)
Combined	-0.091 (0.100)		0.020 (0.091)		-0.093 (0.100)		0.011 (0.094)	
Emotional Stability	-0.114 *** (0.036)	-0.061 (0.058)	-0.071 ** (0.033)	-0.044 (0.069)	-0.097 ** (0.045)	-0.060 (0.058)	-0.046 (0.042)	-0.072 (0.070)
Combined	0.096 (0.095)		0.139 (0.094)		0.100 (0.095)		0.152 (0.096)	
Openness to Experience	-0.045 (0.037)	0.051 (0.064)	0.005 (0.033)	-0.070 (0.062)	-0.082 ** (0.045)	0.049 (0.064)	0.038 (0.041)	-0.121 * (0.064)
Combined	-0.113 (0.103)		0.089 (0.092)		-0.110 (0.103)		0.169 * (0.095)	
N	4,275		4,389		4,275			
Adv. Events	1,634		2,185		2,451			
Events	1,343	469	1,936	496	1,343	469	1,906	476
Both events	178		247		178		236	

Notes: \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level. Every entry represents a single regression on the respective trait for the give time frame with additional controls: age, relationship status, migration background, education, employment and net income. Standard deviation in parenthesis. Combined represents the point estimate of having experienced both health and family events.

The next part will split the sample between women and men, and will use cumulative measures of the adverse life events to investigate accumulation effects if one experiences more than one adverse life event. The actual number of events as well as dummy indicators for the individuals who have experienced an extreme number of events (larger 2 *SD* and larger 3 *SD*)<sup>13</sup> are used as controls in separate regressions. As in the case above the standardized intra-individual changes in the Big-Five between 2005 and 2013 traits are used. The models are based on the 2005 data and are separately estimated for women and men using ordinary least squares applying the same controls as above. Therefore, the results can similarly be interpreted as standard deviation changes in the respective trait.

Table 4.3 shows the estimates for the adverse life event measures. For men only openness to experience is significantly affected by the adverse life events in the family domain. Men in-

<sup>13</sup>Family 2 *SD* ≥ 1 event and 3 *SD* ≥ 2 events. Health 2 *SD* ≥ 2 events and 3 *SD* ≥ 3 events.

Table 4.3: Estimated Effects of Combined Family and Combined Health Events by Gender

	Extraversion	Agreeableness	Conscientiousness	Emotional Stability	Openness to Experience	N
<b>Men</b>						
Family	-0.005 (0.048)	0.033 (0.048)	0.028 (0.046)	0.017 (0.045)	0.091 ** (0.046)	
2SD	-0.003 (0.053)	0.036 (0.054)	0.032 (0.054)	0.039 (0.052)	0.090 * (0.051)	457
3SD	-0.013 (0.177)	0.063 (0.168)	0.027 (0.144)	-0.127 (0.145)	0.249 (0.172)	43
<b>Health</b>						
	0.030 (0.032)	0.005 (0.030)	-0.004 (0.031)	-0.071 ** (0.029)	0.016 (0.030)	
2SD	0.053 (0.074)	-0.050 (0.075)	-0.063 (0.076)	-0.183 ** (0.073)	0.067 (0.073)	240
3SD	0.140 (0.156)	-0.043 (0.142)	-0.017 (0.152)	-0.226 * (0.130)	0.260 ** (0.125)	54
<b>Women</b>						
Family	0.061 (0.045)	-0.051 (0.046)	0.052 (0.047)	0.028 (0.047)	-0.044 (0.046)	
2SD	0.071 (0.050)	-0.043 (0.055)	0.058 (0.054)	0.035 (0.055)	-0.048 (0.054)	439
3SD	0.080 (0.156)	-0.186 (0.135)	0.092 (0.160)	0.018 (0.148)	-0.090 (0.139)	48
<b>Health</b>						
	0.006 (0.032)	0.073 ** (0.033)	0.009 (0.032)	-0.031 (0.033)	0.001 (0.032)	
2SD	0.002 (0.083)	0.110 (0.083)	-0.030 (0.078)	0.004 (0.080)	-0.033 (0.078)	178
3SD	0.042 (0.162)	0.164 (0.152)	-0.176 (0.186)	-0.046 (0.194)	0.349 ** (0.167)	33

Notes: \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level. OLS coefficients are interpreted in terms of a standard-deviation change in the respective mean-level change. The Family and Health regressions include a control simply counting the number of events. N relates to the number of individuals for whom the shock indicator is equal to 1 for having more events than 2 *SD* or 3 *SD* from the mean. Every entry represents a single regression on the respective trait with additional controls: age, relationship status, migration background, education, employment, net income and the number of events in the other domain. The analysis is based on a sample of 2,189 men and 2,086 women aged between 25 and 64.

crease their openness by 0.091 *SD* for each event they experience. The effect is almost identical using the indicator variables for the 2 *SD* but at a lower significance level while for the 3 *SD* the estimated effect is insignificant. This indicates that the effects diminish for additional family events. In the health domain emotional stability and openness are both effected by adverse events. For emotional stability the effect per adverse health event is a decrease by 0.071 *SD*. Additionally, for the 2 *SD* indicator variable the effect increase to 0.183 *SD* if one experiences more than 2 events. For the 3 *SD* indicator variable the effect increases to 0.266 *SD* for individuals how experience more than 3 events in the health domain. Openness is only effected at the extreme if one accumulates events beyond 3 *SD* from the mean with an increase of 0.260 *SD*. Therefore, instead of withdrawing from life men seem to counteract the adverse life events by trying out new things. A part of the effect could be attributed to the change in routine that is likely to be inflicted by some of the adverse health events. In both instances the point estimates increase for the indicator variables suggesting that the effects of the single life events tend to accumulate.

For women there are no significant effects of the adverse family events on the Big-Five. Women get more agreeable with each adverse health event increasing their score by 0.073 *SD*. Similar

to men there is an increase for openness to experience for the 3 *SD* indicator with a slightly larger point estimate of 0.349 *SD* if one experiences equal to or more than 3 adverse health events. Estimating the models based on the 2009 values for the control variables leads to qualitatively similar results for men. For women the results vary greatly showing negative effects of adverse health events on emotional stability and positive effects of adverse family events on extraversion. This sensitivity indicates that the effects for women have to be interpreted cautiously.

