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Does it really get better with age? Life-cycle patterns of confidence in Germany

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Abstract

This paper investigates if and how confidence at the individual level changes over the course of a life. We provide age profiles of a novel continuous confidence measure and the probability of overconfidence, conditioning on personality traits (including the Big Five and optimism), economic preferences, cognitive ability, and the individual's socio-economic status. Our empirical work relies on a representative panel data set from Germany and individuals' self-assessment of their position in the gross wage distribution as our measure of confidence. We find that both the level of confidence and the overconfidence probability increase non-linearly with age up to the fifties. To illustrate the economic importance of the identified age gradient, we consider how both confidence measures predict savings and loan choices of households. We find that high wage-related confidence levels are, in all likelihood, a hindrance for prudent financial decisions in preparation for old age.

Keywords: Confidence; Age; Wage distribution; Germany; SOEP

JEL: D01, D91, J14

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1 Introduction

1.1 Motivation and Main Results

The right level of confidence is widely believed to be a prerequisite for success in life (e.g., Chamorro-Premuzic 2013). Overconfidence, that is, the overestimation of one’s own performance in an absolute or relative sense has recently attracted much attention.¹ It has been associated with serious potential consequences for the decision maker and society overall, including poor financial decision making, unwise sorting choices into competitive settings or compensation schemes, and unhealthy conduct as well as societal repercussions such as increased ideological extremeness (e.g., Barber and Odean 2001, Benartzi 2001, Camerer and Lovallo 1999, Dohmen and Falk 2011, Kahneman 2011, Levy and Tasoff 2017, Moore and Healy 2008, Odean 1999, Ortoleva and Snowberg 2015, Weinstein and Lyon 1999). Underconfidence also has serious downsides as it can, for example, inhibit and depress individuals (e.g., Pikulina et al. 2017). However, overconfidence has been labeled the “mother of all biases” by Moore (2018) and considered to be the most consequential judgmental bias by Nobel laureate Kahneman.²

Despite the well-established role of overconfidence in negative individual and social outcomes, information from a representative sample concerning its prevalence and correlated factors is missing from the literature. As a result, there is currently no clear understanding of how overconfidence relates to age (Prims and Moore 2017, Moore and Schatz 2017). In the popular imagination, young people are considered to be rather overconfident, whereas old people are thought to be cautious and circumspect, anecdotally implying that overconfidence “will get better with age” (Reyna et al. 2011). Along these lines, Kovalchik et al. (2005) find evidence that young individuals are more prone to overconfidence when comparing the decision making of 51

¹Overconfidence can appear in one of three guises (Moore and Healy 2008): (i) overestimation of one’s actual performance, (ii) excessive precision in one’s beliefs (i.e., overprecision), and (iii) overplacement of one’s own performance relative to that of others. It is important to clearly distinguish these different “faces of overconfidence” (see, e.g., Grieco and Hogarth 2009). In this paper, we will focus on the last one. For example, Burks et al. (2013) and Benoit et al. (2015) also focus on relative overconfidence whereas Chen and Schildberg-Hörisch (2018) consider absolute overconfidence.

²In an interview, Daniel Kahneman explains that – if he had to choose out of all biases affecting human judgment – he would select to eradicate overconfidence ([theguardian.com/books/2015/jul/18/daniel-kahneman-books-interview](https://www.theguardian.com/books/2015/jul/18/daniel-kahneman-books-interview) last accessed June 11, 2018).

young students (average age 20) to that of 50 healthy elderly (average age 82). In contrast, as overconfidence can be considered a facet of a person's personality (Almlund et al. 2011: 23), it may also be expected to be relatively stable as one ages. With overconfidence being important for many economic choices, systematic changes in overconfidence over a life span would have far-reaching consequences as a society ages. For example, if overconfidence were to decrease with age, it would result in overall fewer choices distorted by the overconfidence bias in an aging society.

This paper explores how both the level of confidence and the probability of overconfidence vary over a lifespan, providing age profiles from young adulthood until the end of the employment period in the middle of the sixties using a representative data set from Germany. We rely on an innovation sample of the German Socio-Economic Panel (SOEP) with rich information about survey participants. With this data, to account for individual heterogeneity in confidence levels, we can condition on personality traits, economic preferences, cognitive ability, and further socio-economic attributes of our survey participants.

The measurement of confidence is clearly at the heart of any study on over- or underconfidence. Confidence is a construct at the level of the individual and is probably domain-specific (e.g., Merkle and Weber 2011). There are domains in which many individuals are overconfident, leading to the result that individuals are overconfident *on average* (e.g., Moore and Healy 2008, Pikulina et al. 2017). However, there are also domains in which the average individual is underconfident and this assessment masks heterogeneity with some overconfident subjects and many underconfident subjects (e.g., Clark and Friesen 2009, Moore and Schatz 2017). There exist study designs in the literature that do not attempt to measure overconfidence at the individual level but only at the group level finding, for example, that 77 percent of the subjects state that they are (in some way) more able than the mean subject (e.g., Svenson 1981). Many contributions are interested in overconfidence at the individual level but lack direct information on it, and thus have to rely on proxies of overconfidence. For example, Barber and Odean (2001) use an individual's gender and much of the finance literature on CEO overconfidence uses either an CEO's holding on to vested stock options of the firm or media portrayals of the

CEO as a proxy of the CEO’s overconfidence (e.g., Malmendier and Tate 2015). In experimental studies, researchers collect information about individual confidence levels from populations often constrained to students, usually by asking participants to compare themselves on specific quantifiable measures against other participants in that same experiment (e.g., Moore and Schatz 2017). For example, Burks et al. (2013) have their participants involved in two tests of cognitive ability and ask about the subject’s perceived performance relative to that of the other session participants.

In this study, we use a novel confidence measurement at the level of the individual, stemming from the labor-market context and a representative sample. Specifically, we use information about the self-assessed own placement (in percentiles) in the distribution of individual monthly gross wages for people of the own age. The response scale used in the survey for the confidence measure is thus unambiguous, which contrasts with some early studies on overplacement (e.g., Svenson 1981 asked about being a *skillful* driver). We interpret the difference between the perceived and the actual position as the individual’s level of *confidence*. Since monthly gross wages proxy productivity, our data informs about the self-assessed position in the productivity distribution, which is very similar to the overplacement implementations in experiments. In contrast to the often bookish experimental tasks, people understand the concept “monthly gross wage” very well and know it from everyday life. Moreover, our confidence measure carries information about the perceived relative individual earnings capacity, which is probably crucial for many economic choices. It seems intuitive, for example, that people who overplace themselves in the gross wage distribution will tend to overestimate their statutory pension entitlements from the Bismarckian public-pension system in Germany and therefore will tend to save less for old age, when all else is held equal. Despite the fact that German newspapers frequently provide some information about the net household income distribution in Germany, it is likely that individuals lack complete information about the gross wage distribution of people of their own age.³ This feature of our novel confidence measure is shared with most

³In the summer of 2018 alone, there were articles at least in *Der Spiegel*, *Focus*, *Die Zeit*, *Die Welt*, *Süddeutsche Zeitung*, and *Manager Magazin*.

contributions on overconfidence (see, e.g., the discussion in Benoit et al. 2014).

We establish a robust relationship between age and confidence. Using ordinary least squares regressions and a partially linear semiparametric regression approach, we find evidence in support of an inverted U-shape pattern to confidence through increasing age. In other words, the level of confidence increases up to the fifties and tends to decline thereafter. We also find that our confidence measure is related to the items of the Big 5 personality inventory (particularly conscientiousness and agreeableness), whereas there is no robust correlation with risk or time preferences. The age profile remains robust when we include information about the individuals' cognitive performance and labor-market status. When we consider the probability that an individual at a given age is overconfident, we obtain very similar results. There is a notable non-linear increase in the overconfidence probability up to the fifties and a tendency for a decline thereafter.

In general, an age gradient may be difficult to isolate because measurements may also reveal changes across cohorts. For example, Malmendier and Nagel (2011) provide evidence that cohort effects can be very important when considering risk taking. In order to separate age from cohort effects when analyzing confidence, we incorporate the average GDP growth rate during the *impressionable years* of the respective individual in our estimation.⁴ Indeed, we find that cohort effects are relevant for the overconfidence probability, highlighting the importance of the cohort proxy variable for the true identification of the age gradient. Importantly, the age gradient we find in the data is robust to the inclusion of the cohort proxy variable.

To underline the behavioral implications of wage-related confidence and its age profile, we turn to financial decision-making of households. For our sample, we find that the level of confidence and the overconfidence status predict savings choices and that the overconfidence status predicts loan choices. These results give strong indication that overconfidence is harmful to preparing for old age. The age gradient of confidence is such that overconfidence presents a hurdle to prudent financial planning during critical years during which saving is affordable and

⁴The impressionable years hypothesis proposes that individuals are susceptible to attitude change during late adolescence and early adulthood and that susceptibility drops radically thereafter. Evidence that confirms the hypothesis is presented, for example, in Krosnick and Alwin (1989).

also paramount to life situation in old age.

1.2 Related Literature

Our paper studies a confidence measurement regarding the individuals' position in the distribution of monthly gross wages of all full-time employees, and how this trait evolves over the life course using a representative sample from Germany. In a related paper, Prims and Moore (2017) investigate how the three different types of overconfidence, that is, overestimation, overplacement, and overprecision, correlate with age using experimental subjects recruited via mTurk, for example, and having them perform tasks and guess their absolute and relative performance on these tasks. They find a positive relationship between age and overprecision but no significant correlations regarding overestimation and overplacement. However, Prims and Moore (2017) highlight that many dimensions differ between young and old individuals which cannot be controlled for in their experiments. In contrast, we are able to include information about various individual characteristics in our empirical models using representative survey data.

