The Dog that Didn't Bark: What Item Non-Response Shows about Cognitive and Non-Cognitive Ability

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Abstract

What survey respondents choose not to answer (item non-response) provides a useful task based measure of cognitive ability (e.g., IQ) and non-cognitive ability (e.g., Conscientiousness). Using the German Socio-Economic Panel (SOEP) and the National Longitudinal Survey of Youth 1997 (NLSY97), we find consistent correlation between item non-response and traditional measures of IQ and Conscientiousness. We also find that item non-response is more strongly correlated with earnings in the SOEP than traditional measures of either IQ or Conscientiousness. We also use the Survey of Income and Program Participation (SIPP) Gold Standard, which has no explicit measure of either cognitive or non-cognitive ability, to show that item non-response predicts earnings from self-reported and administrative sources. Consistent with previous work showing that Conscientiousness and IQ are positively associated with longevity, we document that item non-response is associated with decreased mortality risk. Our findings suggest that item non-response provides an important measure of cognitive and non-cognitive ability that is contained on every survey.

(JEL: I2, J24)

Inspector Gregory: "Is there any other point to which you would wish to draw my attention?"
Holmes: "To the curious incident of the dog in the night-time."
Inspector Gregory: "The dog did nothing in the night-time."
Holmes: "That was the curious incident."
        -Sir Arthur Conan Doyle, *The Memoirs of Sherlock Holmes*, 1892, pp. 21-22

I. Introduction

Studying the importance of non-cognitive skills, such as conscientiousness, perseverance, and motivation, has been hamstrung by the fact that many popular data sets in economics do not contain information on an individual's personality traits. However, surveys contain a valuable but neglected piece of data: what respondents do not say. Respondents skip, refuse to answer, or claim ignorance on at least a few questions in virtually all surveys. When a respondent forgets to fill in answers to some questions on the survey form, or refuses to provide an answer to the interviewer, we gain important information about the respondent. For example, information about how careful the respondent is, how much she values privacy, her ability to understand questions, and how open she is to sharing personal information with a stranger.

In this paper we argue that the fraction of survey questions a respondent is asked but does not answer provides scholars with a useful index that captures a variety of traits about that person. We propose that item non-response, and its equivalent inverse, the item response rate, is a measure of non-cognitive skills (e.g., personality traits, such as conscientiousness), and cognitive skills, such as intelligence.

The psychology literature describes Conscientiousness as one of the dimensions of the Big Five Factor model, a popular classification of personality traits (Goldberg, 1993; Barenbaum and Winter, 2008; John and Srivastava, 1999; Krueger et al., 2008). The Big Five Factor model claims that at the highest level, five factors describe personality traits: Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. These factors represent

personality traits at the broadest level of abstraction and summarize other, more specific aspects

of personality. For example, the trait Conscientiousness includes dutifulness, ambition, and self-

discipline, and Agreeableness includes trust, straight-forwardness, and altruism (Almlund et al.,

2011). Some recent work suggests that classifying traits into six (Ashton, Lee, Perugini et al.,

2004) or seven dimensions (Saucier, 2003) is a useful classification in non-English speaking

cultures.

While the role of cognitive ability in economics has been extensively studied, (Boissiere,

Knight, and Sabot, 1985) economists, more recently, have turned some attention to non-cognitive

ability, and have found that the latter is an important variable for explaining economic outcomes

(Almlund et al., 2011). Despite non-cognitive ability's important relationship to outcomes as

diverse as earnings (Bowles, Gintis, and Osborne, 2001), longevity (Savelyev, 2010), and career

choice (Dohmen et al., 2011), there are few large U.S. surveys that attempt to formally measure

it. Notably, the vast majority of federal survey datasets including the Current Population Survey

(CPS), American Community Survey (ACS), and the Survey of Income and Program

Participation (SIPP) contain no direct measure of either cognitive or non-cognitive ability. Even

those surveys that do measure personality or IQ rarely do so more than once or twice per sample

panel. This paper builds on the existing literature of cognitive and non-cognitive ability by

proposing a new measure, item non-response, as a function of both forms of ability, one that is

inherently built into every wave of every survey conducted. This measure has the advantage of

not being self-reported, which reduces the probability that a respondent can lie about the

existence of a trait.

We first test the hypothesis that item non-response is a reflection of an individual's

personality traits. The National Longitudinal Survey of Youth 1997 (NLSY97) and German

Socio-Economic Panel (SOEP) contain measurements of personality traits, including

Conscientiousness and IQ. For ease of interpretation we use fraction answered as our measure of

item response, the inverse of item non-response.[1] Using these data, we test the hypothesis that

item response is positively correlated with Conscientiousness and find support for this claim.

Those who answer more questions on surveys tend to report higher levels of conscientious

behavior. We also regress item response on the measure of IQ provided in the SOEP and the

NLSY97 and find a correlation. Those who answer a larger fraction of questions have a higher

IQ. We suggest that this finding is consistent with the hypothesis that high-IQ individuals find it

easier to understand survey questions and thus find it less costly to respond.

We also test whether item response or the traditional measures of Conscientiousness and

IQ, found in SOEP and NLSY97, is a better predictor of economic outcomes. For the SOEP, we

find that item response is more strongly correlated with earnings than self-reported measures of

Conscientiousness. For the NLSY97, we find that fraction answered predicts earnings with

similar accuracy to regressions that include both Conscientiousness and IQ.

Having established support for the hypothesis that item response is a function of

Conscientiousness and IQ, we find the item response rate derived from the Survey of Income and

Program Participation (SIPP), which has no explicit measures of cognitive or non-cognitive

ability. We find that higher item response is associated with higher self-reported earnings. In

order to confirm that this relationship is not a mechanical artifact of the data collection process,[2]

we use the SIPP Gold Standard File, that links SIPP records to Social Security Administration

earnings data, to obtain out-of-sample estimates of how item response correlates with earnings.

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[1] This is a measure of item response and not non-response but the two are mirror images. The fraction answered is equal to the number answered over the number asked, while the fraction not answered is equal to one minus the fraction answered. For ease of interpretation, we use the item response measure in our regressions.
[2] Those who answer more questions might report more sources of earnings.

We find that item response is an even stronger predictor of administrative earnings than it is of self-reported earnings.

Motivated by the finding that Conscientiousness and IQ are positively correlated with longevity (Savelyev, 2010), we also analyze how item non-response effects mortality. For this we take advantage of the SIPP Gold Standard's administrative death records. We find that individuals with higher response rates are less likely to die. This again suggests that item response is capturing the same characteristics captured in traditional measures of IQ and Conscientiousness.

In this paper, we document the new, previously unknown stylized fact, that item response is correlated with earnings, and longevity. Our results give researchers a proxy for IQ and Conscientiousness on the numerous surveys that do not contain explicit personality trait and IQ measures.

II. A Brief Review of the Economics Literature on the Effects of Non-Cognitive Skills

There is a long history in the field of psychology of studying the effects of non-cognitive skills. Recently, economists have studied the importance of non-cognitive skills for human behavior and economic outcomes. A recent chapter from the Handbook of the Economics of Education (2011) summarizes findings on the importance of non-cognitive skills and emphasizes the importance of the personality trait Conscientiousness for outcomes: "One principle finding of our survey, consistent with the claims of the early psychologists cited in Section 2, is that Conscientiousness is the most predictive Big Five trait across many outcomes." (Almlund et al., p. 127).

Conscientiousness is defined by the American Psychological Association as "The tendency to be organized, responsible, and hardworking" (cited in Heckman, Integrating Personality Psychology into Economics, 2011, p. 5). Conscientiousness is an important determinant for a wide variety of economic market outcomes, particularly earnings. In fact, many studies have found a positive correlation between earnings and Conscientiousness, as measured by the Big Five (see, for example, Heineck and Anger, 2010; Nyhus and Pons, 2005; Salgado, 1997; Hogan and Holland, 2003; Barrick and Mount, 1991). In fact, Almlund et al. (2011) find that in many cases, Conscientiousness may be a better predictor of earnings than intelligence: "Of the Big Five traits, Conscientiousness best predicts overall job performance but is less predictive than measures of Intelligence. Conscientiousness, however, predicts performance and wages across a broad range of occupational categories, whereas the predictive power of measures of intelligence decreases with job complexity" (Almlund et al., 2011, p. 127).

Conscientiousness is also positively correlated with years of education (see, for example, Goldberg et al., 1998; van Eijck and de Graaf, 2004; Almlund et al., 2011). Conscientiousness predicts student grades with the same accuracy as intelligence and "correlations between Conscientiousness and academic performance were largely independent of intelligence" (Poropat, 2009, p. 1). Personality traits can also explain much of the wage disparity between high school graduates and GED recipients. Specifically, while GED recipients have the same level of cognitive ability as high school graduates, the former earn far less.[3] Much of this difference in earnings can be explained by differences in non-cognitive ability between GED recipients and high school graduates (Heckman et al., pp. 18-19, 31-32).[4]

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[3] As measured by the AFQT in the NLSY.
[4] As measured by Rosenberg Self-Esteem Scale and Rotter Locus of Control in the NLSY.