The last step of this part of the analysis now uses the separate life events to estimate their effects on the Big-Five. Table 4.4 shows the significantly estimated life events for the different Big-Five measures by gender. Every column represents a single regression analysis with the standardized intra-individual change as the dependent variable and additional controls mentioned above measured in 2005<sup>14</sup>. Similar to Cobb-Clark and Schurer (2012) the results are interpreted as standard deviation changes. The blank spaces represent insignificant estimates with p-values above 0.1 for the regressions<sup>15</sup>.

Table 4.4: Estimated Effects of Adverse Life Events by Gender

	Women					Men				
	Ext	Agree	Consc	Emstab	Open	Ext	Agree	Consc	Emstab	Open
Death of a spouse										
Death of father										
Death of mother										0.18 ** (0.07)
Death of a child			0.43 ** (0.20)	-0.80 *** (0.09)	-2.03 *** (0.44)				-0.73 *** (0.28)	
Death a household m.					-0.76 ** (0.34)					
Stroke		0.62 *** (0.19)	-0.48 ** (0.20)				0.41 * (0.23)			
High blood pressure										
Diabetes									-0.18 * (0.09)	
Cancer										
Disability					-0.17 * (0.09)					

Notes: \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. Every column represents a single regression on the respective trait with additional controls: age, relationship status, migration background, education, employment and net income. Standard errors in parenthesis. The analysis is based *SOEP* data with a sample of 2,189 men and 2,086 women

While the personality of a man only seems to be effected by the death of his mother or a child, women show significant effects only for the death of a child or another person living in the household. Similar to men there are strong effects for the death of a child that do not show up for the combined measures. This indicates that the combination of the adverse events disguises

<sup>14</sup>Using the measures based on the 2009 values results in qualitatively similar results.

<sup>15</sup>The interested reader is referred to the appendix for the complete table.

effects of single adverse life events. Men are most effected by the death of a child which decreases their emotional stability by 0.73 standard deviations (*SD*) while the death of their mother increases their openness to experience by 0.18 *SD*.

For women the effect of the death of a child is slightly larger with a decrease 0.80 *SD* in their emotional stability score. Furthermore, the death of a child seems to increase the conscientiousness of women by 0.43 *SD* and has a negative effect on their openness to experience with a decrease of 2.03 *SD*. There is also a negative effect of 0.76 *SD* of the death of another household member on openness to experience. This indicates a withdrawal into the known, by being less curious and feeling less excitable. There are no effects of the death of a spouse or the death of the father for neither women nor men. This is odd as one would expect significant changes at least by the death of a spouse. The average age for individuals who lose a spouse is six years above the sample average indicating that most individuals are older and the event might not come as such a surprise. Therefore, it has a lower impact on the personality traits. Interesting to note is that the combined adverse life events in the family domain show no significant effect on openness to experience, while at the same time the largest point estimate for the single adverse life event is the death of a child on openness to experience.

If diagnosed with a stroke both women and men show positive effects on agreeableness. Women become more agreeable with an increase of 0.62 *SD* and men increase by 0.41 *SD*. Therefore, both are getting more tender minded and less stubborn. Additionally, women also show a decrease for conscientiousness after a stroke by 0.48 *SD*, decreasing their level of competence, organization, and motivation. For both women and men there are no effects of high blood pressure indicating that this diagnosis has no severe impact on the personality traits. This matches the expectation as high blood pressure has no severe impact on the life style of individuals. If men are diagnosed with diabetes their emotional stability decreases by 0.18 *SD*. Women's emotional stability is negatively effected when they become disabled in any way decreasing emotional stability by 0.17 *SD*. The presented results are generally in line with findings by Specht et al. (2011) for the 2005 to 2009 time horizon. Certain life events can have a significant effect on the size of the intra-individual change and therefore on the Big-Five traits themselves although they can only explain a small part of the observed variation.

### 4.3.3 Economic Impact

Another question is how economically important these changes in the Big-Five dimensions are. This analysis uses estimates for the wage effects based on the used sample drawn from the *SOEP*. The estimation sample includes 1,451 women and 1,595 men for whom at least 2 observations are available resulting in 3,775 observations for women and 4,319 observations for men. The log of the gross monthly wage is regressed on the standardized personality traits. Table 4.5 reports the estimates of the pooled OLS regression as well as the estimates of the Hausman-Taylor regression following Heineck and Anger (2010) and the estimates of a fixed-effects regression using the observed variation in the Big-Five traits. All models account for selection bias using the sample selection procedure proposed by Heckman (1979) and include individual controls following the estimation approach by Heineck and Anger (2010)<sup>16</sup>.

Table 4.5: Monthly Gross Wages Regressed on Personality Traits

Variable	Men			Women		
	OLS	HT	FE	OLS	HT	FE
Extraversion	0.0029 (0.0077)	0.0246 (0.0230)	0.0030 (0.0057)	-0.0151 (0.0094)	-0.0339 (0.0217)	0.0020 (0.0088)
Agreeableness	-0.0408*** (0.0075)	-0.0756 (0.0602)	-0.0054 (0.0046)	-0.0315*** (0.0095)	-0.0856*** (0.0187)	0.0141* (0.0074)
Conscientiousness	0.0080 (0.0073)	0.0164 (0.0182)	0.0044 (0.0054)	0.0162* (0.0097)	0.0224 (0.0251)	0.0162** (0.0080)
Emotional stability	0.0122 (0.0084)	0.0097 (0.0171)	0.0007 (0.0053)	-0.0054 (0.0087)	0.0024 (0.0181)	-0.0074 (0.0081)
Openness	0.0193** (0.0078)	-0.0151 (0.0237)	0.0018 (0.0058)	-0.0117 (0.0090)	0.0089 (0.0196)	-0.0048 (0.0086)
Invid. controls	+	+	+	+	+	+
Add. traits	+	+	-	+	+	-
$R^2$	0.54		0.23	0.54		0.22

Note: \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. Standard errors appear in parentheses. Clustered standard errors are calculated to account for possible intra-individual correlation of error terms. The sample size in each regression is  $N=3,775$  (1,451) for women and  $N=4,319$  (1,595) for men. All models account for sample selection using Heckman's correction procedure (Heckman, 1979). HT refers to the Hausman-Taylor regression and FE to the fixed-effects regression. The FE regression excludes locus of control, pos. reciprocity and neg. reciprocity as these are time-invariant in the data.