Our main interest – how an important individual trait evolves over the lifespan – was considered in the preceding literature with respect to economic preferences and personality traits (e.g., Golsteyn and Schildberg-Hörisch 2017, Mata et al. 2018, Schildberg-Hörisch 2018, Sunde and Dohmen 2016).⁵ For example, Dohmen et al. (2017) and Schurer (2015) explore how risk preferences change with age, finding that the willingness to take risks generally decreases with age. With respect to this relationship between a key economic preference and age, Bonsang and Dohmen (2015) find that – conditional on socio-demographic characteristics – about half of the age-related cross-sectional difference in the willingness to take risks can be explained by cognitive skills. Papers dealing with financial decision-making of the elderly similarly put a possible decline in cognitive ability at the center of attention (e.g., Gamble et al. 2015, Korniotis and Kumar 2011, Pak and Babiarczyk 2018). It appears that the confidence in managing one's own finances does not adjust appropriately to reflect the deterioration of cognitive ability as well as

⁵With respect to personality development across the lifespan, Almlund et al. (2011), Borghans et al. (2008), Cobb-Clark and Schurer (2012, 2013), and Specht (2017) provide insightful contributions.

the decline in financial literacy in old age (e.g., Finke et al. 2017, Pak and Chatterjee 2016). This gap tends to produce overestimation or overprecision in the financial domain when elderly grow older. Against the background of this literature, we understand the importance of being able to include cognitive ability into our empirical specifications. In our regression analysis, we rely on two widely-used measures of cognitive skill to isolate age effects on confidence.

Our confidence measure uses the self-assessed own position in the distribution of monthly gross wages. Similar survey data information regarding various types of household income was used in studies about the demand for redistribution. Cruces et al. (2013), Engelhardt and Wagener (forthcoming), and Karadja et al. (2017) are interested in how individuals in Argentina, Germany, and Sweden, respectively, position themselves in some kind of distribution related to household income and how this bears on their demand for redistribution.⁶ All studies find that the majority of people *underestimate* their position in the specific household income distribution used. Their information treatments show that individuals' demand for redistribution responds to receiving information about their true relative position.

The present paper contributes to the literature on confidence levels by exploring age profiles. Interestingly, there is also no established understanding with respect to how a number of other individual characteristics bear on confidence levels (e.g., Moore and Dev 2017). For example, Hügelschäfer and Achtziger (2014) find that male students are overconfident and female students are underconfident in an experimental task that tests for *overestimation*. In contrast, De Paola et al. (2014) find no significant main gender effect for either *overestimation* or *overplacement* in their regression analysis, also relying on a student sample. In our study that concerns *overplacement* in a representative sample of full-time employees, we do not find significant gender effects in our preferred empirical specifications that include labor-market status indicators. This is consistent with Moore and Schatz (2017) emphasizing that several studies find no gender differences regarding *overplacement*.

⁶Karadja et al. (2017) ask about the position in the *national total annual income* distribution, Cruces et al. (2013) consider *total monthly income at the household level*, and Engelhardt and Wagener (forthcoming) inquire about the relative position in terms of *the standard of living*. The measure that we use is thus much closer to the productivity of the respondent, as there is no possible distortion from capital income, for example.

1.3 Plan of the Paper

The structure of the paper is as follows. Section 2 presents the data. In Section 3, we present our empirical analysis and results. We discuss the robustness of our results at the end of Section 3. Section 4 concludes.

2 Data

Our empirical analysis is based on the SOEP Innovation Sample (SOEP-IS). The SOEP-IS is a nationally representative, longitudinal data set created in 2012 with the intention to improve the well-established German Socio-Economic Panel (SOEP). Like the SOEP, the SOEP-IS is representative for the population of private households in Germany. We use SOEP-IS data from the years 2013, 2014, and 2015. The present paper relies on a measure of the perceived relative monthly gross wage that was collected in the SOEP-IS in the year 2014 (i.e., we consider a cross section and add information from the years 2013 and 2015). Specifically, the question we use asks: “Imagine one would randomly select 100 German residents of your age, what do you think: How many of these 100 people would have a higher monthly gross wage than you?”.⁷ This question was answered by survey participants of one subsample of the SOEP-IS (namely I3) with full-time employment. The information allows us to calculate the self-assessed percentile in the monthly gross wage distribution of the respective age group for all survey respondents with full-time employment and valid information. Furthermore, we can exploit representative SOEP-IS information on the actual individual monthly gross wage for the same group of full-time employees in the contemporaneous year.

To calculate an individual measure of confidence, we must first define the age ranges for the reference group presented in the survey question, namely “German residents of your age”. In 2014, we have information on the perceived individual position in the monthly gross wage

⁷The survey also asks about the self-placement in terms of net household income. We focus on individual monthly gross wages instead of net household income for two reasons: (1) We think that the monthly gross wage is a better indicator of individual productivity than the net household income, because the latter is heavily influenced by income redistribution. (2) We suspect that household net income is much more difficult to assess, since, for instance, tax laws and social policies (e.g., child allowances) moderate how total annual gross income at the household level translates into net household income.

distribution as well as their reported monthly gross wage for 463 full-time employees between 18 and 65 years of age. We use the following age quintiles to define the age-specific reference groups: 18-30, 31-40, 41-48, 49-55, 56-65 years of age.⁸ For each full-time employee, we calculate the observed percentile in the age-specific monthly gross wage distribution, using monthly gross wage information from all employees in the SOEP-IS 2014. Our measure of confidence is then defined as perceived percentile minus actual percentile in the age-specific monthly gross wage distribution. Positive confidence values thus indicate overplacement of one's own monthly gross wage income relative to that of others of the respective age-specific reference group, that is, it signifies overconfidence.

Since our confidence measure is an integral part of our study, it is of importance that both the age distribution and the monthly gross wage distribution for the 463 respondents from our working sample are comparable to the distributions for the representative SOEP core study 2014 with 10,161 full-time employees. Table 6 in our appendix provides evidence that the distributions of age and the monthly gross wage are very similar in fact. Our working sample closely matches the SOEP core study in other respects as well. For example, the share of male employees in our working sample is 0.67 and compares with 0.65 in the SOEP core study 2014.

Our paper seeks to describe the individual heterogeneity of confidence levels with respect to age conditionally on personality, economic preferences, cognitive ability, and further socio-economic indicators. For example, Burks et al. (2013) hypothesize that overconfidence may be a function of personality traits. In terms of personality, we consider the Big Five personality inventory (e.g. Costa and McCrae 1992), which includes the traits openness, conscientiousness, extraversion, agreeableness, and neuroticism. This taxonomy is generally viewed as a set of core dimensions that provides a useful way to describe individual differences in personality (Specht et al. 2014). Table 7 in our appendix presents a definition and correlated trait descriptors for the Big 5 traits. The Big 5 personality trait scores represent respondents' self-assessments in the form of ratings of how well specific statements describe their personality on a scale from 1

⁸We discuss results from alternative specifications of the age ranges for the reference group in Section 3.4.

(“not at all true”) to 7 (“completely true”).⁹ Our Big Five personality variables are generated by standardizing the sum of the scores of the dimension-specific questions. They were collected in the survey year 2013. A higher value of the derived variable represents a stronger intensity of that trait. In addition to the information about the Big Five traits, we consider optimism as a personality trait that is easily confounded with overconfidence, since optimism represents the tendency to overestimate the occurrence of preferred outcomes (e.g., Heger and Papageorge 2018). Hence, to make a clear distinction between overconfidence and optimism, we include a covariate measuring optimism stemming from the survey year 2014 in our regression analysis. Optimism is incorporated as a dummy variable which equals 1 if a respondent reports being optimistic about the future.¹⁰

In terms of relating measured confidence levels to economic preferences, we consider risk and time preferences. Our measure of individual risk preferences is based on the question: “How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?”. Respondents provide answers using a 11-point Likert scale from 0 (“risk averse”) to 10 (“fully prepared to take risks”). The risk information was experimentally validated by Dohmen et al. (2011). We use the risk information from the survey year 2013 in our regression exercises. The relationship between risk attitudes and absolute overconfidence takes center stage in Murad et al. (2016). Considering time preferences, we use response information (also from survey year 2013) from the question: “How would you describe yourself: Are you generally an impatient person, or someone who always shows great patience?” with answers provided on a 11-point Likert scale from 0 (“very impatient”) to 10 (“very patient”). The patience information was experimentally validated by Vischer et al. (2013).

Cognitive ability might be related to our measure of confidence. For instance, information must be collected and processed to come up with an estimate of the perceived percentile in the monthly gross wage distribution. The SOEP-IS provides two measures of cognitive ability,

⁹Dehne and Schupp (2007) describe the implementation of the Big Five inventory in the SOEP and the reliability of measurements.

¹⁰Heger and Papageorge (2018) find a positive correlation between overconfidence and optimism measures in their data.

one relating to word recognition as a measurement of crystallized abilities and the other with symbols and numbers measuring fluid abilities. We standardize both measures of cognitive ability from the survey year 2014. Both measures correspond to modules of the Wechsler Adult Intelligence Scale and are used in Anger and Schnitzlein (2017), for example.

In addition to age in years, we include in our set of covariates a gender dummy variable and a dummy variable which is equal to one when the respondent was born in Germany. In some regression exercises, we add the education of the individual measured by the number of years of education. Moreover, we will report results from extended empirical specifications that additionally incorporate a host of variables describing the individual’s labor-market status including the monthly gross wage, the number of hours worked, the number of years with the current employer, employer size, own autonomy on the job, and whether respondents are either employed in a white- or blue-collar collar job or are self-employed. This information stems from the SOEP-IS 2014.