Non-cognitive skills are clearly an important trait in understanding how labor markets work, but the difficulty of accurately measuring them seems to give economists pause.

III. Potential Drawbacks of Some Previously Used Personality Trait Measures

One feature of the aforementioned literature on Conscientiousness is that the measure of Conscientiousness is largely self-reported. Personality measures, such as Conscientiousness, are most often obtained from self-assessments. For example, the measure is derived from the degree to which the respondent agrees with statements such as "I am a thorough worker, or, I do not tend to be lazy, or I carry out tasks efficiently." Survey participants respond to these statements by giving each statement a ranking from one to seven, indicating how well a sentence describes him or her. In the case of three questions, as in the SOEP, the measure of Conscientiousness is defined as sum of the three ranks, a number between 3 and 21. In NLSY two questions are used to measure Conscientiousness, a number between 2 and 14.

One may worry that some respondents might be unrealistically generous about their answers, giving themselves high marks on those questions. Thus, Conscientiousness may be mis-measured due to self-deception or dishonesty. Self-reported Conscientiousness may be different from true Conscientiousness. The possibility of mis-measurement has an analog in the literature that compares self-reported intelligence to objective intelligence. Here, Paulhus et al. (1998) found that the "correlations between single-item self-reports of intelligence and IQ scores are rather low (.20–.25)."

There are reasons to be as skeptical of self-reported assessments of personality as self-reported intelligence. Relative to self-assessment of non-cognitive traits, item response is a more objective personality measure because it has the benefit of being a task-based measure. When a

respondent is asked to assess his Conscientiousness he might exaggerate his ability to be careful and well organized. However, if the respondent is tasked with a difficult assignment, such as completing a large survey, it becomes harder to exaggerate those abilities, especially when the individual is not aware that the surveyor can obtain an assessment of Conscientiousness from item response. While our results are somewhat suggestive, this topic requires further investigation.

IV. Model

Both cognitive and non-cognitive ability affect outcomes such as earnings. Some of the labor literature discusses the bias of the coefficient on education, when a researcher does not control for cognitive ability, such as intelligence (Card, 1999). Similarly, to estimate the causal effect of the returns to education, if non-cognitive skills are an important determinant of both education and wages, an unbiased estimate on education is obtained by also including a measure of non-cognitive ability.

Suppose an outcome y, such as earnings, for individual i, is determined by his education, ed, cognitive ability, ca, and non-cognitive ability, nc, with some error term μ.

$$y_i = \beta_0 + \beta_1 ed_i + \beta_2 ca_i + \beta_3 nc_i + \mu_i \tag{1}$$

Education is just one example of a variable of interest to economists whose effect might be estimated with bias when not controlling for cognitive and non-cognitive ability. Studies have found the returns to education are inflated by about 10 percent when cognitive ability is not controlled for (Card, 1999). Similarly, true return to education might be overstated in models that do not include measures capturing non-cognitive ability (Judge et al., 1999; Almlund et al., 2011).

We employ item response as a measure of cognitive and non-cognitive skills. We hypothesize that the data generating process for item response is a function of IQ and Conscientiousness. A conscientious individual, for example, might be more willing to continue providing answers on a long and difficult survey than someone less conscientious. Further, it takes a minimum amount of cognitive ability to answer questions, and therefore some individuals may find it less costly to answer questions. These considerations motivate us to use item response in a survey as a proxy for ca and nc.

We define r, as the fraction of questions answered to questions asked to respondent i, and we model this variable as a function of ca and nc plus an error term, ϵ_i, to capture random variation in other factors effecting item non-response. Other factors could include the approach of the field representative conducting the survey, the time of day of the interview, or whether the respondent is well rested, etc.

$$r_i = f(ca_i, nc_i) + \epsilon_i \tag{2}$$

Assuming a linear relation,

$$nr_{i,t} = \delta_0 + \delta_1 ca_i + \delta_2 nc_i + \epsilon_i \tag{3}$$

we estimate

$$y_i = \gamma_0 + \gamma_1 ed_i + \gamma_2 r + \mu_i \tag{4}$$

Thus, γ_2 captures, in part, both the effect of cognitive and non-cognitive ability. The coefficient on γ_1 has less omitted variable bias than an equation without r and should be closer to the true β_1 in equation (1).

V. Data and the Construction of the Item Response Variable

In our analysis we use three publicly available data sets, the Survey of Income and Program Participation (SIPP), the National Longitudinal Study of Youth 1997 (NLSY97), and the German Socio-Economic Panel Study (SOEP).[5] We use the NLSY97 and the SOEP to test whether item response is correlated with personality traits, especially Conscientiousness, and to test whether item response is correlated with socio-economic outcomes. We use the SIPP to test whether item-non response predicts earnings. We also use the SIPP Gold Standard File, which links administrative records from the Social Security Administration on earnings and mortality to the SIPP. Access to administrative measures of earnings overcomes the potential mechanical relationship between item non-response and under reported earnings. It also allows us to test the effect of our measure on mortality, since death data is not available for most respondents in SIPP.

The NLSY97 contains survey data for children born between 1980 and 1984, resulting in a sample of individuals that are of similar ages. The first round of the survey was in 1997 and there were annual follow-up surveys every year. In 1999, most NLSY97 respondents participated in a form of the Armed Services Vocational Aptitude Battery (CAT-ASVAB), which measures intelligence.[6] The score from this test is expressed as a percentile, that is, where each individual ranks relative to others in this survey.

From the NLSY97 we obtain a measure of Conscientiousness and other personally traits from the 2008 survey. The personality trait measures are based on the Ten-Item Personality Inventory.[7] This inventory test is based on ten questions regarding the personality of individuals participating in the survey, and two of the ten questions correspond to each of the Big Five

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[5] Both of these datasets are surveys and thus subject to sampling and non-sampling error.
[6] For details on how this test was administered please see
http://www.nlsinfo.org/nlsy97/nlsdocs/nlsy97/topicalguide/asvab.html
[7] For details please see http://homepage.psy.utexas.edu/homepage/faculty/swann/docu/GOSL.PDF.

components. The responses for each of the five are scaled from one to seven, so that a higher number means more open, more conscientious, more extraversion, more agreeable or more neurotic.[8]

The NLSY97 includes variables indicating the fraction of questions answered with "Don't Know" and the fraction answered with "Refused." We create our item non-response measure as the sum of these two fractions from the 2008 survey.

The SOEP is an annual longitudinal survey that has been following the same panel of individuals since 1984. New households have been added to the original sample to reflect changes in the German population and survey attrition over the years, but many households from the original sample remain (Bund-Länder Commission for Educational Planning and Research Promotion, retrieved2011). SOEP features a very large core set of questions asked in every wave, as well as large topical modules asked intermittently with at least one per wave. SOEP is administered by a field representative who either guides a respondent through the paper survey or allows the respondent to fill out the survey on her own. From the SOEP we use the 2005 and 2009 panels since those are the only panels which ask questions pertaining to the respondent's personality traits.

For every question, SOEP records if a question was asked to a particular respondent and if the respondent "refused to answer" or provided "an answer, which is not plausible and cannot be corrected, for example when a respondent claims to receive welfare benefits of €10,000 per month" (Kraus, 2012). We count only "refused to answer" as item non-response in SOEP since the implausible answers might be due to recording error rather than respondent error.

Each SIPP panel is a longitudinal survey of more than 40,000 households interviewed every four months over a course of three to four and a half years (US Census Bureau, 2011).

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[8] NLSY uses emotional stability, the opposite of neuroticism. We reverse code it to be consistent with SOEP.

SIPP is a large survey featuring hundreds of questions in the core questionnaire. These questions are asked in every wave of the survey, and additionally hundreds of questions are asked in intermittent topical modules. This paper makes use of the first wave of both the 2004 and 2008 panels, the periods most concurrent with the waves of SOEP and NLSY containing measures of personality. We also use administrative records from the SIPP Gold Standard File (GSF) version 6. The GSF is a census data product that merges Social Security Administration data to SIPP panels. This data includes yearly earning variables from 1972 to 2009 (Abowd, Stinson, and Benedetto, 2006).

The SIPP is administered by a field representative going in person to the sampled household and giving the survey to all respondents in the household. If a respondent in the household is not present, another member of the household answers the survey questions for him as a proxy. In order to be certain that we are measuring the effects of item non-response of individuals to whom data entries apply, we have restricted the sample to only those who answered the questions for themselves.