The pooled OLS regression with sample selection estimates significant wage-effects of agreeableness decreasing the wage of men by 4.1% and women by 3.2% per standard deviation increase in the trait. Additionally, there seem to be positive effects of conscientiousness on women's wage increasing the wage by 1.6% per standard deviation increase. Also openness seems to have a positive effect on the wage of men increasing it by 1.9% per standard deviation

<sup>16</sup>The controls are: age, age squared, living in east Germany, being a couple, migration background, education, being a state employee, working in a firm with over 2,000 employees, having a white collar job, working full time, having a time limited contract, tenure, tenure squared and year dummies.

increase.

Following the approach by Heineck and Anger (2010) the Hausman-Taylor estimator is used to estimate the wage effects of the Big-Five utilizing the panel design of the *SOEP*. The underlying assumption is that the traits are stable over time. Contrary to Heineck and Anger (2010) there are now three observations for the Big-Five for the years 2005, 2009, and 2013. The standardized average trait score for each individual over the three years is used in each year in order to apply the Hausman-Taylor estimator and to satisfy the stability assumption. Using the average implies that the observed variations are measurement errors and that the average represents the assumed to be stable Big-Five trait. The cognitive ability control variable used by Heineck and Anger (2010) cannot be included as no one in the sample took part in the measurement of the cognitive abilities. Similar to Heineck and Anger (2010) the Hausman-Taylor estimates return no significant estimates of the Big-Five for men. For women the same trait (agreeableness) shows a significant effect as in Heineck and Anger (2010) but the point estimate is more than twice the size of the point estimate by Heineck and Anger (2010). The negative effect of agreeableness decreases the wage by 8.6% per standard deviation. It has to be considered that testing for over-identification after estimation indicates that the Hausman-Taylor estimator may not be appropriate in this case.

Finally, the fixed-effects estimations use the observed variation in the Big-Five utilizing the within variation of each individual. Applying the fixed effects estimator denies the use of the locus of control and the reciprocity variables as controls as they are time invariant. As for the Hausman-Taylor estimates there are no significant effects for men. For women there is now a positive effect of agreeableness increasing the wage by 1.4% per standard deviation and a positive effect for conscientiousness increasing the wage by 1.6% per standard deviation. Over the full trait scale observed in the sample the effect from the lowest to the highest value would be 8.6% for agreeableness and 9.4% for conscientiousness<sup>17</sup>. There is a reversal of the effect direction of agreeableness between the Hausman-Taylor estimation and the fixed-effects estimation. One reason could be the exclusion of the additional controls locus of control and reciprocity. A separate Hausman-Taylor regression which excludes the additional traits has been estimated and shows no qualitative change in the estimate. The estimated effect is now 0.7% per standard deviation and is still negative. Therefore, the reversal in the effect is not caused by

<sup>17</sup>The change over the full scale is calculated using the difference between the highest and the lowest value divided by the standard deviation of the trait times the effect of the trait:  $\Delta_{full} = ((max_{Big5} - min_{Big5}) / SD_{Big5}) \cdot w_{Big5}$ .

the exclusion of the locus of control and instead is due to the observed variation in the data.

The problem remaining with the fixed-effects estimates is the variation used for the estimation. There is the possibility of reversed causality as there is no way to be sure that the change in the traits has caused the change in wage and not the other way around. If changes in the wage actually change the traits, the estimation would suffer from endogeneity and the estimates would likely be inconsistent. Nevertheless, given the facets associated with agreeableness a positive relationship seems more plausible than the other way around. This also holds true for the possible effect of conscientiousness on wage. Still the fixed effects estimates should be seen as purely exploratory.

The average wage based on the estimation sample gives an average gross monthly wage for women of €2167.69 and €3447.54 for men in 2005 wages. The gross monthly wages are used as there are 695 wage observations missing the information on contracted working hours. Therefore, using the hourly wages would have further reduced the sample size. The 3 *SD* adverse health-events are used to give an upper bound for the possible effects of the Big-Five on wage. Combining the estimates with the average monthly wage for women and men gives the wage equivalent personality change expressed in Euros per month in 2005 values. The wage effects for the change in the Big-Five are computed as follows:

$$\Delta_i^w = w_i^{Big5} \cdot s_i^{Big5} \cdot \bar{x}_i^w; \quad i \in \{men, women\}$$

where  $\Delta_i^w$  is the wage equivalent effect of the adverse life events based on the change in a Big-Five trait,  $w_i^{Big5}$  as the Big-Five wage return induced by a one standard deviation change in the trait,  $s_i^{Big5}$  the estimated standard deviation change in response to the adverse life events, and  $\bar{x}_i$  as the average monthly wage for men and women. The results are reported in Table 4.6.

There are basically no wage equivalent effects as there is no combination in which both the wage effect of the Big-Five and the Big-Five changes in response to adverse health events are significant. For the sake of the argument using the face values gives the following results. The largest effect would be an increase in the average gross monthly income for men by €14.48 based on the positive effect of adverse health events on extraversion and the positive effect of extraversion on wages. For women the largest effect would be a wage effect of €7.38 for the

Table 4.6: Wage equivalent of changes in Big-Five personality traits due to adverse health events

	Est. FE wage effect	Est. shock of $\leq 3$ health events on Big 5	Wage equiv. in absolute €	
			by individual Big 5 trait	sum over all Big 5 traits
<b>Men</b>				
Extraversion	0.030	0.140	14.48	
Agreeableness	-0.054	-0.043	8.01	
Conscientiousness	0.044	-0.017	2.58	27.64
Emotional Stability	0.001	-0.226*	0.78	
Openness to Experience	-0.002	0.260**	1.79	
<b>Women</b>				
Extraversion	0.002	0.045	0.20	
Agreeableness	0.014*	0.164	4.98	
Conscientiousness	0.016**	-0.176	6.10	22.44
Emotional Stability	-0.074	0.046	7.38	
Openness to Experience	-0.005	0.349***	3.78	

Notes: \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively. Data taken from *SOEP*, average monthly wage in the estimation sample in 2005 values for men = € 3447.54, women = € 2167.69.

change of emotional stability of women in response to adverse health events and the corresponding effect on wages. Summing up the absolute values of the would-be-changes reveals that the possible variation in income amounts to € 27.66 for men and € 22.44 for women per month. Compared to the average monthly wages this would be 0.8% for men and 1% for women.

One effect that can be calculated is the effect of having a stroke on the wages of women since the adverse health event significantly effects the agreeableness and conscientiousness. Both are also significantly estimated in the fixed effects wage regressions. The effect on agreeableness returns a wage equivalent of € 18.82 per month and the effect on conscientiousness returns a wage equivalent of € 16.65. Both effects point in different directions as the health event on conscientiousness is negative. Thus, any observable income effect would be reduced to € 2.17.