In our regression analyses, we also include the average GDP growth rate during the *impressionable years* (e.g., Krosnick and Alwin 1989). We define the years between 18 and 25 as impressionable years. With this in mind, we seek to decouple cohort effects from age effects, as a given average GDP growth rate in the impressionable years may result in different cohorts. The GDP data for the years 1947 to 1989 for East and West Germany and from 1990 to 1991 for West Germany are from Ritschl and Spoerer (1997). The GDP data from 1990 to 1991 for East Germany are from Sleifer (2006).¹¹ The data for the period 1992 to 2017 stem from the German Statistical Offices.¹²

To demonstrate the implications of our analysis of the age gradient of wage-related confidence in an aging society, we analyze the relationship between financial decision making and either the level of confidence or the overconfidence status. To this end, we make use of the panel dimension of the SOEP-IS and relate our confidence measures from 2014 with information on both precautionary and wealth savings in addition to information about any outstanding loans

¹¹These data are available at: histat.gesis.org/histat/.

¹²See statistik-bw.de/VGRdL/tbls/?lang=en-GB.

taken out to finance consumption or other big-ticket items from 2015.

Table 8 in our appendix presents the descriptive statistics for the variables used in our paper except our confidence measures (which are discussed in detail in Section 3.1).

3 Empirical Analysis and Results

In this section, we first summarize key features of our confidence measure and describe how it is related to both the actual position in the wage distribution and age. Next, we present results from regression exercises that seek to assess the relationship between confidence and age conditional on personality, economic preferences, cognitive ability, and further socio-economic attributes of the individual. Then, we report results from regression exercises in which we relate financial decision making to our confidence measures. Finally, we consider the robustness of our key results.

3.1 Confidence over the Life Course and Across the Wage Distribution

Are full-time employees' perceptions of their position in the monthly gross wage distribution biased and, if yes, how? Figure 1 clearly shows that full-time employees in Germany are underconfident on average. This finding is consistent with the assessment by Moore and Schatz (2017) and the literature cited therein, for example, that underplacement is rife (despite widely-held beliefs to the contrary).

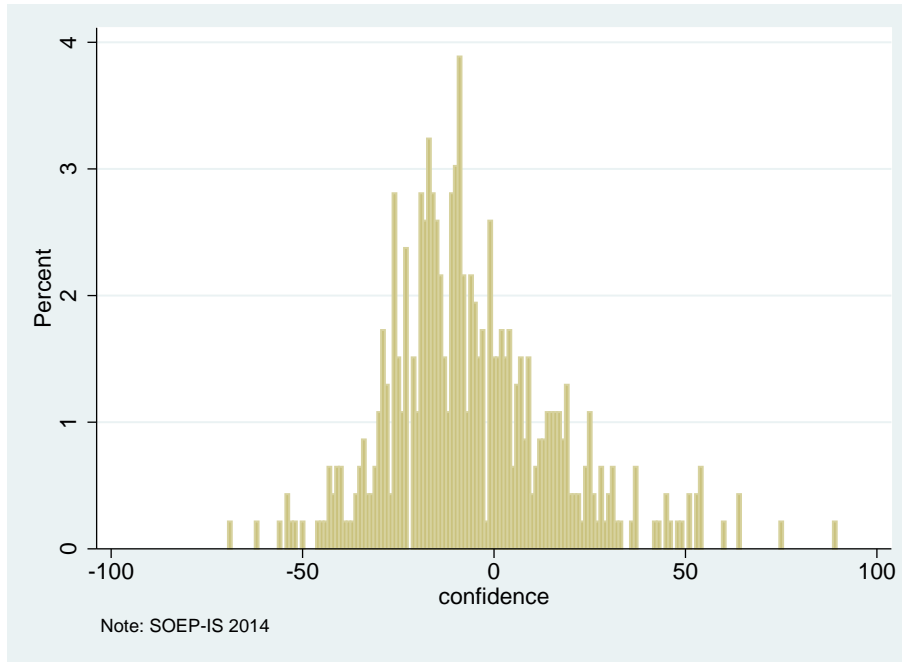


Figure 1: Histogram of Levels of Confidence Measure.

Our confidence measure is substantially skewed to the left with a mean of -6.9 (see Table 1) and a median of -10. However, about a third of the full-time employees under study are overconfident. The absolute value of the mean bias is about 18 for the populations of over- and underconfident individuals (see Table 1), implying that deviations of self-assessment and actual position are relatively large on average. Accordingly, if we allow for a prediction error of ± 5 percentiles (or even ± 10), we still observe that 24 (18) percent of employees are overconfident. In our data, only 1.5 percent of the full-time employees have an unbiased estimate of their relative gross monthly wage.

Monthly gross wage	Mean <i>Confidence</i>	SD <i>Confidence</i>	Share of Overconfident	Mean for Overconfident	Mean for Underconfident
All	-6.86	21.52	0.31	18.01	-18.48
1st quintile	5.45	28.74	0.55	26.26	-20.19
2nd quintile	-3.64	20.78	0.45	14.65	-18.92
3rd quintile	-10.86	18.77	0.28	12.42	-20.16
4th quintile	-12.69	15.42	0.16	8.82	-18.00
5th quintile	-14.36	10.23	0.08	3.69	-16.26

Notes: SOEP-IS 2014. $N = 463$. SOEP weights are used. *Confidence* is calculated as the difference between the perceived and the actual percentile in the age-specific monthly gross wage distribution. A subject is qualified as overconfident (underconfident) when the individual confidence measure is positive (negative).

Table 1: Descriptive Statistics for Confidence Measure.

One might suspect that the *perceived* position in the monthly gross wage distribution is a (non-linear) function of the *actual* position in the monthly gross wage distribution, with low-wage (high-wage) employees overplacing (underplacing) themselves. This is likely because, *inter alia*, there are very well-known correlates of relatively higher income including more education and experience on the job. Considering quintiles of the monthly gross wage distribution (see Table 1), we find that underconfidence is more pronounced for high-wage earners. In addition, we find that high-wage earners give considerably more homogeneous responses in terms of the standard deviation. Overconfidence at the *group level* (i.e., positive *average* values of the confidence measure) only results for the wage earners in lowest quintile. However, the share of overconfident subjects is non-negligible also in higher quintiles, for example, amounting to 16 percent in the fourth quintile. It is noteworthy that the mean level of confidence for the subjects qualified as underconfident is relatively stable across gross wage quintiles whereas the mean for the overconfident subjects decreases notably.

Figure 2 provides evidence for a systematic (non-linear) relationship between the perceived and the actual position in the monthly gross wage distribution. Overconfidence is prevalent up to the 45th percentile of the observed gross monthly wage distribution. In contrast, this holds for underconfidence only for the upper part of the same distribution. Moreover, no obvious functional form between the perceived and the actual position in the monthly gross wage distribution can be detected. Therefore, we use wage vigintile fixed effects for each vigintile in the observed monthly gross wage distribution in all regression exercises below to control for

a non-linear relationship between the perceived and the actual relative wage position. This is analogous to the analysis in Karadja et al. (2017). In addition, in some regression exercises below, we also include the monthly gross wage in order to control for effects from variations of the gross wage within fixed wage vigintiles. Note that including both wage vigintile fixed effects and the monthly gross wage in our empirical specifications signifies exploiting individual variation only regarding the perceived position in the monthly gross wage distribution.

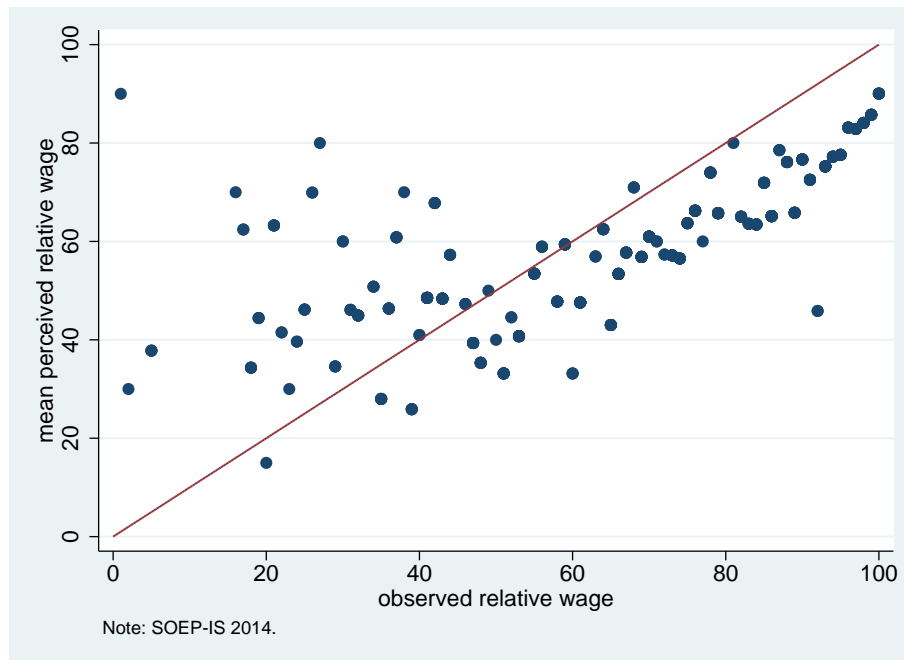


Figure 2: Perceived and Observed Relative Wage (Averaged for Each Percentile).

Figure 3 provides our first descriptive insights into the relationship of our confidence measure and age. We plot the average confidence level by year of age and add estimated raw age profiles of our confidence measure by means of a quadratic function of age as well as local-mean smoothing¹³. Notable underconfidence appears to be particularly likely among young individuals.¹⁴ In contrast, middle-aged people display no or only weak underconfidence on average. Taking the estimated raw age profiles at face value, we also observe a slight decrease in the

¹³We use Stata's `lpoly-tool` with default kernel and default bandwidth.

¹⁴Note that the outlier in terms of overconfidence at age 19 consists of only three observations.

level of confidence after being about 55 years of age.