For every question, SIPP records whether the survey question applied to the respondent, her answer, or whether the respondent said she "didn't know" or "refused" to answer. With this data, we can correctly identify the percent of questions a respondent was willing to answer. We count the categories "don't know" and "refuse" as a non-response.

All three surveys are voluntary and principally appeal to the respondent's sense of civic duty or desire to want to share this information with the field representative. However, some SIPP households in both the 2004 and 2008 panel were experimentally given a $20 or $40 gift card in advance of the survey as a conditional incentive to participate at all in the survey. Further, for some households, field representatives were given discretion with respect to when

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and if to provide a gift card to encourage a reluctant respondent to continue (Monaghan, 2008).

Respondents in the NLSY97 received $30 for participating in the survey, and some of these

individuals received bonus payments, based on incentive experiments that were conducted for a

subset of the participants.

While there is some potential for payments to influence item non-response, we believe

that any effect is small since the incentives were designed to reduce unit non-response, so to

minimize the chance that the individual refused to participate or to continue. The incentive was

not directed at reducing item non-response, which is the unwillingness to answer some number

of questions on the survey. Given that most respondents answer more than 90 percent of the

questions asked, it seems unlikely that the item non-response rates of the vast majority of

respondents were affected by the incentive. We have explicitly controlled for these incentive

payments in NLSY[9] and did not observe any significant change in our results.

For SIPP we compute two measures of non-response. One measure is based on the forty

questions asked of all respondents. The other measure is based on all questions asked in the core

SIPP module. For the latter measure, the number of questions was a maximum of 373 and 371 in

the 2004 and 2008 panels, respectively. For SOEP, we report the item non-response rate based

on all questions asked to the individual.[10]

The histograms in Figure 1 show the fraction of questions answered in SIPP. The left

histogram is calculated based on all the questions that a respondent was asked. The right

histogram uses only those forty questions asked to all respondents. Perhaps not surprisingly, the

distribution is skewed to the right. Somewhat surprisingly, many individuals do not respond to

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[9] The only dataset of the three where this is possible using public data.

[10] For SOEP, we used various measures for non-response rates, showing similar patterns across the measures. For example, we ran the models using a measure of non-response where answers that are not plausible are counted as a form of non-response (a sloppy answer shows less Conscientiousness/intelligence). Our results did not change in meaningful ways.

all of the basic forty questions in SIPP, which include questions regarding gender, age, education, and yes/no statements about owning certain asset types, all of which do not appear to be difficult to answer. In the appendix, Table A1 shows the full list of the forty questions, the fraction of respondents who answered it, and a brief description of each variable.

Figure 2 shows response rates for the NLSY79 and the 2005 and 2009 SOEP data sets. As with SIPP, the fraction of questions answered is highly skewed to the right. However, most respondents do not answer all of the questions asked. Ninety-seven percent of all SIPP respondents fail to answer at least one question in the core SIPP module. Out of the forty questions asked to all SIPP respondents, 64 percent fail to answer at least one question. In the NLSY97, eighty percent of respondents fail to answer at least one question and in the SOEP, fifty percent of respondents fail to answer at least one question asked to them.[11]

VI. Results

Table 1 shows averages and standard deviations of our variables in the SIPP, SOEP and NLSY97 data sets. In all three surveys, the fraction of questions answered is above 96 percent, suggesting item non-response rates are fairly low.

We first test our hypothesis that Conscientiousness and other Big Five personality factors are correlated with the fraction of survey questions answered. Our hypothesis that item non-response measures capture some of what psychologists call Conscientiousness is supported if we find a statistically significant a positive correspondence between the fraction of survey questions answered and the traditional measures of Conscientiousness.

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[11] This difference in item non-response is partly due to SIPP oversampling of poor respondents but is unlikely to explain all the variation. Future research may investigate this difference more closely.

Table 2 shows the beta coefficient from bivariate regressions, testing whether the fraction of survey questions answered can predict any of the Big Five personality traits, Openness, Conscientiousness, Extroversion, Agreeableness, and Neuroticism.[12, 13] Table 2, Panel A shows results from the 2005 SOEP and Table 2, Panel B shows results for the 2009 SOEP, the only years when the Big Five questions were included in the German survey. Table 2, Panel C shows results from regressing fraction answered on the Big Five dimensions for the NLSY97 data set.

The results in Table 2, Panel A and Panel B show that the beta coefficients on the fraction answered is statistically significant and positive when the dependent variable is Conscientiousness, indicating that individuals who are more conscientious answered more of the questions they were asked. The point estimates in Table 2, Panel A suggest that a one standard deviation increase in Conscientiousness is associated with about a one-third standard deviation increase in the fraction of questions answered. For the top two panels, none of the point estimates on item response in any of the other personality traits regressions are statistically significant, except for Neuroticism in Panel B. The findings in Table 3 show that item response is a statistically significant predictor of Conscientiousness in the SOEP data set lends support for our hypothesis that item non-response captures a least some aspects of Conscientiousness.

The bivariate regression results between personality traits and fraction answered for the NLSY97 data set show that fraction answered is also positively and statistically significantly correlated with Conscientiousness, but is also correlated with Openness, Extraversion and Neuroticism. Thus, while the results from this data set support the hypothesis that item non-

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[12] We use standardized beta coefficients to allow for easy comparisons across the different measures and units in the different variables and surveys.

[13] The respondents are asked to rate how well a sentence describes them on 15 questions on a scale from 1 to 7. For example Conscientiousness is defined by the answers to statements "Thorough worker," "Carry out tasks efficiently" and the inverse of "Tend to be lazy" while agreeableness is define through the statements "Able to forgive," "Friendly with others" and the inverse of "Am sometimes too coarse with others" (Gerlitzand Schupp, 2005).

response is in part capturing Conscientiousness, the results from the NLSY suggest that item non-response is correlated with several other personality traits. For example, individuals who answer more questions tend to be more extraverted individuals and less neurotic individuals.

It is possible that surveys with different survey techniques, such as paper, Computer Assisted Personal Interview (CAPI), Computer Assisted Telephone Interviews (CATI), etc., might show different correlations between item response and non-cognitive personality traits. For example, in personal interviews, item response may also be correlated with Extraversion or Agreeableness. It is perhaps surprising that Table 2, Panel A and Panel B show that item response in the SOEP is uncorrelated with either Openness or Extraversion since SOEP is largely a CAPI. NLSY is also a CAPI and here, item response and Openness and Extraversion are positively correlated. Unfortunately, SIPP does not contain direct measures of personality traits, so we cannot replicate the analysis in Table 3 on the SIPP data set.

We also test whether the fraction of questions answered by individuals predicts their IQ. Panels A and B of Table 3 show the results for the SOEP and Panel 3 for the NLSY97 data set. In all panels, the first column includes only Fraction Answered as an explanatory variable, the second column adds age and age squared, and the third column adds education. The first two panels show that fraction answered is positively correlated with IQ in all specifications, and that in all but one, the point estimates on IQ are statistically significant. Although our sample is relatively small, because not all individuals in the SOEP were asked to complete the supplemental IQ questions, our findings show that those individuals who answer more questions tend to test higher on the IQ questions. Table 3, Panel C shows that in all three specifications the point estimates on fraction answered are positive and statistically significant, indicating that a one standard deviation increase in questions answered is associated with a between 0.21 and 0.12

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increase in IQ standard deviation. The magnitude of these beta coefficients are more than three times as large as for the German data set, which may be due to the fact that the NLSY uses a very sophisticated measure of IQ, the Armed Services Vocational Aptitude Battery, while the SOEP uses much simpler and shorter tests.

Research findings suggest that performance on cognitive tests is strongly affected by the amount of effort the person puts into the test. Edlund found that IQ scores go up on average 12 points when the respondents are offered a single M&M candy for each correct answer (Edlund, 1972). This apparent correlation between effort and IQ might be another way in which Conscientiousness is manifest in item non-response.[14] Those with high levels of Conscientiousness will exert more effort than those with a low level and will have higher measured IQs. In fact, when we correlate measured IQ in SOEP with measured Conscientiousness in SOEP, we find a positive and statistically significant correlation, which is consistent with the hypothesis that measured IQ in part reflects the individual's degree of Conscientiousness.

We next compare the relative explanatory value of item response relative to traditional measures of Conscientiousness and IQ. If the coefficients on fraction answered and traditional measures have the same sign in separate regressions but with the same dependent variable and controls, then this is consistent with the hypothesis that item non-response captures the same underlying characteristics.

Table 4, Panels A, B and C show this comparison by regressing log of earnings on our variables of interest, fraction answered, Conscientiousness and IQ. Table 4, Panel A uses the

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[14] For example, Cunha and Heckman (2008) find that the correlation coefficient between cognitive and personality factors is 0.3 and others find that schooling can affect both cognitive personality trait measures (Hansen, Heckman and Mullen 2004, and Heckman, Stixrud and Urzua, 2006). Non-cognitive abilities are correlated with measured intelligence (Almlund et al., 2011).