The economic effect is quite small and if only the effects are used for which the wage effect and the effect of the adverse life events are significant, the wage effect of adverse life events through the Big-Five is close to zero. Only singular adverse events actually result in wage equivalent changes. Furthermore, one has to consider that the health events will affect the wage in a more direct way than through the personality traits as events such as having a stroke or having cancer have a high chance of rendering somebody unable to work.

#### 4.4 Conclusion



The findings presented in this paper show that there are only minor changes in the Big-Five traits for the sample population as a whole. Additionally, there seem to be no systematic age effects. Nevertheless, the analysis shows significant intra-individual changes in the Big-Five traits. This indicates that stable population means are due to positive and negative individual changes canceling each other out. The average absolute change in the traits for the sample population is usually just above two thirds of a standard deviation. Some of this variation can be attributed to adverse life events which influence the traits. Still a large part of the variation is not explainable through life events which begs the question about the source of this variation. Additionally, women seem to more effected by adverse life events compared to men. This difference is most pronounced in the the reaction to adverse family events, which decrease openness to experience of women while they increases it for men.

The last part of the analysis gives an overview of how the adverse life events effect wages through the Big-Five. The wage equivalent effects are relatively small if there are some at all. As for the most pronounced family event, the death of a child, the effect on monthly wages is still below 1% of monthly wages as the trait most affected by this event does not have any effect on wages. The direct effects of the adverse life events on wages are most likely larger in size because some will render the individual unable to work.

Overall it can be concluded that there is a fairly large variation in the traits for a working age population. The time frame between each observation is four years which makes it very hard to establish any causal reasons for these changes. Any significant change found could be interpreted as a lower bound of the actual effect size. As the adverse life events explain only a small part of the observed variation in the Big-Five and the additional change in the placement of the short Big-Five inventory in the *SOEP* leaves space for measurement errors.

On top of that the general time frame discussed in this paper is limited although certain topics in economics deal with the whole working life of an individual. These topics could be the case for career developments, life-cycle spendings and savings for retirement. All of these cover up to and more than 40 years of an individual, while this analysis is based on an eight year time window. This issue will resolve over time once additional waves have been collected. If the representative data sets are continuously collected and stick to the pattern there will be a new wave with Big-Five data in the 2017 *SOEP* wave. Thereby 40 years will still not be covered but it enhances the observational window to 12 years which could give further insights into the

issues discussed. Additionally, representative data that collect the traits on a yearly basis could enable future research to determine the sources of potential changes more precisely.

## 4.5 Appendix to Chapter 4

Table A4.1: Mean Comparison for the *SOEP* and *HILDA* Data

	<i>SOEP</i>		<i>HILDA</i>	
	Mean	SD	Mean	SD
Extraversion	4.821	1.134	4.395	1.087
Agreeableness	5.346	0.965	5.403	0.888
Conscientiousness	5.925	0.872	5.152	1.005
Emotional stability	4.161	1.207	5.195	1.047
Openness to experience	4.490	1.169	4.237	1.052

*Notes:* Data taken from *SOEP* wave 2005, 2009 and 2013. The pooled sample consists of 17,028 individual observations. The *HILDA* means are taken from Cobb-Clark and Schurer (2012). SD = standard deviation

Table A4.2: Descriptive Statistics of Personality Traits and their Change between 2005 and 2013 (Men)

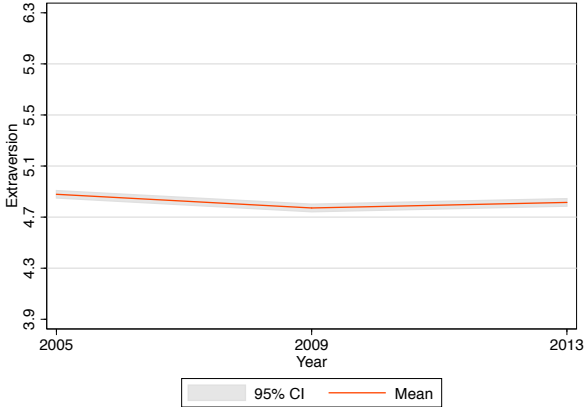
	Level		Changes between 2005 and 2009						
	Mean	SD	Mean	SD	Percentile of distribution				
					1st	25th	50th	75th	99th
Extraversion	4.667	1.136	-0.082	1.010	-2.667	-0.667	0.000	0.667	2.333
Agreeableness	5.172	0.977	-0.114	0.997	-2.667	-0.667	0.000	0.333	2.333
Conscientiousness	5.843	0.898	-0.110	0.894	-2.333	-0.667	0.000	0.333	2.333
Emotional stability	4.417	1.161	0.168	1.143	-2.667	-0.667	0.000	1.000	3.000
Openness	4.388	1.138	-0.039	1.077	-3.000	-0.667	0.000	0.667	2.667
Absolute changes			Mean	SD	1st	25th	50th	75th	99th
Extraversion			0.761	0.669	0	0.333	0.667	1	2.667
Agreeableness			0.763	0.652	0	0.333	0.667	1	2.667
Conscientiousness			0.651	0.623	0	0.333	0.333	1	2.667
Emotional stability			0.887	0.74	0	0.333	0.667	1.333	3.333
Openness			0.820	0.699	0	0.333	0.667	1	3

*Notes:* Data taken from *SOEP* wave 2005, 2009 and 2013. The pooled sample consists of 17,028 individual observations. Level reports the pooled average for the full sample. Std = standard deviation

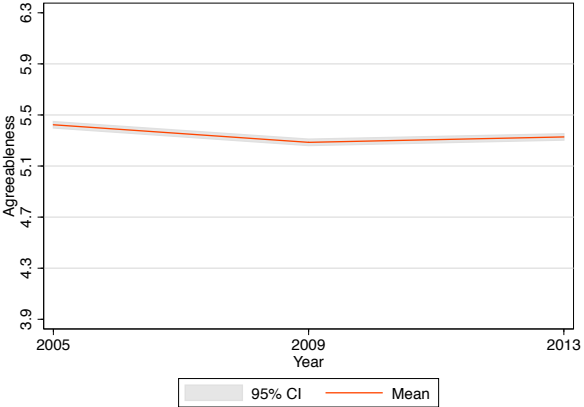
Table A4.3: Descriptive Statistics of Personality Traits and their Change between 2005 and 2013 (Women)