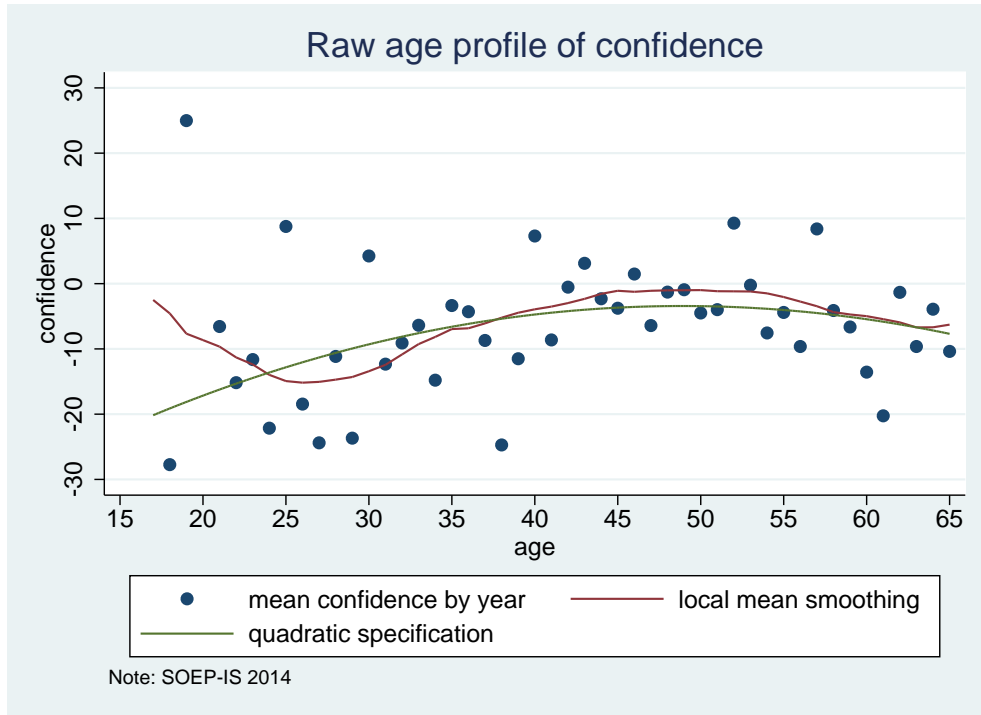


Figure 3: Age Groups and Confidence Levels.

3.2 Confidence Over the Life Course: Regression Results

We are interested in the age gradient of confidence conditional on personality, cognitive ability, both risk and time preferences, both demographic and socio-economic indicators, and wage vigintiles fixed effects. We employ two empirical strategies. First, we use ordinary least squares regressions including a quadratic function of age to model the relationship between our confidence measure and age. Second, we use Robinson’s semiparametric regression estimator to allow for more flexibility in the relationship between confidence and age.¹⁵

¹⁵The employed partially linear model specifies the conditional mean of confidence as the usual linear regression function of all covariates except age and an unknown smooth function of age. The parameters of the parametric part of the model are estimated using ordinary least squares regression after a transformation which eliminates the unknown function. In a second step, standard nonparametric methods can be used to recover the unknown smooth function of age (see, e.g., Henderson and Parmeter 2015: 228-238; Verardi and Debarsy 2012). To test for the appropriateness of the quadratic approximation of the nonparametric function of age in the ordinary least squares specifications, we use the test suggested by Härdle and Mammen (1993). We use Verardi and Debarsy’s Stata-tool `semipar` to estimate the parameters and test statistics of interest.

In Table 2, we report results from both empirical strategies. Columns (1)-(7) display the estimated parameters of ordinary least squares specifications with wage vigintiles fixed effects when we continue to add sets of covariates. Both coefficients of the quadratic function of age are always significantly different from zero and do not change appreciably in size. They indicate an inverted U-shaped relationship between our confidence measure and age with a maximum around 50 years of age. If we estimate the corresponding six semiparametric specifications and calculate the Härdle and Mammen-test-statistics, we can never reject the null hypothesis that the quadratic function is an appropriate approximation of the unknown smooth function of age.¹⁶ Hence, full-time employees' level of wage-related confidence is increasing in age up to the fifties and tending to decrease afterwards. To illustrate the non-linear relationship between our confidence measure and age, Figure 4 displays the nonparametric fit of the semiparametric specification with the preferred full set of covariates from Column (8). Taking the estimated 95 % confidence intervals into account, it becomes clear that middle-aged full-time employees in Germany have a significantly higher level of confidence than full-time employees in their twenties, but that the predicted decrease in the confidence level beyond 55 years of age is not significantly different from the confidence level near the turning point.

¹⁶The respective p-values are in the range [0.18, 0.85].

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	Semi	Semi
Age	1.640* (0.564)	1.631** (0.554)	1.579** (0.584)	1.593** (0.584)	1.619** (0.594)	1.568* (0.620)	1.540* (0.612)		
Age ²	-0.0168* (0.00660)	-0.0168** (0.00649)	-0.0161* (0.00675)	-0.0163* (0.00674)	-0.0165* (0.00689)	-0.0158* (0.00695)	-0.0149* (0.00689)		
Male	-4.317* (1.937)	-4.317* (1.937)	-4.323* (1.931)	-4.169* (1.963)	-4.723* (2.202)	-4.050 (2.214)	-4.007 (2.165)	-4.052 (2.203)	-4.050 (2.136)
German	5.162 (3.199)	5.162 (3.199)	4.858 (3.285)	4.775 (3.384)	4.226 (3.095)	4.211 (3.104)	4.185 (3.109)	3.989 (3.095)	3.930 (3.080)
Cognitive Ability (crystallized)			0.538 (1.117)	0.555 (1.151)	0.324 (1.145)	-0.113 (1.273)	0.0711 (1.269)	-0.209 (1.276)	-0.0761 (1.286)
Cognitive Ability (fluid)			0.577 (1.117)	0.616 (1.127)	0.828 (1.047)	0.450 (1.028)	0.707 (1.038)	0.376 (1.043)	0.530 (1.042)
Risk Tolerance				-0.251 (0.416)	-0.447 (0.433)	-0.545 (0.445)	-0.522 (0.447)	-0.529 (0.443)	-0.522 (0.444)
Patience				-0.130 (0.344)	-0.395 (0.365)	-0.389 (0.364)	-0.336 (0.372)	-0.442 (0.372)	-0.368 (0.372)
Optimism				-0.0421 (1.855)	-0.461 (1.797)	-0.464 (1.828)	-0.301 (1.805)	-0.466 (1.811)	-0.514 (1.838)
Conscientiousness					-2.386* (1.048)	-2.363* (1.051)	-2.328* (1.043)	-2.257* (1.053)	-2.216* (1.042)
Agreeableness				2.284* (0.989)	2.284* (0.989)	2.288* (0.997)	2.268* (0.995)	2.270* (1.000)	2.174* (0.998)
Extraversion					2.470* (1.100)	2.346* (1.106)	2.391* (1.102)	2.161 (1.111)	2.253* (1.098)
Openness					-1.561 (0.941)	-1.611 (0.939)	-1.781 (0.933)	-1.583 (0.952)	-1.773 (0.958)
Neuroticism					-2.236* (1.112)	-2.072 (1.141)	-1.845 (1.121)	-2.157 (1.146)	-2.001 (1.121)
Education (in Years)						-0.0656 (0.416)	-0.153 (0.414)	0.0602 (0.423)	-0.0137 (0.421)
Monthly Gross Wage						0.0005 (0.0011)	0.0008 (0.0011)	0.0007 (0.0010)	-0.0006 (0.00103)
Hours Worked (per Week)						-0.140 (0.147)	-0.160 (0.147)	-0.156 (0.147)	-0.174 (0.147)
Tenure (in Years)						-0.113 (0.102)	-0.124 (0.102)	-0.113 (0.103)	-0.124 (0.103)
White Collar (Yes=1)						2.528 (2.537)	2.534 (2.516)	3.040 (2.504)	3.148 (2.472)
Self Employed (Yes=1)						7.233 (3.786)	8.459* (3.863)	7.967* (3.745)	9.308* (3.815)
Firm Size: 200 ≤ Employees < 2000						4.811* (2.276)	5.082* (2.245)	4.733 (2.312)	4.890* (2.268)
Firm Size: Employees ≥ 2000						4.262 (2.216)	4.754* (2.218)	4.100 (2.224)	4.542* (2.219)
Autonomy (Yes=1)						0.282 (2.241)	0.347 (2.216)	0.162 (2.208)	0.354 (2.174)
Average GDP Growth Rate									
Wage Quintile Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	415	415	415	415	415	415	415	415	415
R ²	0.381	0.397	0.398	0.399	0.438	0.451	0.456	0.398	0.406

Notes: Results from ordinary least squares and semiparametric regressions. The resulting age profile from the semiparametric specification in Column (8) is reported in Figure 4. The resulting age profile from the semiparametric specification in Column (9) is reported in Figure 6 in our appendix. Age, gender, nationality, economic preferences, and Big 5 are taken from SOEP-IS 2013, while optimism and cognitive ability stem from SOEP-IS 2014. The variables are all scaled such that a higher value means, for example, a higher cognitive ability or a higher willingness to take risks. Labor-market status variables are taken from SOEP-IS 2014. The variable *average GDP growth rate* takes the value of the average growth rate during the period 18-25 years of age from the respective subject and is calculated using data from different sources (see Section 2). SOEP weights are used. Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$

Table 2: Regression Analysis for Confidence Levels.