2005 wave of the SOEP, Table 4, Panel B the 2009 wave, and Table 4, Panel C the 2010 wave of

the NLSY97. In each table, columns 1, 4, and 7 show the regressions with the fraction of

questions answered and columns 2, 5, and 7 show the regressions with Conscientiousness, and

columns 3, 6, and 9 show regressions with both Conscientiousness and IQ. The specifications for

each of the three sets differ in that the specification includes no controls, controls for gender and

age, or controls for gender and age and education.

The bivariate regressions results in Table 4, Panels A and B, columns 1 show that a one

standard deviation increase in fraction of questions answered, increases earnings by about 0.14

standard deviations. When all control variables are included, as in columns 7 in all three tables, a

one standard deviation in the fraction of questions answered increases earnings by between 0.06

and 0.10 standard deviations. The consistency of this point estimate across the three data sources

and two different surveys suggests that fraction answered is capturing the same characteristics in

each survey.

Tables 4, Panels A, B and C show that in all specifications a one standard deviation

change in fraction answered has a larger effect than the corresponding columns that report the

effect of a one standard deviation in Conscientiousness. In all three Panels, specifications,

Columns 2, 3, 5, 6, 8, and 9 show that a one standard deviation increase in Conscientiousness

increases earnings between 0.03 and 0.09 standard deviations.

Interestingly, all SOEP specifications that include fraction answered, have a higher R-

squared than the corresponding specifications that include either Conscientiousness or both IQ

and Conscientiousness. In NLSY the R-squared value from the regressions with just

Conscientiousness are smaller than the fraction answered regressions but the specifications with

both IQ and Conscientiousness are larger. This suggests that fraction answered is a stronger

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predictor of earnings relative to measures of IQ via a few questions, as in SOEP, but a weaker predictor as relative to a comprehensive test, like the CAT-ASVAB used in NLSY. The point estimate on fraction answered in Table 4, Panel C, column 7 implies individuals who answer three percentage points more of the questions asked will have an extra $2,200 in earnings per year, 8 percent of median person's annual earnings. In the SOEP data, a one standard deviation increase in fraction answered corresponds to a 5 and 6 percent increase in annual earnings for the median person the 2005 and 2008 waves respectively. These findings suggest that fraction answered is capturing the same kinds of characteristics captured by traditional measures of Conscientiousness and IQ.

Next we test for whether the fraction answered is a positive and statistically significant predictor of self-reported earnings in the SIPP data set, which lacks explicit measures of cognitive or non-cognitive skills.

Table 5, Panel A shows results for the 2004 SIPP panel and Table 5, Panel B for the 2008 SIPP panel. The dependent variable in these regressions is the log of self-reported earnings. In these regressions we include separately two measures of item non-response. In the columns labeled "40," we compute the fraction answered as the number of questions the respondent answered out of the forty questions asked to each responded. In the columns labeled "All," we compute the fraction answered as the number of questions answered over the total number of questions asked. We report results from a bivariate regression, including only fraction answered, and then report results from three subsequent specifications where we first add gender, then age and age squared, and then indicator variables for the completed degree, with high school dropouts as the reference group.

In all specifications, the point estimate on fraction answered is positive and statistically significant. As in the previous table, the point estimates on fraction answered are getting smaller, though only slightly, as we add more controls. The largest drop comes from including education as a control. This is intuitive because fraction answered is a measure of IQ and Conscientiousness and these two traits are correlated with educational attainment (see Heckman et al. 2010). Some of the explanatory power of fraction answered is captured by education, just as it is for the traditional measures of IQ and Conscientiousness in Table 4. The point estimates on fraction answered indicate that a one standard deviation increase in fraction answered increase log earnings by 0.07 and 0.09 standard deviations when our fraction answered measure is based on all questions asked and between 0.04 and 0.08 standard deviations when our measure is based on the aforementioned forty questions. Table 5, panel A, column 8 indicates that those who have a one standard deviation increase in the fraction of questions have $2,832 more annual earnings, 12 percent of the median person's earnings.

One concern about these estimates from the SIPP, SOEP and NLSY79 earnings regressions is that respondents who answer more questions will have more sources of earnings contributing to their measured earnings. For example, if a respondent refuses to answer earnings questions about a second job, their fraction answered decreases and so would their measured earnings. However, in this case, the point estimate on fraction answers does not accurately reflect the effect of Conscientiousness and IQ on earnings. In this example, the refusal to answer leads to an overestimate of the effect of item-response on real earnings.

To avoid this problem and problems related to mis-measurement associated with self-reported earnings, we repeat the analysis in Table 6, Panel A and Panel B, using the SIPP Gold Standard, which contains earnings from the Social Security Administration. Since this data is

collected independently of the number of questions the respondent answered, social security earnings should have no spurious correlation to the survey data collection process.

Panel A of Table 6 presents results for the 2004 SIPP panel and Panel B reports results from the 2008 SIPP panel. As in Table 5, we report results for our two measures of fraction answered. In both panels we find that all point estimates on item non-response are positive and statistically significant and roughly the same size for both. A one standard deviation increase in fraction answered is associated with a between 0.11 to 0.15 increase of a standard deviation in administrative earnings. The magnitudes of the point estimates are nearly twice as large as in the self-reported income regressions. As in Table 5, the point estimates on fraction answered decrease slightly when we add indicators for educational achievement.

The fraction of questions answered has a quantitatively important effect on earnings. The results in Table 6, Panel A, column 7 indicate that individuals who answer two more questions out of the forty questions that were asked to all respondents, have $5,681 higher earnings per year, 18 percent for the median SIPP respondent's earnings.

Having established the relationship between item response and earnings, we turn our attention to other outcomes associated with IQ and Conscientiousness. There is an established positive correlation between IQ and longevity (see Gottfredson and Deary, 2004). Recently, work by Savelyev (2010) shows that Conscientiousness is positively correlated with longevity. To test the hypothesis that non-response shows the same correlation found for IQ and Conscientiousness, we use the mortality records in the SIPP Gold Standard. These mortality records include "a hierarchy of administrative sources: (i) SSA's [Master Beneficiary Record] file, (ii) the Census Personal Characteristics File with death information coming from the SSA Numident and Master Death Files, and (iii) SSA's [Supplemental Security Income Record] file"

(U.S. Census Bureau, 2010, p. 16). Our dependent variable equals 1 if the person died between being interviewed in SIPP and May 30th of 2010 and zero otherwise.[15] We are only looking at 7 years of potential deaths from the 2004 panel and 2 years from the 2008 panel. As a result, only 3 percent of the 2004 panel has died and 1 percent of the 2008 panel.

Table 7, Panels A and B report the results for the 2004 SIPP panel and the 2008 SIPP panel, respectively. We use the same two measurements for fraction answered as in the previous tables where we used the SIPP data.

For the 2004 wave in Panel A we find that fraction answered reduces the likelihood of death, and is statistically significant in seven of the eight specifications. The point estimate from column 8 indicates that a one standard deviation increase in the fraction of questions answered reduces the likelihood of death by 0.38 standard deviations. This corresponds to a decrease in the probability of death of 7 percent.

In Panel B of Table 7, we find that all of the point estimates on fraction answered are negative and statistically significant, lending support to the hypothesis that Conscientiousness and IQ, as measured by fraction answered, increase longevity. The point estimate on column 8 indicates that a one standard deviation increase in the fraction of questions answered leads to a decrease in the probability of death of 12 percent. Among our other controls, we find that those with more education are likely to live longer, males experience death earlier than females, and, as expected, longevity decreases in age.

VI. Discussion

If individuals with higher opportunity cost of time (i.e., higher earnings) choose not to answer as many questions, then this is a factor that works against the likelihood of finding the

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[15] The last day of administrative data available.

effects of item non-response that we report in this paper. To the extent that individuals with higher opportunity cost respond to fewer questions, our estimates identify the lower bound of the effect of item non-response on earnings.

We are unable to conclusively resolve the problem on reverse causation (i.e., higher earnings result in answering more questions and higher measured IQ and Conscientiousness). If the traits that lead to low item non-response are largely fixed by genes or very early childhood interventions, then there is less room for this concern.