	Level		Changes between 2005 and 2009						
	Mean	SD	Mean	SD	Percentile of distribution				
					1st	25th	50th	75th	99th
Extraversion	4.934	1.105	-0.100	0.946	-2.333	-0.667	0.000	0.333	2.333
Agreeableness	5.529	0.926	-0.137	0.915	-2.333	-0.667	0.000	0.333	2.000
Conscientiousness	6.000	0.853	-0.091	0.851	-2.333	-0.667	0.000	0.333	2.000
Emotional Stability	3.889	1.208	0.119	1.126	-2.667	-0.667	0.000	0.667	3.000
Openness to Experience	4.564	1.207	-0.138	1.067	-2.667	-0.667	0.000	0.667	2.667
Absolute changes			Mean	SD	1st	25th	50th	75th	99th
Extraversion			0.741	0.639	0.000	0.333	0.667	1.000	2.667
Agreeableness			0.706	0.619	0.000	0.333	0.667	1.000	2.667
Conscientiousness			0.615	0.597	0.000	0.333	0.333	1.000	2.667
Emotional Stability			0.912	0.754	0.000	0.333	0.667	1.333	3.333
Openness to Experience			0.825	0.700	0.000	0.333	0.667	1.333	3.000

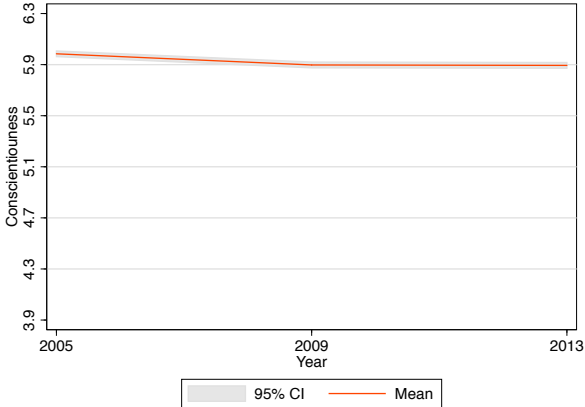
*Notes:* Data taken from *SOEP* wave 2005, 2009 and 2013. The pooled sample consists of 17,028 individual observations. Std = standard deviation



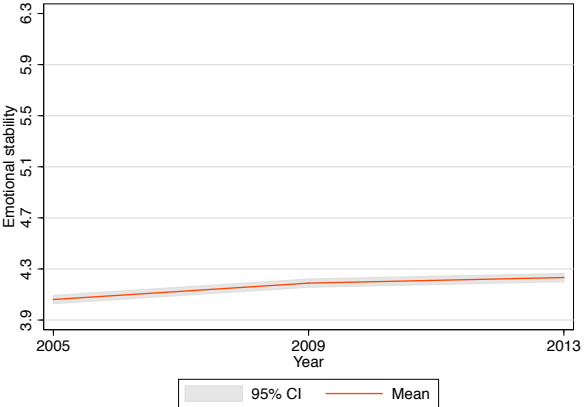
(a) Extraversion



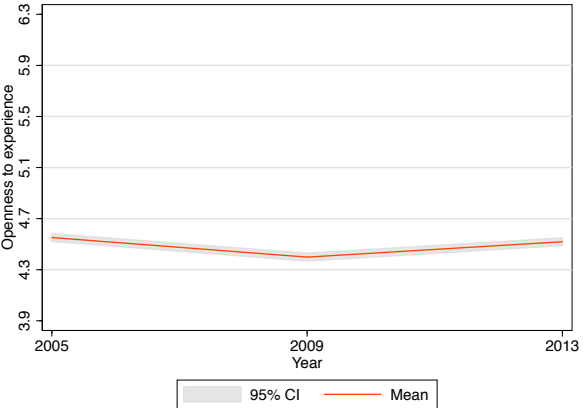
(b) Agreeableness



(c) Conscientiousness

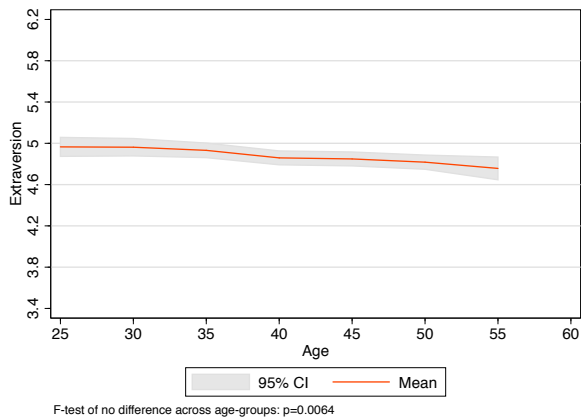


(d) Emotional stability

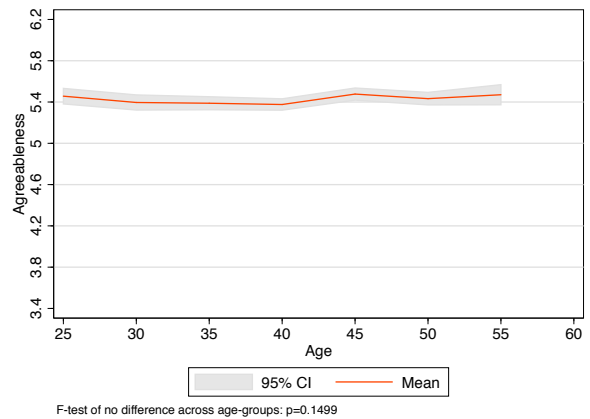


(e) Openness to experience

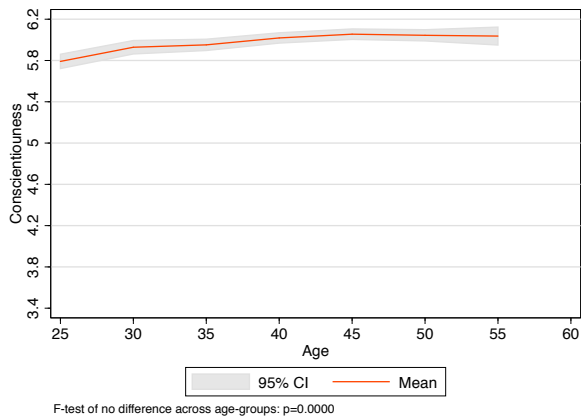
Figure A4.1: Sample Mean Levels of the Big-Five Personality Traits from 2005 to 2013