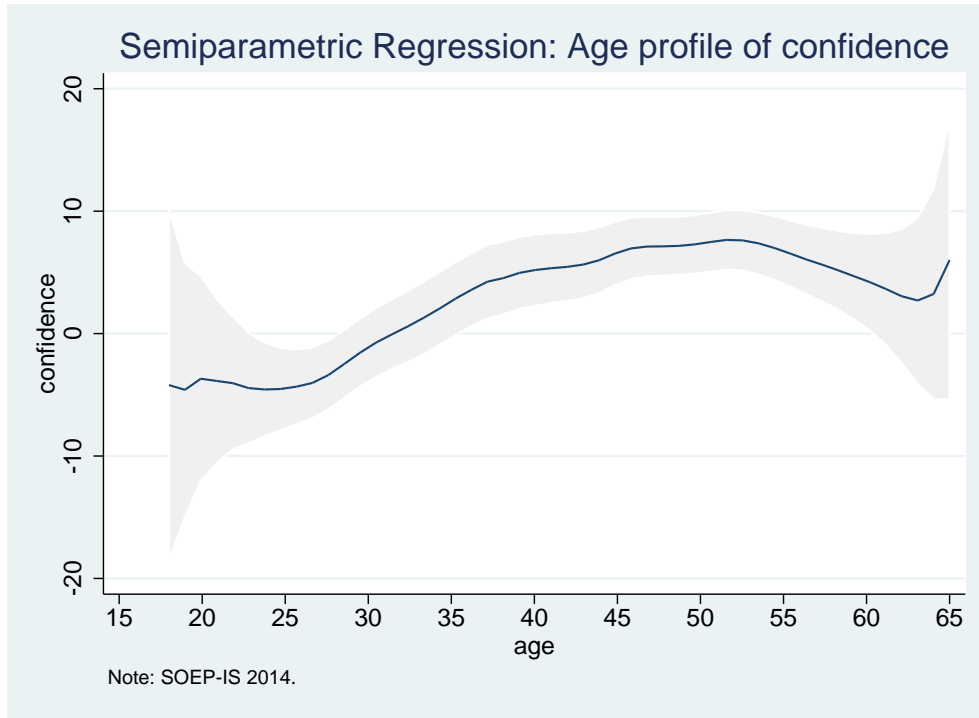


Figure 4: Relationship of Confidence Level and Age Conditional on Covariate Vector

Table 3 presents the results from Probit specifications with a dependent variable set equal to one when the subject is overconfident (i.e., shows a positive confidence measure) and zero otherwise. Columns (1)-(7) display parameter estimates from increasingly comprehensive specifications. The coefficients of the quadratic function of age are both always significantly different from zero. Figure 5 shows the corresponding age profile of the predicted probability of being overconfident based on the specification in Column (6). The overconfidence probability more than triples from something below 0.1 at 19 years of age to something above .4 in the early fifties and decreases afterwards. Similar to the age profile of the level of confidence, middle-aged full-time employees are significantly more likely to be overconfident than full-time employees in their twenties, but the decrease in the overconfidence probability after 50 years of age is not significantly different from the level around the turning point.¹⁷

¹⁷If we apply linear probability model specifications, both coefficients of the quadratic function of age are always significantly different from zero. The estimates indicate an inverted u-shaped relationship between the overconfidence probability and age with a maximum in the range 46 to 54 years of age.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Age	0.113* (0.0487)	0.121* (0.0493)	0.124* (0.0506)	0.126* (0.0509)	0.135* (0.0529)	0.189** (0.0620)	0.191** (0.0625)	0.00740** (0.00206)	Average partial effects 0.00894** (0.00212)
Age ²	-0.00119* (0.000572)	-0.00129* (0.000578)	-0.00129* (0.000584)	-0.00130* (0.000591)	-0.00139* (0.000615)	-0.00182* (0.000716)	-0.00177* (0.000727)		
Male	-0.455** (0.158)	-0.455** (0.159)	-0.469** (0.159)	-0.492** (0.159)	-0.516** (0.177)	-0.350 (0.184)	-0.354 (0.185)	-0.0820 (0.0428)	-0.0817 (0.0424)
German	0.257 (0.253)	0.243 (0.253)	0.228 (0.252)	0.228 (0.252)	0.208 (0.261)	0.333 (0.271)	0.286 (0.259)	0.0781 (0.0633)	0.0660 (0.0597)
Cognitive Ability (crystallized)		-0.00493 (0.0941)	-0.0169 (0.0940)	-0.0446 (0.0940)	-0.0446 (0.0959)	-0.114 (0.113)	-0.0926 (0.112)	-0.0267 (0.0265)	-0.0214 (0.0260)
Cognitive Ability (fluid)		0.0818 (0.103)	0.0818 (0.103)	0.0818 (0.102)	0.0999 (0.0967)	0.0737 (0.1000)	0.117 (0.100)	0.0173 (0.0235)	0.0270 (0.0232)
Risk Tolerance		0.0427 (0.0339)	0.0427 (0.0339)	0.0427 (0.0339)	0.0315 (0.0347)	-0.00318 (0.0370)	0.00298 (0.0378)	-0.000746 (0.00868)	0.000688 (0.00872)
Patience		-0.00748 (0.0288)	-0.00748 (0.0288)	-0.00748 (0.0288)	-0.0331 (0.0309)	-0.0191 (0.0323)	-0.0155 (0.0321)	-0.00448 (0.00757)	-0.00358 (0.00742)
Optimism		-0.0538 (0.162)	-0.0538 (0.162)	-0.0538 (0.162)	-0.106 (0.161)	-0.0802 (0.171)	-0.0410 (0.169)	-0.0188 (0.0402)	-0.00946 (0.0391)
Conscientiousness					-0.211* (0.0897)	-0.209* (0.0974)	-0.201* (0.0970)	-0.0491* (0.0223)	-0.0463* (0.0220)
Agreeableness					0.214* (0.0873)	0.235** (0.0876)	0.234** (0.0883)	0.0552** (0.0199)	0.0540** (0.0197)
Extraversion					0.108 (0.0911)	0.175 (0.0962)	0.179 (0.0954)	0.0410 (0.0226)	0.0414 (0.0220)
Openness					-0.0227 (0.0889)	-0.0510 (0.0924)	-0.0795 (0.0921)	-0.0120 (0.0217)	-0.0184 (0.0213)
Neuroticism					-0.122 (0.0869)	-0.0767 (0.0946)	-0.0523 (0.0968)	-0.0180 (0.0222)	-0.0121 (0.0224)
Education (in Years)						0.000253 (0.0438)	-0.0133 (0.0437)	0.0000595 (0.0103)	-0.00308 (0.0101)
Monthly Gross Wage						-0.000300* (0.000117)	-0.000247* (0.000113)	-0.0000703** (0.0000267)	-0.0000570* (0.0000256)
Hours Worked (per Week)						-0.0189 (0.0109)	-0.0211 (0.0109)	-0.00444 (0.00257)	-0.00486 (0.00251)
Tenure (in Years)						-0.0174 (0.0102)	-0.0192 (0.0102)	-0.00408 (0.00239)	-0.00443 (0.00235)
White Collar (Yes=1)						0.380 (0.215)	0.381 (0.215)	0.0892 (0.0502)	0.0879 (0.0493)
Self Employed (Yes=1)						1.067** (0.354)	1.216** (0.352)	0.250** (0.0826)	0.281** (0.0802)
Firm Size: 200 ≤ Employees < 2000						0.620** (0.221)	0.648** (0.223)	0.145** (0.0505)	0.150** (0.0500)
Firm Size: Employees ≥ 2000						0.669** (0.216)	0.712** (0.217)	0.157** (0.0499)	0.164** (0.0493)
Autonomy (Yes=1)						-0.0235 (0.212)	-0.0373 (0.212)	-0.0055 (0.0496)	-0.0086 (0.0490)
Average GDP Growth Rate									
Wage Vigintile Fixed Effects	Yes 415	Yes 415	Yes 415	Yes 415	Yes 415	Yes 415	Yes 415	Yes 415	Yes 415
Pseudo R ²	0.212	0.233	0.234	0.238	0.266	0.321	0.332	0.321	0.332

Notes: Results from Probit regressions. The resulting age profile from the specification in Column (6) is reported in Figure 5. The resulting age profile from the specification in Column (7) is reported in Figure 7 in our appendix. Age, gender, nationality, economic preferences, and Big 5 are taken from SOEP-IS 2013, while optimism and cognitive ability stem from SOEP-IS 2014. The variables are all scaled such that a higher value means, for example, a higher cognitive ability or a higher willingness to take risks. Labor-market status variables are taken from SOEP-IS 2014. The variable *average GDP growth rate* takes the value of the average growth rate during the period 18-25 years of age for the respective subject and is calculated using data from different sources (see Section 2). SOEP weights are used. Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$

Table 3: Probit Analysis of Overconfidence Status.

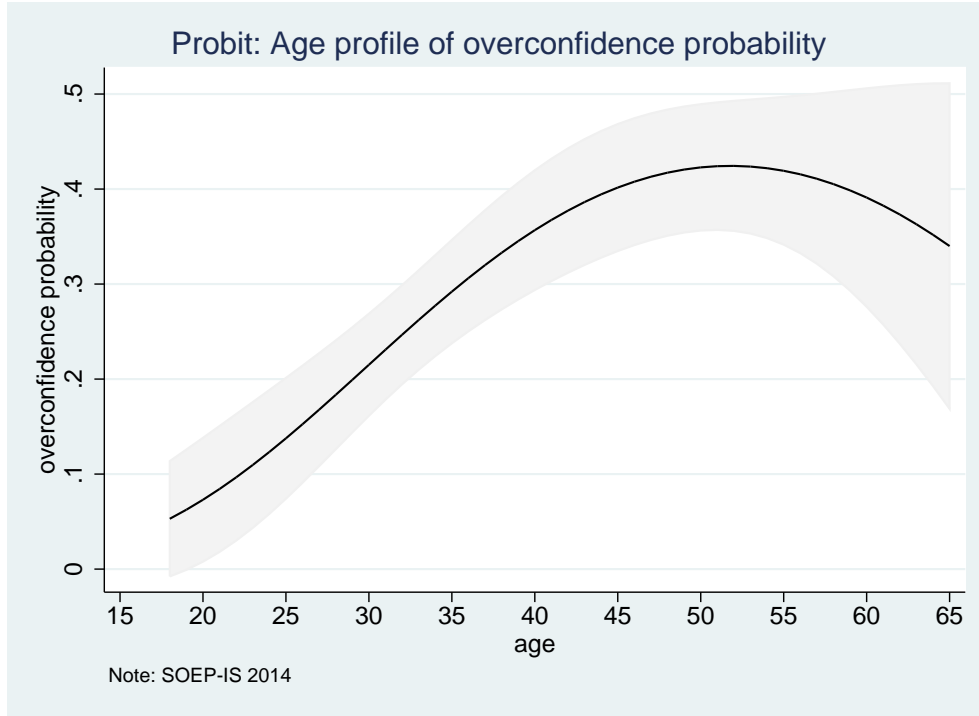


Figure 5: Relationship of Overconfidence Probability and Age Conditional on Covariate Vector