There is strong evidence that IQ is relatively fixed beyond the age of eight (see Hopkins and Bracht, 1975, and Schuerger and Witt, 1989). If this is correct, then our data allow us to measure the causal effect of IQ on earnings. However, a causal interpretation is less certain for personality traits. Many psychologists have relied on the viewpoint expressed by the 19th century psychologist William James, "in most of us, by the age of thirty, the character has set like plaster, and will never soften again" (James, 1890, pp. 125-126; see also McCrae and Costa, 1990, 1994, 1996, 2003; Costa, McCrae and Siegler, 1999; Cobb-Clark and Schurer, 2012). However, some recent work has begun to dispute this result. Roberts and DelVecchio, in a survey of personality research, find evidence of a life cycle in personality traits with stepwise changes at different points that do not stabilize until after age 50. However, they caveat their conclusion with "Without accounting for the full range of approaches to consistency, it would be premature to render a final judgment concerning whether and when personality traits are fixed" (Roberts and DelVecchio, 2000, p. 19). If Conscientiousness and other personality traits are fixed beyond a young age, as it appears to be for IQ, then our results regarding item non-response and earnings have a causal interpretation. However, even if personality traits are malleable, there is no evidence that earnings are endogenously correlated with that change. In

fact, in our panels we find that measures of personality in the young are still strong predictors of earnings in years long after the original measurement. This suggests that even if personality traits do change, they are serially correlated and we have little reason to worry about endogeneity in these two variables.

VII. Conclusions

Non-cognitive ability is an important explanatory variable in economics. We have shown that item non-response serves as a useful metric of cognitive and non-cognitive ability. Our study shows how item non-response is correlated with traditional measures of IQ and Conscientiousness in SOEP and NLSY. We also show how item non-response is a good predictor of earnings, and is more precise than the traditional measure of Conscientiousness. This metric supplies a measure of cognitive and non-cognitive ability that can be of use in all surveys.

We demonstrate the potential usefulness of this metric by applying it to SIPP and the SIPP Gold Standard. We find the correlation between survey-reported earnings and fraction answered has the same magnitude as it did in SOEP and NLSY, which were similar to the coefficients from the traditional measures of Conscientiousness and IQ. In order to correct for possible spurious correlation between earnings and item non-response, we analyzed the correlation between earnings from administrative sources and fraction answered. Here we find an even stronger correlation than we found in the survey data.

We also test our proxy's ability to generate the same predictions found by other researchers between Conscientiousness along IQ in non-monetary dimensions. IQ and Conscientiousness are both positively correlated with longevity. Using administrative death records we find that item non-response shows the same correlation.

Our findings suggest that item non-response is a useful proxy for understanding human behavior. This proxy can be of great use to researchers since it already exists on every survey ever conducted without adding any additional respondent burden or data collection cost.

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Figure 1 – SIPP Fraction Answered of Questions Eligible
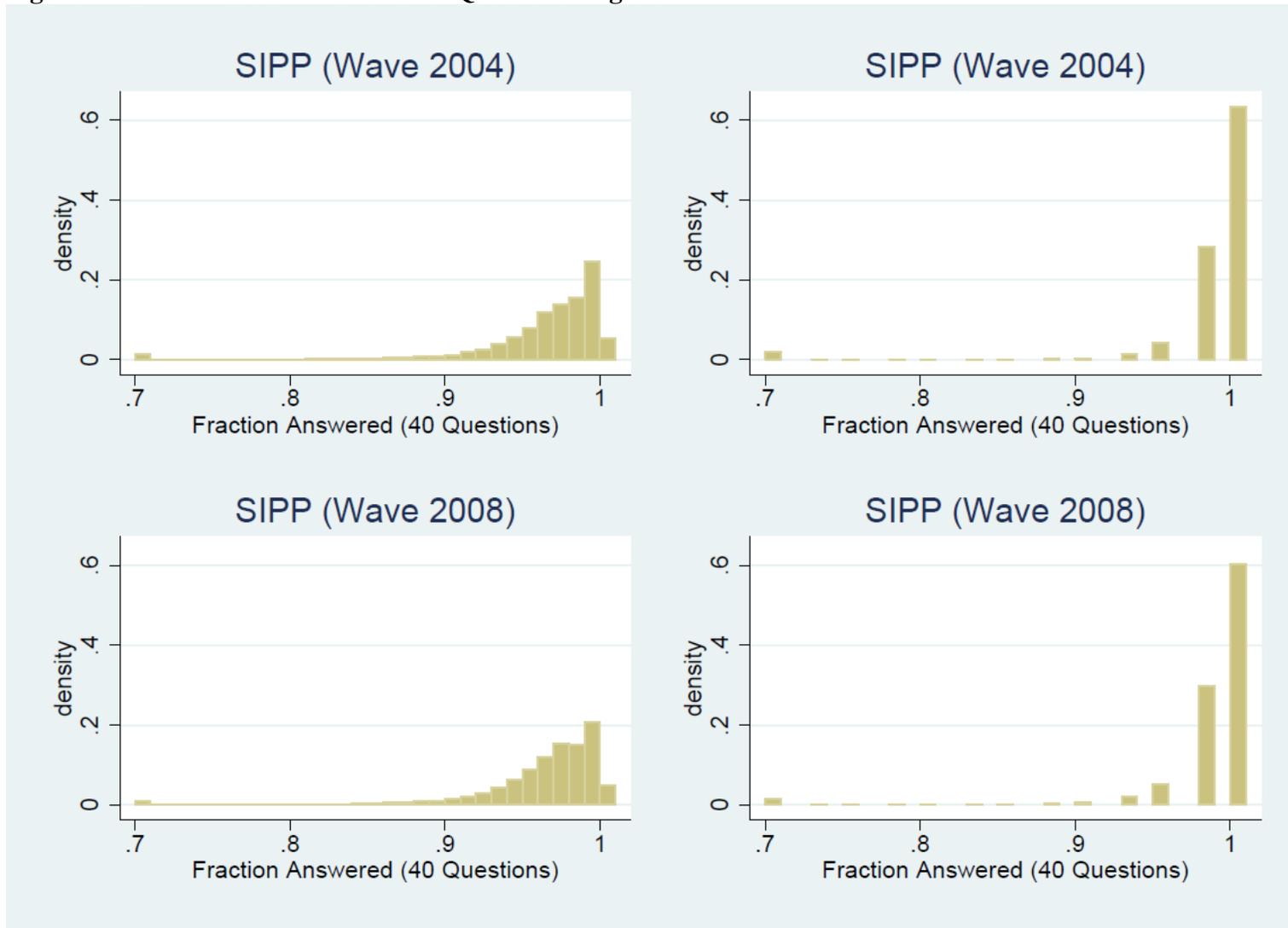
Source: US Census Bureau, Survey of Income and Program Participation (SIPP), 2004 and 2008 panels http://www.census.gov/sipp/source.html

Figure 2 – NLSY97 and SOEP Fraction Answered of Questions Eligible
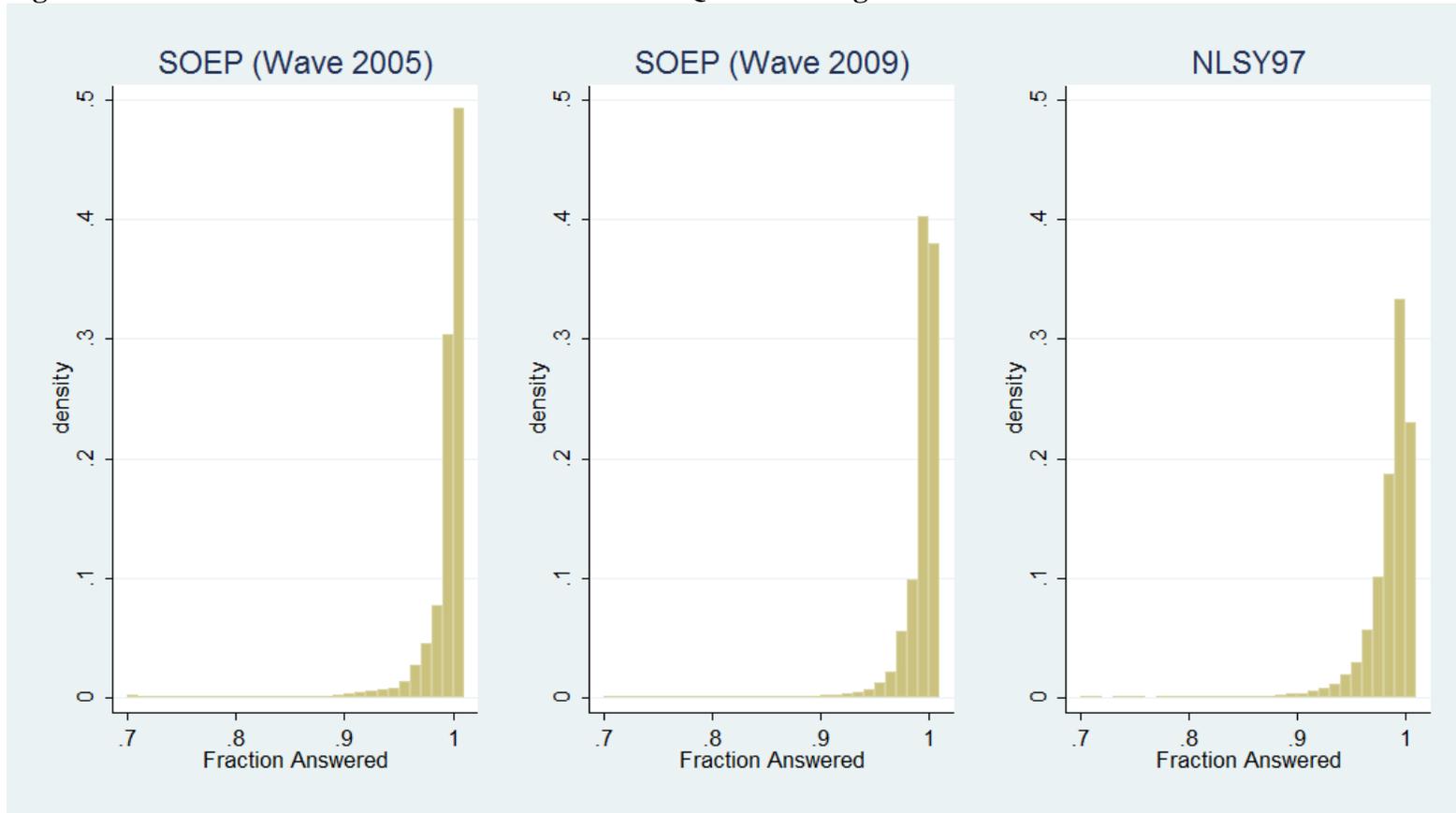
Source: German Socio-Economic Panel Study (SOEP), 2005 and 2009 waves
http://www.diw.de/english/soep_overview/33899.html , and NLSY97,2008 wave.