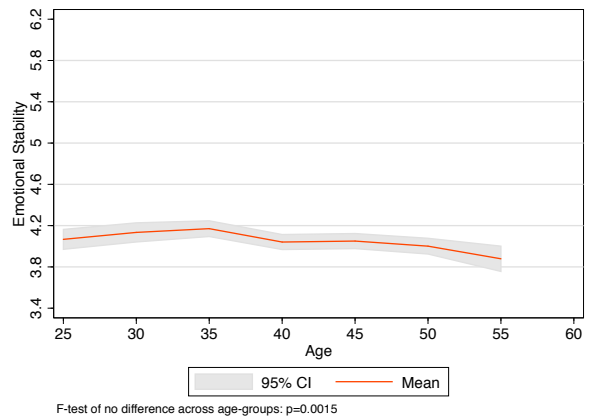
(a) Extraversion



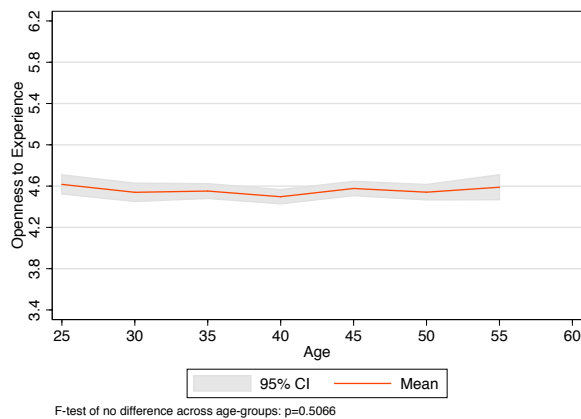
(b) Agreeableness



(c) Conscientiousness



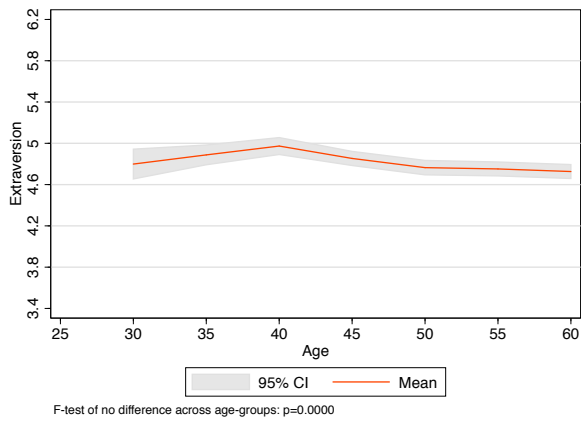
(d) Emotional stability



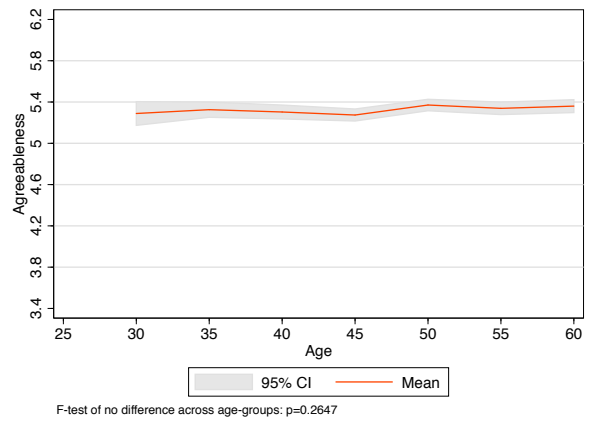
(e) Openness to experience

Note: Age groups are defined as 25 = 25-29; 30 = 30-34; 35 = 35-39; 40 = 40-44; 45 = 45-49; 50 = 50-54; 55 = 55-59; 60 = 60-64

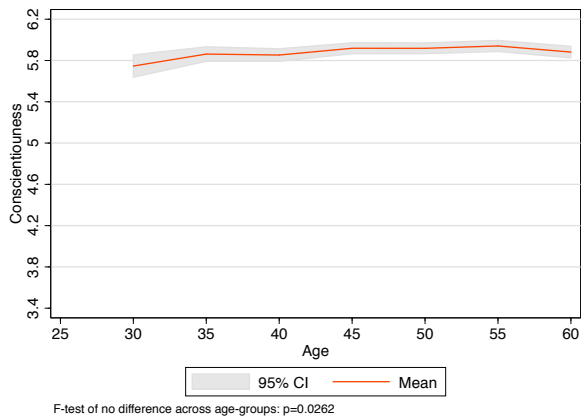
Figure A4.2: Mean Values for Big-Five Personality Traits over Age Groups for 2005