One might be concerned that cohort effects confound the estimated age gradients in Tables 2 and 3.¹⁸ To deal with this issue, we include the GDP growth rate averaged over the impressionable years of our full-time employees as a covariate to proxy cohort-specific effects.¹⁹ The basic idea is that GDP growth rates averaged over the impressionable years from 18 to 25 years of age is a valid proxy for overconfidence patterns across cohorts, because cohorts tend to show different average levels of overconfidence due to varying economic prospects during these very influential years. We find evidence in support of this hypothesis with respect to the overconfidence probability but not the confidence level (see Columns (7) and (9) in Tables 2 and 3). The estimated average partial effect indicates that an increase in average GDP growth during the impressionable years by two standard deviations is associated with a decrease of the overconfidence probability by 10 percentage points (about 30 percent). The estimated age

¹⁸Since we have information about confidence only from the year 2014, we cannot address potential period effects.

¹⁹We thereby follow the approach of Giuliano and Spilimbergo (2014) who establish cohort effects by showing that having experienced a recession when young has a long-lasting effect on the locus of control and redistribution preferences. See Section 2 for the definition and data sources of the proxy variable.

coefficients remain significant in all cases and the corresponding age profiles of overconfidence remain robust (see Figures 6 and 7 in our appendix).

Overall, our results indicate that the wage-related confidence level of full-time employees in Germany significantly increases over a lifespan from 20 years to 50 years of age. For the majority of underconfident employees, this implies that the underestimation of their own performance is decreasing over time. This might have to do with learning, for example. However, for a remarkable share of employees, the observed age gradient of our confidence measures indicates that their bias in the perception of their own wage performance is not diminishing over time. This might have severe consequences for their economic decisions.

Next, we briefly address some results of our preferred empirical specifications with the full set of covariates and wage vigintiles fixed effects. Tables 2 and 3 show that the coefficients of our two cognitive ability measures are always not statistically significant different from zero. Hence, we do not find a relationship between confidence and measures of fluid and crystallized intelligence (which both decline in old age). Moreover, our regression results suggest that there is no statistically significant relationship between confidence and our lagged measures of risk and time preferences. This also holds for our optimism proxy variable. In contrast, we find significant correlations between the lagged Big 5 personality traits and both confidence measures. The evidence is such that employees with a higher conscientiousness score (i.e., employees who are efficient and well organized) exhibit lower confidence levels. Confidence levels tend to be higher for employees who are either more agreeable (i.e, more forgiving and sympathetic) or more extraverted (i.e., more sociable and enthusiastic).

3.3 Confidence and Financial Decision Making

Financial choices made over a lifespan are very important for old age. Policymakers in most countries are rightly concerned about the financial security of aging populations; much data indicates shortcomings in savings and insufficient preparations for unexpected emergencies and retirement (e.g., Lyons et al. 2018). With the criticality of sound financial decisions in mind, we aim now to analyze whether our wage-related confidence measures are significantly related

to financial decision making.

To this end, we will first use information about precautionary savings and savings for wealth accumulation included in the SOEP-IS 2015. Specifically, the survey first asks about whether the respondent’s household regularly invests spare money to save for either precautionary or wealth accumulation purposes, and then collects information about the respective amounts. Accordingly, we generate dummy variables for the incidence of savings for wealth accumulation and precautionary reasons, as well as continuous variables of the (log of the) amount of savings for both reasons.²⁰ We then use standard Probit- and Tobit-specifications in our regression exercises to relate our two confidence measures from 2014 to savings behavior in 2015, incorporating personality, cognitive ability, both risk and time preferences, education, and some demographic information. Since savings are often decided at the household level, we additionally include information about house ownership, household net income, and about the household structure. Wage vigintile fixed effects are incorporated again as a vector of additional covariates to control for different levels of monthly gross wage income in a flexible way. Note that only one observation per household is included in the estimating sample, which is in most cases the one for the head of the household. Table 4 displays the results of our correlation analysis.

Considering the determinants of the incidence of savings for precautionary and wealth accumulation purposes, we find that both the confidence level and the overconfidence probability are significantly negatively related to the incidence of saving for wealth accumulation (see Table 4). The estimated average partial effect indicates that being overconfident in 2014 goes along with a 15.7 percentage points lower probability of saving for wealth accumulation purposes in 2015. This effect suggests significant economic repercussions, since the overall raw probability of savings for wealth accumulation is 0.32 in our estimating sample. Moreover, the estimated coefficients of both confidence measures are significantly negative in the corresponding Tobit

²⁰To take the skewness in the distribution of both saving variables into account, we calculate the natural log of total household savings. To accommodate for the fact that some households have zero savings, we add 1 to the actual value of this variable before taking the natural log. This procedure is often used in the savings literature (e.g., Gerhard et al. 2018).

specifications. Taken at face value, the estimated overconfidence coefficient implies that being overconfident in 2014 predicts an amount of savings for wealth accumulation in 2015 that is more than 40 percent lower.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Incidence Wealth Savings	Incidence Wealth Savings	Incidence Precaut. Savings	Incidence Precaut. Savings	Amount Wealth Savings	Amount Wealth Savings	Amount Precaut. Savings	Amount Precaut. Savings
Overconfidence	-0.157** (0.0594)		-0.0359 (0.0642)		-2.791** (1.070)		-0.262 (0.620)	
Confidence Level		-0.00338** (0.00131)		-0.00155 (0.00142)		-0.0630** (0.0234)		-0.0137 (0.0137)
Age	-0.00283 (0.00302)	-0.00227 (0.00303)	0.00166 (0.00317)	0.00197 (0.00315)	-0.286 (0.298)	-0.201 (0.306)	0.0393 (0.184)	0.0583 (0.183)
Age ²					0.00279 (0.00340)	0.00190 (0.00348)	-0.000169 (0.00209)	-0.000364 (0.00207)
Male	0.0328 (0.0610)	0.0543 (0.0604)	0.0794 (0.0622)	0.0810 (0.0615)	0.922 (1.124)	1.272 (1.117)	0.673 (0.565)	0.694 (0.558)
German	0.0390 (0.0833)	0.0422 (0.0863)	0.0776 (0.0880)	0.0820 (0.0874)	0.610 (1.527)	0.616 (1.598)	0.512 (0.929)	0.544 (0.923)
Cognitive Ability (crystallized)	0.0296 (0.0369)	0.0311 (0.0372)	0.0138 (0.0351)	0.0140 (0.0351)	0.614 (0.652)	0.661 (0.662)	0.106 (0.345)	0.111 (0.343)
Cognitive Ability (fluid)	-0.0268 (0.0319)	-0.0273 (0.0322)	0.0445 (0.0337)	0.0457 (0.0337)	-0.278 (0.539)	-0.291 (0.547)	0.390 (0.297)	0.394 (0.297)
Risk Tolerance	0.0324** (0.0118)	0.0313** (0.0118)	-0.0262 (0.0136)	-0.0261 (0.0136)	0.510* (0.209)	0.499* (0.209)	-0.230 (0.120)	-0.229 (0.119)
Patience	0.00840 (0.0109)	0.00594 (0.0108)	0.0222 (0.0114)	0.0211 (0.0114)	0.178 (0.190)	0.126 (0.187)	0.186 (0.110)	0.176 (0.109)
Conscientiousness	-0.0500 (0.0290)	-0.0475 (0.0294)	-0.00538 (0.0325)	-0.00658 (0.0323)	-0.835 (0.498)	-0.819 (0.505)	0.0159 (0.302)	0.000513 (0.300)
Agreeableness	-0.0242 (0.0282)	-0.0272 (0.0280)	0.0192 (0.0285)	0.0210 (0.0283)	-0.445 (0.479)	-0.500 (0.474)	0.117 (0.267)	0.134 (0.265)
Extraversion	0.0677* (0.0310)	0.0703* (0.0309)	0.0791* (0.0317)	0.0815* (0.0317)	1.128* (0.564)	1.160* (0.564)	0.617* (0.305)	0.641* (0.303)
Openness	-0.0255 (0.0300)	-0.0299 (0.0301)	-0.0120 (0.0316)	-0.0141 (0.0318)	-0.427 (0.523)	-0.475 (0.524)	-0.0635 (0.282)	-0.0757 (0.282)
Neuroticism	0.0228 (0.0293)	0.0205 (0.0303)	-0.00145 (0.0307)	-0.00379 (0.0308)	0.338 (0.500)	0.267 (0.520)	-0.00859 (0.287)	-0.0312 (0.288)
Optimism	0.00226 (0.0552)	0.00732 (0.0564)	-0.0964 (0.0582)	-0.0967 (0.0582)	0.225 (0.967)	0.324 (0.985)	-0.740 (0.539)	-0.742 (0.538)
Education (in Years)	-0.00738 (0.0136)	-0.00405 (0.0133)	0.0158 (0.0142)	0.0167 (0.0141)	-0.0916 (0.235)	-0.0475 (0.231)	0.182 (0.122)	0.187 (0.121)
Single Household (Yes= 1)	0.272** (0.0720)	0.255** (0.0713)	0.0145 (0.0704)	0.00956 (0.0697)	3.886** (1.154)	3.660** (1.165)	-0.0183 (0.696)	-0.0446 (0.695)
Couple with no Kids (Yes= 1)	0.156* (0.0644)	0.158* (0.0639)	0.126 (0.0678)	0.126 (0.0676)	2.652* (1.095)	2.657* (1.091)	0.929 (0.573)	0.927 (0.574)
House Ownership (Yes= 1)	-0.000960 (0.0571)	0.00180 (0.0566)	0.0297 (0.0593)	0.0283 (0.0592)	0.107 (0.997)	0.147 (0.999)	0.426 (0.537)	0.411 (0.537)
Household Net Income/1,000	0.112** (0.0278)	0.106** (0.0270)	0.00818 (0.0221)	0.00745 (0.0219)	1.657** (0.303)	1.595** (0.303)	0.219 (0.232)	0.219 (0.229)
Wage Quintile Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	299	299	299	299	298	298	298	298
Pseudo R ²	0.234	0.230	0.182	0.184	0.104	0.103	0.062	0.062