Table 1: Summary Statistics – Means and Standard Deviations

	SIPP	SIPP	SOEP	SOEP	NLSY97
	2004	**2008**	**2005**	**2009**	**2010**
N	38,845	37,833	20,049	19,849	7, 490
Fraction answered (all questions)	0.96	0.96	0.99	0.99	0.96
(0-1)	(0.06)	(0.05)	(0.03)	(0.03)	(0.04)
Fraction answered (questions asked to all respondents)	0.98	0.98	NA	NA	NA
(0-1)[1]	(0.06)	(0.06)			
Self-Reported Conscientiousness	NA	NA	17.7	17.5	11.4
(SIPP: NA; SOEP: 3-21; NLSY: 2-14)	NA	NA	(2.8)	(2.8)	(2.2)
IQ[2]	NA	NA	51.2	51.2	45.4
(SIPP: NA; SOEP: 3-123; NLSY: 1-100)	NA	NA	(18.0)	(18.0)	(29.1)
Age	43	44	47	46	28
	(13.13)	(18.04)	(17.6)	(17.7)	(1.4)
Male	0.43	0.45	0.48	0.48	0.51
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Earnings [3]	$30,732	$33,432	€ 28,261	€ 29,041	$32,010
	(42,912)	(44,004)	(21,289)	€ 21,925	(23,162)
Annual Admin Earnings	$27,092	$32,972	NA	NA	NA
	(60,431)	(62,407)	NA	NA	NA
Died [4]	0.03	0.01	NA	NA	NA
	(0.16)	(0.10)	NA	NA	NA

[1] We have not identified the questions in SOEP or NLSY97 asked to all respondents.

[2] IQ is only measured once in SOEP so the same score applies in both waves. IQ was not measured for the full sample in either wave so regressions using IQ have fewer observations. For NLSY97 IQ was measured for the whole panel.

[3] Monthly data annualized for SIPP and SOEP, Annual for NLSY97.

[4] From administrative records, the fraction of respondents who died between participation in the survey and May 30th of 2010.

Standard Deviations in parentheses. Data sources: US Census Bureau, Survey of Income and Program Participation (SIPP), 2004 and 2008 panels and the SIPP Gold Standard v6.0 http://www.census.gov/sipp/FinalReporttoSocialSecurityAdministration.pdf; http://www.census.gov/sipp/source.html

German Socio-Economic Panel Study (SOEP), 2005 and 2009 waves: http://www.diw.de/english/soep_overview/33899.html

National Longitudinal Survey of Youth 1997 (NLSY97): https://www.nlsinfo.org/ http://www.bls.gov/nls/

Table 2: Item Response and the Big Five Personality Traits

Panel A: SOEP (Wave 2005)

	(1) Openness	(2) Conscientiousness	(3) Extraversion	(4) Agreeableness	(5) Neuroticism
Fraction	-0.005	0.032**	-0.002	0.007	0.014
Answered	(-0.70)	(3.87)	(-0.30)	(0.96)	(1.95)
N	19,730	19,755	19,852	19,843	19,838
R^2	0.000	0.001	0.000	0.000	0.000

Standardized beta coefficients; robust t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$

Panel B: SOEP (Wave 2009)

	(1) Openness	(2) Conscientiousness	(3) Extraversion	(4) Agreeableness	(5) Neuroticism
Fraction	-0.005	0.029**	-0.003	-0.007	-0.014*
Answered	(-0.64)	(3.95)	(-0.45)	(-1.01)	(-2.08)
N	19,515	19,540	19,595	19,621	19,632
R^2	0.000	0.001	0.000	0.000	0.000

Standardized beta coefficients; robust t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$

Table 2: NLSY97 (Wave 2008)

	(1) Openness	(2) Conscientiousness	(3) Extraversion	(4) Agreeableness	(5) Neuroticism
Fraction	0.037**	0.036**	0.072**	0.009	-0.072**
Answered	(2.94)	(2.88)	(6.12)	(0.75)	(-5.49)
N	7,363	7,424	7,346	7,153	7,420
R^2	0.001	0.001	0.005	0.000	0.005

Standardized beta coefficients; robust t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$

Table 3: Regression of IQ on Fraction Answered
Panel A: SOEP (Wave 2005)

	(1)	(2)	(3)
Fraction Answered	0.022	0.048**	0.039**
	(1.41)	(3.10)	(2.58)
Age		0.315**	0.127
		(3.87)	(1.48)
Age2		-0.693**	-0.484**
		(-8.72)	(-5.74)
Education			0.245**
			(15.12)
N	3,473	3,473	3,290
R^2	0.000	0.150	0.207

Standardized beta coefficients; robust t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$

Panel B: SOEP (Wave 2009)

	(1)	(2)	(3)
Fraction Answered	0.074**	0.052**	0.051**
	(4.50)	(3.38)	(3.40)
Age		0.233**	0.140
		(2.91)	(1.75)
Age2		-0.570**	-0.445**
		(-7.32)	(-5.69)
Education			0.234**
			(15.33)
N	3,977	3,977	3,872
R^2	0.005	0.123	0.176

Standardized beta coefficients; robust t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$

Table 3: Regression of IQ on Fraction Answered (continued)

Panel C: NLSY97

	(1)	(2)	(3)
Fraction Answered	0.204**	0.207**	0.117**
	(9.86)	(9.85)	(7.43)
Age=26		0.000	0.000
		(.)	(.)
Age=27		0.007	0.002
		(0.41)	(0.16)
Age=28		-0.013	-0.009
		(-0.80)	(-0.70)
Age=29		-0.015	-0.013
		(-0.94)	(-0.94)
Age=30		-0.037*	-0.034*
		(-2.34)	(-2.52)
Education			0.564**
			(55.11)
N	6,044	6,044	5,680
R^2	0.042	0.043	0.354

Standardized beta coefficients; robust t statistics in parentheses

Note: Age and education are from 2010, fraction answered is from 2008 and IQ is from 1999

$^* p < 0.05$, $^{**} p < 0.01$

Table 4: Regressions of Log of Earnings on Fraction Answered, Conscientiousness and IQ

Panel A: SOEP (Wave 2005)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Fraction Answered	0.135**			0.081**			0.071**		
	(7.80)			(6.58)			(5.94)		
Conscientiousness		0.073**	0.081**		0.028**	0.052*		0.054**	0.064**
		(6.55)	(3.12)		(3.06)	(2.31)		(6.13)	(2.99)
IQ			0.107**			0.142**			0.061**
			(4.40)			(6.85)			(2.92)
Male				0.348**	0.354**	0.382**	0.361**	0.368**	0.392**
				(40.52)	(40.68)	(18.02)	(44.28)	(44.67)	(19.29)
Age				2.037**	2.075**	1.719**	1.690**	1.699**	1.416**
				(32.90)	(33.56)	(11.37)	(28.39)	(28.55)	(9.99)
Age2				-1.763**	-1.802**	-1.465**	-1.482**	-1.495**	-1.241**
				(-27.96)	(-28.59)	(-9.47)	(-24.50)	(-24.75)	(-8.59)
Education							0.330**	0.337**	0.310**
							(41.31)	(41.88)	(13.97)
N	9,684	9,620	1,611	9,684	9,620	1,611	9,373	9,316	1,575
R^2	0.018	0.005	0.017	0.298	0.293	0.285	0.388	0.386	0.355