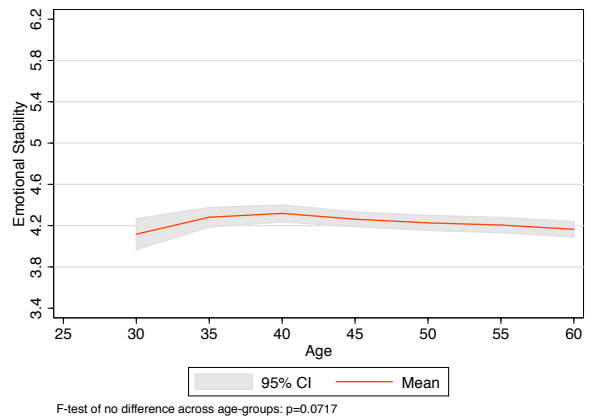
(a) Extraversion



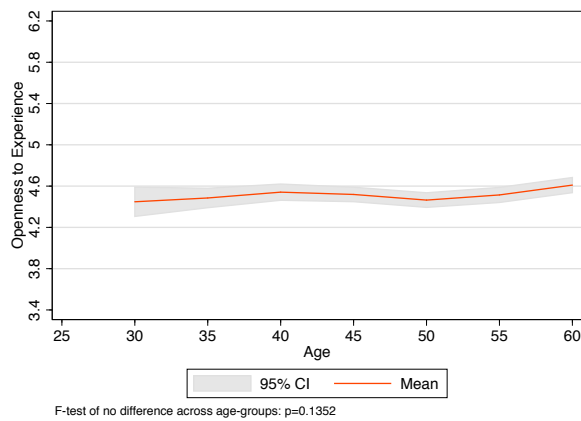
(b) Agreeableness



(c) Conscientiousness



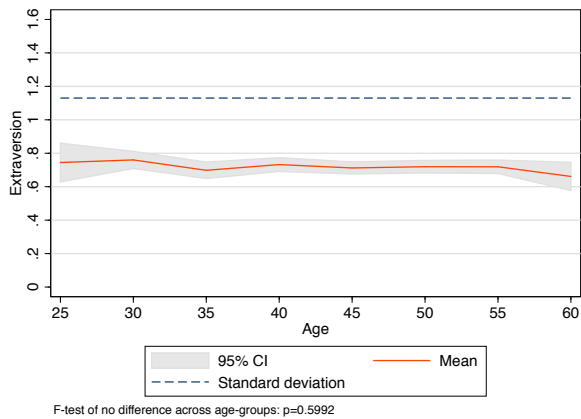
(d) Emotional stability



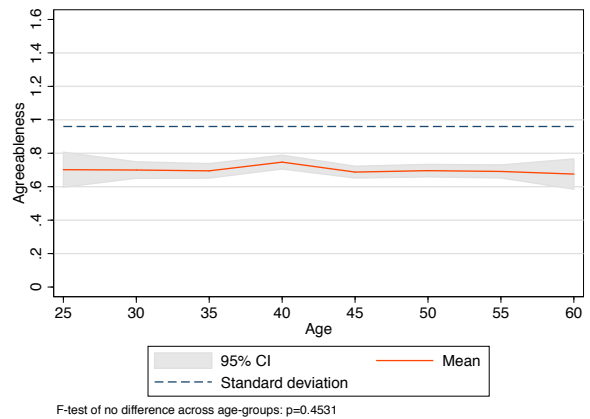
(e) Openness to experience

Note: Age groups are defined as 25 = 25-29; 30 = 30-34; 35 = 35-39; 40 = 40-44; 45 = 45-49; 50 = 50-54; 55 = 55-59; 60 = 60-64

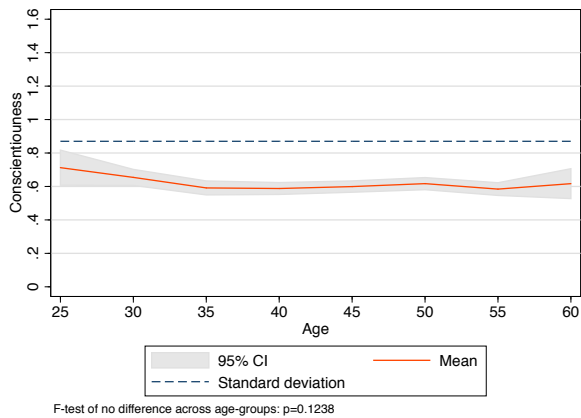
Figure A4.3: Mean Values for Big-Five Personality Traits over Age Groups for 2013



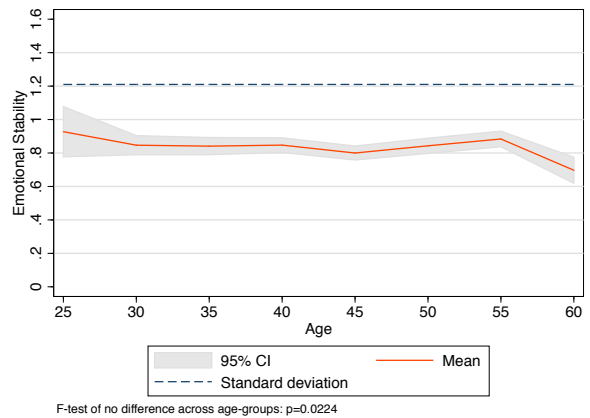
(a) Extraversion



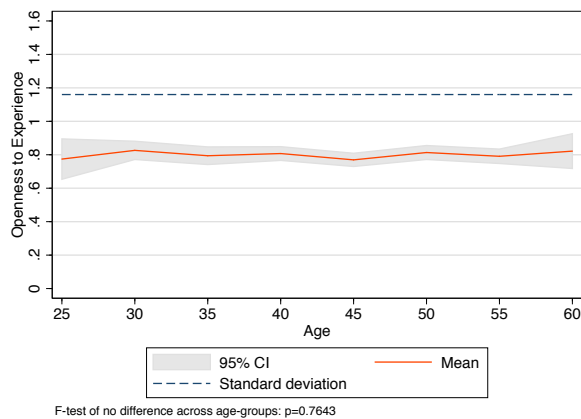
(b) Agreeableness



(c) Conscientiousness



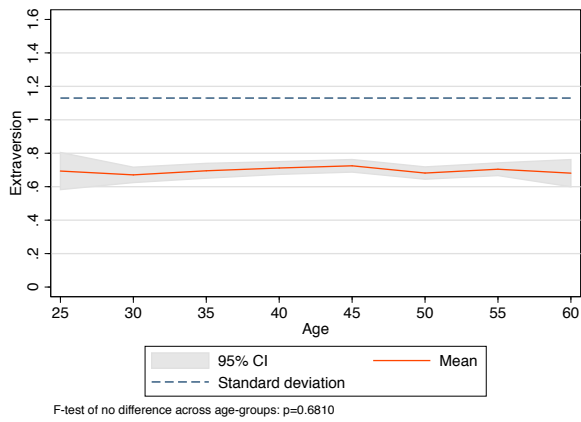
(d) Emotional stability



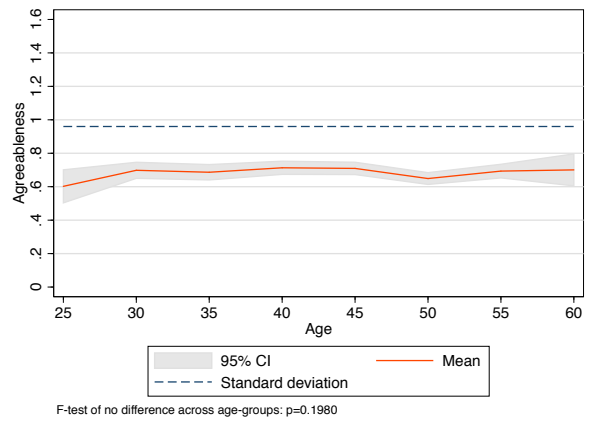
(e) Openness to experience

Note: Age groups are defined as 25 = 25-29; 30 = 30-34; 35 = 35-39; 40 = 40-44; 45 = 45-49; 50 = 50-54; 55 = 55-59; 60 = 60-64