Notes: Results from Probit regressions (Columns (1)-(4); average partial effects) and Tobit regressions (Columns (5)-(8); coefficients). The dependent variable is the presence (Probit) and amount (Tobit) of wealth and precautionary savings. In Tobit regressions, the dependent variable is the log of the savings amount + 1. Both kinds of information are taken from SOEP-IS 2015. Age, gender, nationality, patience, and Big 5 are taken from SOEP-IS 2013, optimism, risk attitude, education in years, and cognitive ability stem from SOEP-IS 2014. The variables are all scaled such that a higher value means, for example, a higher cognitive ability or a higher willingness to take risks. SOEP weights are used. Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$

Table 4: Overconfidence and Savings.

Respondents with high wage-related confidence levels may also be more inclined to overspend on consumption. The SOEP-IS 2015 provides information on outstanding loans taken out to

finance consumption or other big-ticket items at the household level. Again, we generate a dummy variable for the incidence of an outstanding loan to finance consumption as well as continuous variables of the (log of the) amount that is due every month.²¹ We then use standard Probit- and Tobit-specifications in our regression exercises to relate both the confidence level and the overconfidence probability to outstanding loans in 2015, incorporating the vector of covariates used above as well as a vector of gross monthly wage vigintile fixed effects. Again, only one observation per household is included in our estimating sample. Table 5 displays the results of the regression exercises.

²¹To accommodate for the fact that some households have zero monthly loan payments, we use the same procedure as before and add 1 to the actual value of this variable before taking the natural log.

	(1)	(2)	(3)	(4)
	Incidence	Incidence	Amount	Amount
	Loan Repayment	Loan Repayment	Loan Repayment	Loan Repayment
Overconfidence	0.127* (0.0555)		2.262* (0.950)	
Confidence Level		0.00201 (0.00144)		0.0398 (0.0249)
Age	-0.000305 (0.00268)	-0.000758 (0.00272)	0.0829 (0.297)	0.0440 (0.301)
Age ²			-0.00103 (0.00346)	-0.000691 (0.00350)
Male	0.0486 (0.0570)	0.0374 (0.0576)	0.667 (0.992)	0.488 (1.006)
German	0.0164 (0.0802)	0.0222 (0.0799)	0.235 (1.335)	0.307 (1.325)
Cognitive Ability (crystallized)	0.00574 (0.0330)	0.00690 (0.0328)	0.0735 (0.514)	0.110 (0.512)
Cognitive Ability (fluid)	-0.0112 (0.0293)	-0.01000 (0.0296)	-0.228 (0.529)	-0.216 (0.538)
Risk Tolerance	0.00995 (0.0116)	0.0104 (0.0117)	0.175 (0.199)	0.174 (0.200)
Patience	-0.000351 (0.0108)	0.00100 (0.0111)	-0.0205 (0.185)	0.00498 (0.192)
Conscientiousness	-0.0656* (0.0270)	-0.0686* (0.0276)	-1.039* (0.461)	-1.092* (0.475)
Agreeableness	-0.00611 (0.0269)	-0.00358 (0.0277)	-0.146 (0.462)	-0.132 (0.478)
Extraversion	0.0690* (0.0281)	0.0710* (0.0288)	1.144* (0.508)	1.183* (0.520)
Openness	-0.0157 (0.0288)	-0.0123 (0.0290)	-0.209 (0.508)	-0.137 (0.511)
Neuroticism	0.0273 (0.0285)	0.0291 (0.0289)	0.429 (0.487)	0.465 (0.495)
Optimism	0.107* (0.0523)	0.104* (0.0528)	1.838* (0.905)	1.855* (0.914)
Education (in Years)	-0.0531** (0.0128)	-0.0549** (0.0126)	-0.946** (0.230)	-0.981** (0.229)
Single Household (Yes= 1)	-0.00421 (0.0659)	0.00984 (0.0663)	-0.486 (1.161)	-0.277 (1.171)
Couple with no Kids (Yes= 1)	-0.0210 (0.0615)	-0.0185 (0.0621)	-0.471 (1.064)	-0.455 (1.077)
Home Ownership (Yes= 1)	-0.120* (0.0520)	-0.121* (0.0521)	-2.108* (0.948)	-2.098* (0.948)
Household Net Income/1,000	-0.00971 (0.0210)	-0.00489 (0.0213)	-0.209 (0.369)	-0.127 (0.371)
Wage Quintile Fixed Effects	Yes	Yes	Yes	Yes
N	299	299	298	298
Pseudo R ²	0.212	0.205	0.092	0.090

Notes: Results from Probit (Columns (1)-(2); average partial effects) and Tobit regressions (Columns (3)-(4); coefficients). The dependent variable is the presence (Probit) and amount (Tobit) of amounts due as a result of loans for big-ticket items. In Tobit regressions, the dependent variable is the log of the amount due + 1. Both kinds of information are taken from SOEP-IS 2015. Age, gender, nationality, patience, and Big 5 are taken from SOEP-IS 2013, optimism, risk attitude, education in years, and cognitive ability stem from SOEP-IS 2014. The variables are all scaled such that a higher value means, for example, a higher cognitive ability or a higher willingness to take risks. SOEP weights are used. Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$

Table 5: Overconfidence and Loans.

With respect to the relationship of confidence and outstanding consumption loans, we find that being overconfident in 2014 predicts the incidence as well as the monthly amount owed in

these loans in 2015. More specifically, the estimated average partial effect indicates that being overconfident in 2014 goes along with a 12.7 percentage points higher probability of having to pay back a loan in 2015. This effect is economically significant, since the raw probability of having an outstanding loan is about 0.32. The estimated significant Tobit coefficient of overconfidence implies that being overconfident is associated with a by 60 percent higher amount due every month.

In summary, our results indicate that wage-related overconfidence is concomitant with more consumption loans and less savings for wealth accumulation purposes. If we combine these results with the increasing age profile of the overconfidence probability described in Section 3.2, our results imply that during the period of life where saving for old ages should start at the latest, full-time employees get more likely overconfident which in turn reduces savings for wealth accumulation purposes.

3.4 Discussion

In this section, we discuss the robustness of our results to changing assumptions about the applicable reference groups and the corresponding distribution of monthly gross wage incomes. Identifying the right reference group is an important step in our derivation of the confidence measure. Next, we address the potential effects of survey respondents' rounding their assessments for the own-position in the distribution. It is probable that at least some full-time employees reported rounded values of their position estimates (see Manski and Molinari 2010, for example). This could introduce deviations of perceived from actual positions not truly attributable to overconfidence. Lastly, we explore whether a different risk tolerance measure, namely a proxy for risk attitudes in the financial domain, yields different results.

Reference groups Our key information on the perceived relative gross monthly wage is based on a somewhat vague wording of the age-specific reference group (“in your age”). When we apply age quintiles (9 years on average per age group) in our empirical work above, we use a rather broad reference group definition. As robustness checks, we use age deciles (5 years

on average per age group) and 15 quantiles (3 years on average per age group) to calculate our individual confidence measure. Table 1 in our Supplementary Material documents that our results are not notably affected.

Rounding In our main analysis, we calculate our confidence measure by deducting the observed percentile from the perceived percentile in the monthly gross wage distribution. Most of our full-time employees in the sample report their perceived relative wage as multiples of five, which gives an indication of rounding. To check whether potential rounding affects our result, we conduct the following simple test: We round the observed percentiles of the monthly gross wage distribution to the closest multiple of five and calculate our confidence measure as perceived position minus rounded observed position in the wage distribution. We thereby lower the risk of discrepancies between the perceived and the actual position in the monthly gross wage distribution due to rounding by the respondents. Table 2 in our Supplementary Material shows that the estimated age profiles are very similar to the age profiles documented in the main text.

Financial Risk Preferences The SOEP-IS 2014 collects information on risk attitudes in different domains. In our main analysis, we include the self-reported *general* willingness to take risks. It may be argued that using risk attitudes regarding financial investments is also meaningful for the study at hand, as our confidence measure is created using relative monthly gross wages and our analysis of outcomes deals with savings and loans.²² When we employ the self-reported willingness to take risk in financial matters in our regression exercises, we find age-specific confidence profiles, which are very similar to the profiles presented in the main part of our analysis. Moreover, the willingness to take risk in financial matters is positively correlated with the probability of being overconfident (see Table 3 in our Supplementary Material).²³ Furthermore, the correlations between our confidence measures and our financial behavior variables remain stable when we include the willingness to take risk in financial matters in our

²²For example, Bonsang and Dohmen (2015) focus solely on financial risk preferences in their study of risk attitudes and cognitive aging.

²³This finding is consistent with the results presented in Murad et al. (2016).

regression exercises (not documented).

4 Conclusion

Human judgment is plagued by several cognitive biases. The susceptibility to bias can be expected to depend on age. Using data from a representative sample from Germany, this paper documents that both the wage-related confidence level and the probability of being overconfident in the labor market are related to age. Specifically, we find that confidence levels regarding one's relative wage income increase with age until the early fifties after which a tendency for a decline is observable. With overconfidence potentially impeding key economic choices, systematic changes in wage-related overconfidence over a lifespan can be expected to have far-reaching consequences in an aging society.