Standardized beta coefficients; robust t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$

Table 4: Regressions of Log of Earnings on Fraction Answered, Conscientiousness and IQ (continued)

Panel B: SOEP (Wave 2009)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Fraction Answered	0.134**			0.087**			0.063**		
	(8.03)			(6.74)			(5.55)		
Conscientiousness		0.055**	0.045		0.030**	0.053*		0.052**	0.074**
		(5.06)	(1.86)		(3.19)	(2.46)		(5.94)	(3.65)
IQ			0.075**			0.082**			0.018
			(3.19)			(3.94)			(0.93)
Male				0.352**	0.358**	0.439**	0.372**	0.380**	0.448**
				(39.55)	(39.94)	(21.67)	(44.15)	(44.89)	(23.56)
Age				1.635**	1.675**	1.249**	1.326**	1.332**	1.104**
				(28.66)	(29.43)	(8.82)	(23.72)	(23.84)	(7.75)
Age2				-1.383**	-1.423**	-1.097**	-1.127**	-1.137**	-0.996**
				(-24.00)	(-24.78)	(-7.62)	(-20.02)	(-20.26)	(-6.89)
Education							0.344**	0.352**	0.339**
							(42.37)	(42.67)	(18.33)
N	9,427	9,378	1,817	9,427	9,378	1,817	9,082	9,034	1,766
R^2	0.018	0.003	0.007	0.261	0.255	0.246	0.363	0.362	0.349

Standardized beta coefficients; robust t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$

Table 4: Regressions of Log of Earnings on Fraction Answered, Conscientiousness and IQ (continued)

Panel C: NLSY97

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Fraction Answered	0.148**			0.134**			0.095**		
	(6.54)			(6.08)			(4.71)		
Conscientiousness		0.078**	0.096**		0.085**	0.106**		0.076**	0.096**
		(5.43)	(6.19)		(5.94)	(6.92)		(5.49)	(6.30)
IQ			0.272**			0.278**			0.182**
			(16.53)			(17.18)			(9.89)
Male				0.131**	0.140**	0.164**	0.171**	0.181**	0.185**
				(9.37)	(9.97)	(11.06)	(12.64)	(13.28)	(12.39)
Age=26				0.000	0.000	0.000	0.000	0.000	0.000
				(.)	(.)	(.)	(.)	(.)	(.)
Age=27				0.036*	0.034	0.023	0.034	0.032	0.022
				(1.99)	(1.85)	(1.19)	(1.91)	(1.79)	(1.11)
Age=28				0.062**	0.071**	0.060**	0.064**	0.070**	0.060**
				(3.39)	(3.85)	(3.14)	(3.65)	(3.94)	(3.16)
Age=29				0.086**	0.097**	0.086**	0.085**	0.093**	0.086**
				(4.66)	(5.22)	(4.40)	(4.71)	(5.09)	(4.36)
Age=30				0.094**	0.109**	0.102**	0.101**	0.113**	0.105**
				(5.16)	(5.99)	(5.42)	(5.77)	(6.43)	(5.66)
Education							0.280**	0.288**	0.174**
							(19.33)	(19.68)	(9.65)
N	4,975	4,950	4,106	4,975	4,950	4,106	4,941	4,917	4,079
R^2	0.022	0.006	0.079	0.046	0.036	0.115	0.122	0.119	0.137

Standardized beta coefficients; robust t statistics in parentheses

Note: Age, education and earnings are from 2010, fraction answered and Conscientiousness is from 2008 and IQ is from 1999

* $p < 0.05$, ** $p < 0.01$

Table 5 Panel A: SIPP - Log of Survey Self-Reported Earnings on Fraction Answered (Panel 2004)

	(1) 40	(2) All	(3) 40	(4) All	(5) 40	(6) All	(7) 40	(8) All
Fraction Answered	0.061**	0.087**	0.058**	0.086**	0.057**	0.079**	0.038**	0.066**
	(10.96)	(13.95)	(10.81)	(14.11)	(10.58)	(13.22)	(7.45)	(11.15)
Male			0.207**	0.208**	0.209**	0.209**	0.207**	0.207**
			(43.14)	(43.30)	(44.28)	(44.42)	(43.54)	(43.63)
Age					0.889**	0.886**	0.822**	0.818**
					(20.64)	(20.57)	(18.89)	(18.83)
Age2					-1.025**	-1.019**	-0.963**	-0.958**
					(-23.13)	(-23.01)	(-21.49)	(-21.38)
High School							0.177**	0.177**
							(18.82)	(18.81)
Some College							0.287**	0.286**
							(28.58)	(28.55)
College Degree							0.300**	0.300**
							(35.51)	(35.53)
Graduate Degree							0.274**	0.274**
							(39.36)	(39.41)
N	38,845	38,845	38,845	38,845	38,845	38,845	35,663	35,663
R^2	0.005	0.008	0.047	0.050	0.076	0.079	0.136	0.138

Standardized beta coefficients; robust t statistics in parentheses

Models marked '40' measure Fraction Answered using the 40 questions asked to all respondents in the sample.

Models marked 'All' measure Fraction Answered using the total number of questions asked to the respondent.

Source: Survey of Income and Program Participation (SIPP) and the SIPP Gold Standard v6.0

$^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$

Table 5: Panel B: SIPP - Log of Survey Self-Reported Earnings on Fraction Answered (Panel 2008)

	(1) 40	(2) All	(3) 40	(4) All	(5) 40	(6) All	(7) 40	(8) All
Fraction Answered	0.084[**]	0.094[**]	0.081[**]	0.093[**]	0.082[**]	0.086[**]	0.066[**]	0.082[**]
	(12.89)	(14.55)	(12.79)	(14.54)	(13.08)	(13.95)	(10.75)	(13.23)
Male			0.171[**]	0.171[**]	0.172[**]	0.173[**]	0.173[**]	0.173[**]
			(33.43)	(33.56)	(34.46)	(34.57)	(34.94)	(35.03)
Age					0.903[**]	0.910[**]	0.869[**]	0.875[**]
					(20.00)	(20.16)	(19.42)	(19.57)
age2					-1.044[**]	-1.047[**]	-1.011[**]	-1.012[**]
					(-22.65)	(-22.69)	(-22.09)	(-22.14)
High School							0.162[**]	0.163[**]
							(17.04)	(17.22)
Some College							0.277[**]	0.280[**]
							(27.43)	(27.81)
College Degree							0.322[**]	0.325[**]
							(36.80)	(37.39)
Graduate Degree							0.303[**]	0.307[**]
							(41.98)	(42.71)
N	37,672	37,672	37,672	37,672	37,672	37,672	34,496	34,496
R^2	0.010	0.012	0.032	0.034	0.055	0.055	0.128	0.130

Standardized beta coefficients; robust t statistics in parentheses

Models marked '40' measure Fraction Answered using the 40 questions asked to all respondents in the sample.

Models marked 'All' measure Fraction Answered using the total number of questions asked to the respondent.

Source: Survey of Income and Program Participation (SIPP) and the SIPP Gold Standard v6.0

[*] $p < 0.05$, [**] $p < 0.01$, [***] $p < 0.001$

Table 6: Panel A: SIPP - Log of Administrative Earnings on Fraction Answered (Panel 2004)

	(1) 40	(2) All	(3) 40	(4) All	(5) 40	(6) All	(7) 40	(8) All
Fraction Answered	0.116**	0.146**	0.115**	0.146**	0.114**	0.143**	0.094**	0.128**
	(18.83)	(21.42)	(18.73)	(21.40)	(18.74)	(21.25)	(15.17)	(18.35)
Male			0.103**	0.104**	0.103**	0.104**	0.110**	0.110**
			(20.47)	(20.72)	(20.66)	(20.90)	(21.77)	(21.95)
Age					0.905**	0.900**	0.809**	0.804**
					(20.60)	(20.49)	(18.17)	(18.07)
age2					-0.927**	-0.918**	-0.849**	-0.840**
					(-21.04)	(-20.84)	(-18.95)	(-18.77)
High School							0.187**	0.187**
							(21.49)	(21.52)
Some College							0.298**	0.298**
							(31.92)	(32.00)
College Degree							0.302**	0.303**
							(37.35)	(37.59)
Graduate Degree							0.267**	0.268**
							(38.84)	(39.11)
N	38,845	38,845	38,845	38,845	38,845	38,845	35,663	35,663
R^2	0.013	0.018	0.024	0.029	0.036	0.040	0.091	0.096

Standardized beta coefficients; robust t statistics in parentheses

Sample is restricted to respondents between the ages of 25 and 62.

Models marked '40' measure Fraction Answered using the 40 questions asked to all respondents in the sample.

Models marked 'All' measure Fraction Answered using the total number of questions asked to the respondent.