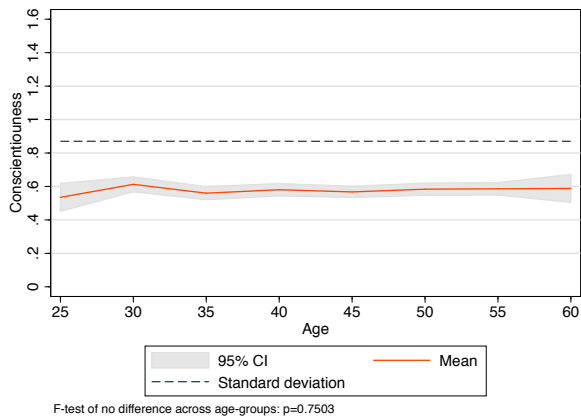
Figure A4.4: Absolute Changes in Big-Five Personality Traits between 2005 and 2009



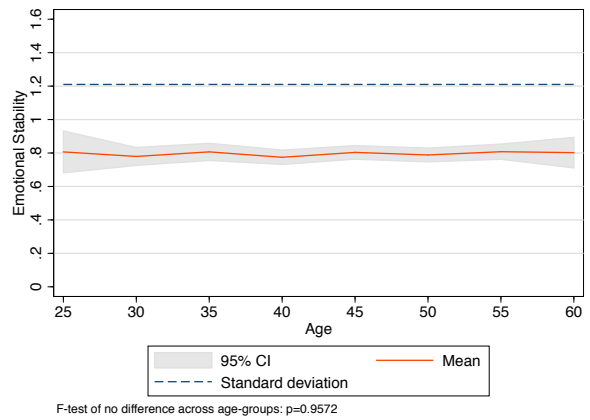
(a) Extraversion



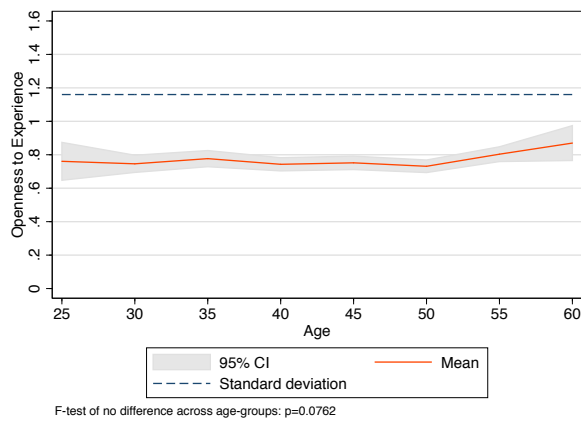
(b) Agreeableness



(c) Conscientiousness



(d) Emotional stability



(e) Openness to experience

Note: Age groups are defined as 25 = 25-29; 30 = 30-34; 35 = 35-39; 40 = 40-44; 45 = 45-49; 50 = 50-54; 55 = 55-59; 60 = 60-64

Figure A4.5: Absolute Changes in Big-Five Personality Traits between 2009 and 20013



Table A4.4: Number of Adverse Life Events between 2005 and 2013 by Gender

	Men	Women	Combined
Death of a spouse	17	59	76
Death of the father	270	330	600
Death of the mother	274	277	551
Death of a child	5	5	10
Death of another household member	21	13	34
Stroke	49	36	85
High blood pressure	870	827	1697
Diabetes	217	159	376
Cancer	93	172	265
Disability	214	237	531

Notes: Data taken from *SOEP* wave 2005 to 2013. The pooled sample consists of 17,028 individual observations. Std = standard deviation

Table A4.5: Estimated Effects of Adverse Life Events by Gender

	Women					Men				
	Ext	Agree	Consc	Emstab	Open	Ext	Agree	Consc	Emstab	Open
Death of a spouse	-0.07 (0.15)	-0.05 (0.18)	-0.05 (0.16)	0.29 (0.18)	-0.14 (0.12)	0.15 (0.42)	0.16 (0.40)	0.17 (0.34)	0.11 (0.31)	0.13 (0.26)
Death of father	0.08 (0.06)	-0.05 (0.06)	0.05 (0.06)	-0.03 (0.06)	0.03 (0.07)	-0.04 (0.07)	0.08 (0.07)	0.03 (0.07)	-0.02 (0.06)	0.00 (0.07)
Death of mother	0.07 (0.07)	-0.04 (0.08)	0.04 (0.08)	0.08 (0.08)	-0.05 (0.08)	0.06 (0.07)	-0.02 (0.07)	0.00 (0.07)	0.07 (0.07)	0.18** (0.07)
Death of a child	-0.21 (0.74)	0.36 (0.62)	0.43** (0.20)	-0.80*** (0.09)	-2.03*** (0.44)	0.14 (0.27)	0.56 (0.37)	-0.30 (0.37)	-0.73*** (0.28)	0.32 (0.46)
Death a household m.	0.12 (0.31)	-0.07 (0.61)	0.47 (0.45)	-0.48 (0.37)	-0.76** (0.34)	-0.52 (0.35)	-0.09 (0.24)	0.24 (0.28)	-0.24 (0.23)	0.10 (0.23)
Stroke	0.02 (0.23)	0.62*** (0.19)	-0.48** (0.20)	-0.05 (0.21)	-0.12 (0.15)	0.15 (0.24)	0.41* (0.23)	-0.26 (0.25)	-0.10 (0.18)	0.13 (0.24)
High blood pressure	-0.01 (0.05)	0.03 (0.05)	0.06 (0.05)	0.02 (0.05)	-0.02 (0.05)	0.04 (0.05)	0.03 (0.05)	0.03 (0.05)	-0.03 (0.05)	0.00 (0.05)
Diabetes	0.09 (0.12)	0.11 (0.12)	-0.01 (0.11)	0.10 (0.12)	0.17 (0.12)	0.04 (0.08)	-0.11 (0.09)	-0.04 (0.08)	-0.18* (0.09)	0.12 (0.08)
Cancer	0.05 (0.10)	0.02 (0.10)	0.06 (0.10)	-0.12 (0.09)	-0.08 (0.10)	0.09 (0.12)	-0.02 (0.10)	0.08 (0.11)	-0.12 (0.12)	0.12 (0.11)
Disability	-0.04 (0.09)	0.08 (0.09)	-0.03 (0.08)	-0.17* (0.09)	0.01 (0.08)	-0.06 (0.09)	0.00 (0.09)	-0.06 (0.09)	-0.04 (0.09)	-0.14 (0.09)

Notes: \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10%, respectively. Every entry represents a single regression on the respective trait with additional controls: age, relationship status, migration background, education, employment and net income. Standard errors in parenthesis. The analysis is based *SOEP* data with a sample of 2,189 men and 2,086 women

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