We establish that wage-related overconfidence appears to deter savings for wealth accumulation and induce taking out loans, and that overconfidence shows most prominently during the life period when the ability to save is probably the greatest. This highlights an interdependence between the age gradient of overconfidence and the financial security of the elderly. We thereby identify overconfidence as an important bias, possibly heavily bearing on retirement savings, and adding to other behavioral-induced distortions described before (e.g., Benartzi and Thaler 2013).

Our paper shows that a novel wage-related confidence measure follows a clear pattern over the lifespan and documents the importance in the domain of financial decision-making. However, our study has its limitations. First, we analyze a cross-section of two measures of relative overconfidence, where longitudinal data with information about all three overconfidence facets would be ideal. Such longitudinal data would allow analysis of a full age-period-cohort model of overconfidence as well as the temporal stability of different facets of wage-related overconfidence. Second, we cannot relate our wage-related confidence measure to confidence measures from the literature (that are collected in the context of specific experimental tasks, for example) since the SOEP-IS does not provide appropriate data. As a result, we cannot contribute to the

interesting research question about the potential context-specificity of confidence measures.

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Appendix

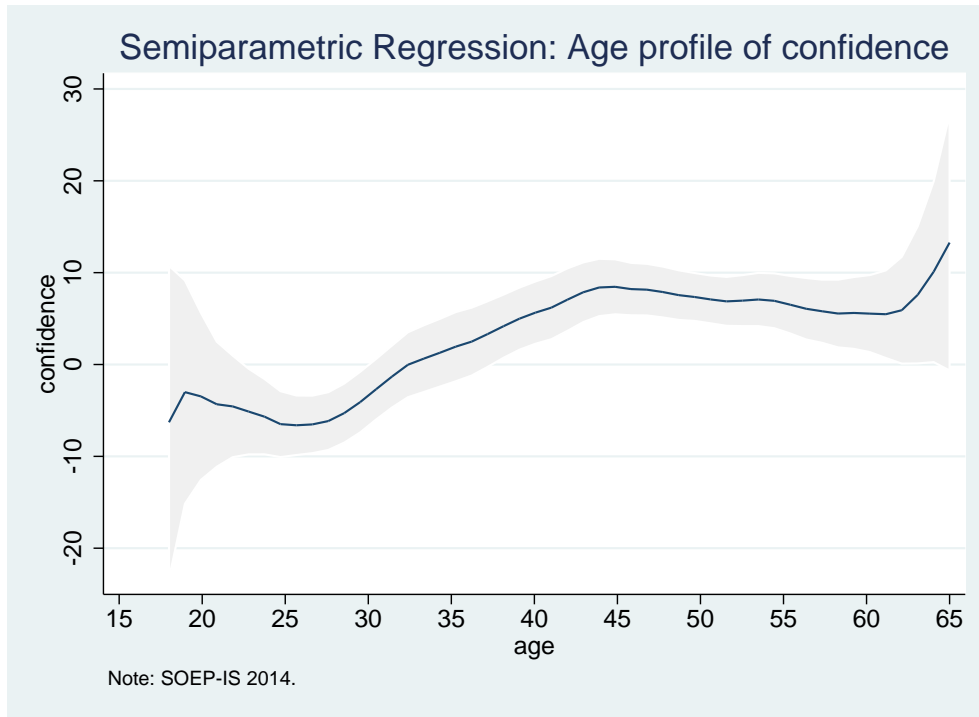


Figure 6: Relationship of Confidence Level and Age Conditional on Covariate Vector With Cohort Proxy Variable

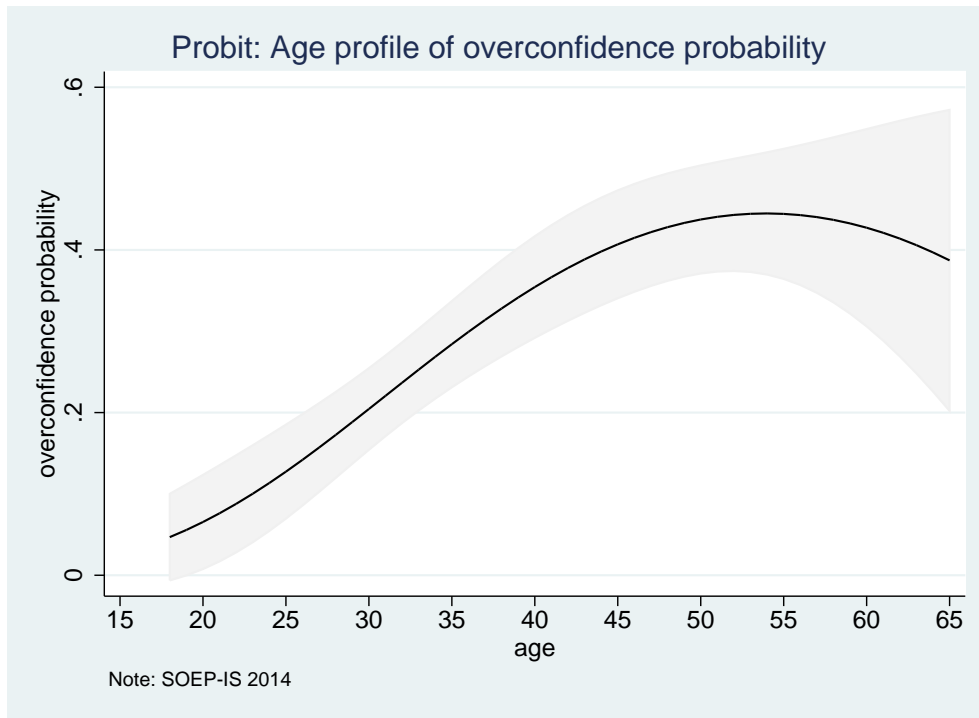


Figure 7: Relationship of Overconfidence Probability and Age Conditional on Covariate Vector With Cohort Proxy Variable

Variable	Mean	P5	P10	P25	P50	P75	P90	P95
<i>Monthly Gross Wage</i>								
SOEP-CORE ($N = 10,161$)	3,323.188	1,200	1,518	2100	2,880	3,994	5,500	6800
SOEP-IS Working Sample ($N = 463$)	3,272.387	1,200	1,520	2100	3,000	4,000	5,500	6600
<i>Age</i>								
SOEP-CORE ($N = 10,161$)	43.7521	25	27	34	45	53	58	61
SOEP-IS Working Sample ($N = 463$)	42.043	23	26	30	43	52	58	61

Notes: SOEP weights are used.

Table 6: Relating SOEP-IS 2014 to SOEP-CORE 2014 Using Percentiles.

Description of Trait	Correlated Trait Descriptors
<i>Openness</i>	
Individual differences in the tendency to be open to new aesthetic, cultural, and intellectual experiences	Imaginative, artistic, excitable, wide interests, curious, unconventional
<i>Conscientiousness</i>	
The tendency to be responsible and hardworking; located at one end of a dimension of individual differences (conscientiousness versus lack of direction)	Efficient, organized, not careless, ambitious, not lazy, not impulsive
<i>Extraversion</i>	
An orientation of one's interests and energies toward the outer world of people and things rather than the inner world of subjective experience	Friendly, sociable, self-confident, energetic, adventurous, enthusiastic
<i>Agreeableness</i>	
The tendency to act in a cooperative, unselfish manner; located at one end of a dimension of individual differences (agreeableness versus disagreeableness)	Forgiving, not demanding, warm, not stubborn, not show-off, sympathetic
<i>Neuroticism</i>	
A chronic level of emotional instability and proneness to psychological distress	Worrying, irritable, not contented, shy, moody, not self-confident

Table 7: Big Five Personality Traits (e.g., Almlund et al. 2011, Table 3).

	<i>N</i>	Mean	STD
Age	415	41.97	12.42
Male	415	0.654	0.476
German	415	0.874	0.333
Cognitive Ability (crystallized)	415	0.0473	0.922
Cognitive Ability (fluid)	415	0.421	0.953
(General) Risk Tolerance	415	5.114	2.312
Financial Risk Tolerance	409	2.540	2.229
Patience	415	6.127	2.540
Conscientiousness	415	0.0655	0.943
Agreeableness	415	-0.0557	0.995
Extraversion	415	-0.00380	1.065
Openness	415	0.0447	0.993
Neuroticism	415	-0.112	0.929
Optimism	415	0.421	0.494
Education (in Years)	415	12.89	2.585
Monthly Gross Wage	415	3254.5	1743.1
Hours Worked (per Week)	415	43.63	8.184
Tenure (in Years)	415	11.02	10.18
White Collar (Yes= 1)	415	0.703	0.458
Self-Employed (Yes= 1)	415	0.105	0.307
Firm Size: $200 \leq \text{Employees} < 2000$	415	0.220	0.415
Firm Size: $\text{Employees} \geq 2000$	415	0.267	0.443
Autonomy (Yes= 1)	415	0.290	0.454
Average GDP Growth Rate	415	1.945	1.071
Wealth Savings (Yes=1)	324	0.315	0.465
Precautionary Savings (Yes=1)	324	0.637	0.482
Wealth Savings Amount (Log)	298	1.897	2.783
Precautionary Savings Amount (Log)	298	3.561	2.757
Loan Outstanding (yes=1)	324	0.328	0.470
Loan Outstanding Amount (Log)	298	1.720	2.559
Single Household (Yes= 1)	299	0.312	0.464
Couple with no Kids (Yes= 1)	299	0.276	0.448
House Ownership (Yes= 1)	299	0.467	0.500
Household Net Income	299	3,135.19	1,647.95

Notes: SOEP-IS. SOEP weights are used.

Table 8: Descriptive Statistics.