Source: Survey of Income and Program Participation (SIPP) and the SIPP Gold Standard v6.0

* $p < 0.05$, ** $p < 0.01$

Table 6: Panel B: SIPP – Log of Administrative Earnings on Fraction Answered (Panel 2008)

	(1) 40	(2) All	(3) 40	(4) All	(5) 40	(6) All	(7) 40	(8) All
Fraction Answered	0.147**	0.152**	0.146**	0.151**	0.145**	0.149**	0.128**	0.142**
	(19.97)	(21.78)	(19.95)	(21.73)	(19.95)	(21.60)	(17.18)	(20.04)
Male			0.119**	0.120**	0.120**	0.121**	0.128**	0.129**
			(23.76)	(23.96)	(24.06)	(24.24)	(25.50)	(25.65)
Age					0.763**	0.775**	0.739**	0.751**
					(17.16)	(17.41)	(16.44)	(16.72)
Age2					-0.814**	-0.818**	-0.797**	-0.801**
					(-18.13)	(-18.20)	(-17.53)	(-17.63)
High School							0.208**	0.210**
							(22.00)	(22.37)
Some College							0.339**	0.345**
							(33.86)	(34.66)
College Degree							0.342**	0.349**
							(38.64)	(39.77)
Graduate Degree							0.317**	0.324**
							(43.09)	(44.37)
N	37,833	37,833	37,833	37,833	37,833	37,833	34,647	34,647
R^2	0.022	0.021	0.036	0.036	0.046	0.046	0.117	0.120

Standardized beta coefficients; robust t statistics in parentheses

Sample is restricted to respondents between the ages of 25 and 62.

Models marked '40' measure Fraction Answered using the 40 questions asked to all respondents in the sample.

Models marked 'All' measure Fraction Answered using the total number of questions asked to the respondent.

Source: Survey of Income and Program Participation (SIPP) and the SIPP Gold Standard v6.0

* $p < 0.05$, ** $p < 0.01$

Table 7: Panel A: SIPP - Death on Fraction Answered (Panel 2004)

	(1) 40	(2) All	(3) 40	(4) All	(5) 40	(6) All	(7) 40	(8) All
Fraction Answered	-0.408**	-0.609**	-0.421**	-0.619**	-0.325*	-0.393*	-0.240	-0.379*
	(-2.90)	(-4.47)	(-3.03)	(-4.55)	(-2.23)	(-2.54)	(-1.43)	(-2.29)
Male			1.095**	1.095**	1.054**	1.053**	1.172**	1.173**
			(4.93)	(4.93)	(4.69)	(4.68)	(4.92)	(4.93)
Age					1.830	1.845	2.361	2.387
					(0.68)	(0.69)	(0.83)	(0.84)
Age2					4.164	4.137	3.729	3.692
					(1.70)	(1.68)	(1.44)	(1.42)
High School							-1.241**	-1.240**
							(-3.86)	(-3.86)
Some College							-1.858**	-1.860**
							(-5.30)	(-5.31)
College Degree							-3.110**	-3.117**
							(-8.12)	(-8.14)
Graduate Degree							-2.727**	-2.734**
							(-7.63)	(-7.66)
N	32,261	32,261	32,261	32,261	32,261	32,261	30,483	30,483
pseudo R^2	0.001	0.001	0.004	0.004	0.086	0.086	0.102	0.102

Standardized beta coefficients; robust t statistics in parentheses
Sample is restricted to respondents between the ages of 25 and 62.
Models marked '40' measure Fraction Answered using the 40 questions asked to all respondents in the sample.
Models marked 'All' measure Fraction Answered using the total number of questions asked to the respondent.
Source: Survey of Income and Program Participation (SIPP) and the SIPP Gold Standard v6.0
* $p < 0.05$, ** $p < 0.01$

Table 7: Panel B: SIPP - Death on Fraction Answered (Panel 2008)

	(1) 40	(2) All	(3) 40	(4) All	(5) 40	(6) All	(7) 40	(8) All
Fraction Answered	-0.946**	-1.134**	-0.956**	-1.144**	-0.916**	-0.928**	-0.934**	-1.019**
	(-4.34)	(-5.08)	(-4.45)	(-5.13)	(-4.27)	(-3.73)	(-3.60)	(-3.49)
Male			2.065**	2.060**	2.012**	2.015**	2.157**	2.161**
			(4.07)	(4.06)	(3.95)	(3.96)	(3.78)	(3.79)
Age					-0.909	-0.983	1.350	1.280
					(-0.16)	(-0.17)	(0.21)	(0.20)
Age2					8.191	8.217	6.108	6.120
					(1.52)	(1.52)	(1.03)	(1.03)
High School							-1.823*	-1.849*
							(-2.46)	(-2.49)
Some College							-3.516**	-3.569**
							(-4.24)	(-4.31)
College Degree							-5.585**	-5.646**
							(-6.03)	(-6.10)
Graduate Degree							-5.784**	-5.861**
							(-5.84)	(-5.92)
N	34,536	34,536	34,536	34,536	34,536	34,536	31,903	31,903
pseudo R^2	0.002	0.002	0.006	0.006	0.054	0.053	0.070	0.070

Standardized beta coefficients; robust t statistics in parentheses
Sample is restricted to respondents between the ages of 25 and 62.
Models marked '40' measure Fraction Answered using the 40 questions asked to all respondents in the sample.
Models marked 'All' measure Fraction Answered using the total number of questions asked to the respondent.
Source: Survey of Income and Program Participation (SIPP) and the SIPP Gold Standard v6.0
* $p < 0.05$, ** $p < 0.01$

Table A1: Mean Item Response Rate of the 40 Questions Asked to All Respondents

| | Mean Item Response Rate | | |
Variable	2004	2008	Question Description
TAGE	1.00000	1.00000	Edited and imputed age as of last birthday.
ESEX	0.99998	0.99998	Sex of this person
ESPEAK	0.99944	0.99970	Speak language other than English
ETENURE	0.99882	0.99845	Ownership status of living quarters
EBORNUS	0.99716	0.99804	Respondent was born in the U.S.
EPAOTHR1	0.99660	0.99735	Whether ... received transportation assistance
EPAOTHR4	0.99672	0.99733	Whether ... received clothing assistance
EPAOTHR3	0.99660	0.99731	Whether ... received food assistance
EPAOTHR6	0.99586	0.99715	Whether ... received welfare assistance
EPACASH2	0.99626	0.99704	Whether ... received general assistance or relief
EPACASH3	0.99644	0.99704	Whether ... received short-term cash assistance
EPACASH1	0.99644	0.99692	Whether ... or child received cash assistance
ESSISELF	0.99608	0.99687	Receipt of Federal SSI for self (ISS Code 3)
ECITIZEN	0.99541	0.99644	US Citizenship Status of Respondent
EMS	0.99642	0.99631	Marital status
EEDUCATE	0.99339	0.99183	Highest Degree received or grade completed
RENROLL	0.99175	0.99183	Enrolled Full/Part sometime during 4 month period
ECDMTH	0.99381	0.99101	Medicaid coverage in this month
EAST1B	0.98653	0.98873	IRA or Keogh account owned
EAST1C	0.98612	0.98750	401k or thrift plan owned
EAST4B	0.98055	0.98630	Royalty income received
EAST4C	0.98049	0.98597	Other financial investments owned
EAST3E	0.98023	0.98591	Mortgage held
EAST1A	0.98037	0.98552	U.S. government savings bonds owned
EAST4A	0.97967	0.98509	Rental property owned
EHIMTH	0.98855	0.98506	Health ins cover this month (not Medicare or Medicaid)

Table A1: Mean Item Response Rate of the 40 Questions Asked to All Respondents (continued)

Variable	Mean Item Response Rate 2004	2008	Question Description
EAST3D	0.97896	0.98431	U.S. government securities owned
EAST3C	0.97785	0.98345	Municipal or corporate bonds owned
ERACE	0.98730	0.98119	The race(s) the respondent is
EAST2D	0.97573	0.97979	Certificate of deposit owned
EAST2C	0.97406	0.97895	Money market deposit account owned
EPDJBTHN	0.97825	0.97761	Paid job during the reference period
EAST2A	0.97362	0.97754	Interest earning checking account owned
EAST3A	0.97074	0.97619	Mutual funds owned
EAST2B	0.97252	0.97596	Savings account owned
EAST3B	0.96945	0.97523	Stocks owned
TBYEAR	0.97979	0.97494	Year of birth
EBMNTH	0.97783	0.97131	Month of birth
EORIGIN	0.97161	0.96442	Spanish, Hispanic or Latino
EHIOWNER	0.72384	0.70334	Covered by own health insurance plan, someone else's, both or neither

Source: US Census Bureau, Survey of Income and Program Participation (SIPP), 2004 and 2008 panels http://www.census.gov/sipp/source.htm