Secular rise in economically valuable personality traits

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Although trends in many physical characteristics and cognitive capabilities of modern humans are well-documented, less is known about how personality traits have evolved over time. We analyze data from a standardized personality test administered to 79% of Finnish men born between 1962 and 1976 (n = 419,523) and find steady increases in personality traits that predict higher income in later life. The magnitudes of these trends are similar to the simultaneous increase in cognitive abilities, at 0.2–0.6 SD during the 15-y window. When anchored to earnings, the change in personality traits amounts to a 12% increase. Both personality and cognitive ability have consistent associations with family background, but the trends are similar across groups defined by parental income, parental education, number of siblings, and rural/urban status. Nevertheless, much of the trends in test scores can be attributed to changes in the family background composition, namely 33% for personality and 64% for cognitive ability. These composition effects are mostly due to improvements in parents' education. We conclude that there is a "Flynn effect" for personality that mirrors the original Flynn effect for cognitive ability in magnitude and practical significance but is less driven by compositional changes in family background.

personality traits | cognitive ability | cohort effects | earnings | Flynn effect

There are many well-documented trends in average physical characteristics and cognitive capabilities of modern humans. Average height and body mass index have been on the rise around the world (1–4). Average IQ scores have increased at a rate of 0.2 SD per decade since the 1950s (5). In this study, we document similar trends in economically valuable personality traits of young adult males, as measured by a standardized test.

Recent findings in economics and psychology show that personality traits, especially conscientiousness and neuroticism, are important predictors of outcomes such as education and income in various populations. The predictive power of personality tests can be higher or lower than that of IQ depending on the measures used (6–8). Although most studies have reported contemporaneous correlations, there is evidence that traits measured at adolescence predict educational attainment and adult income (9–13). Recent studies also show that employment growth has been strong in occupations that require high levels of social skills (14, 15).

Previous evidence on trends in personality traits has been constrained by a lack of high-quality data on representative samples of successive cohorts of the same source population. Comparisons of cross-sectional studies of US college students have shown positive trends over time in traits such as extraversion and narcissism (16–18). However, students who participate in surveys are known to differ systematically from those who do not participate in characteristics such as academic achievement and vocational interests (19–21). Moreover, the selectivity of college admissions has changed over time, which has changed the composition of college student populations by socioeconomic backgrounds (22, 23). There are some studies where the same personality test was given to different cohorts of the same source population at the same age (24–27), but generalizing their findings to wider populations is problematic due to self-selection of survey respondents (19, 20). On the other hand, researchers have used large and representative data on high school seniors in the United States. However, most items in this dataset measure social attitudes and personal values, and researchers have had to construct proxy measures for personality from a small number of items. Results have been mixed; some argue that personality traits have remained stable (28), whereas others claim to find increases in individualistic traits (29, 30).

Our data come from the Finnish Defense Forces (FDF), which has tested all military conscripts since 1982. Finnish men are drafted to military service in the year they turn 18, and most start their service at age 19 or 20. Both cognitive ability and personality tests are taken in the second week of military service in standardized group-administered conditions. Due to the comprehensive conscription system that grants relatively few exceptions, these data cover 79% of the population of Finnish men born between 1962 and 1976 (n = 419,523). We also have test data for three additional cohorts born between 1977 and 1979 who took the personality test at the local draft board. However, these test results may not be directly comparable with earlier cohorts due to differences in the testing environment. The test score data have been linked with information on later life income and demographic background variables derived from administrative registers and population censuses. We present the data in more detail in *Materials and Methods*.

In comparison with earlier work, our test score data have both strengths and weaknesses. The main strength is that we observe a large and stable fraction of Finnish men over birth cohorts and that the test items remained unchanged during the period we examine. This facilitates the interpretation of changes in test results across cohorts. The most serious weakness of our data is that it does not include women. We also do not have test results for those men who chose to do the civilian service or were exempted from service due to medical reasons.

Another important limitation of the FDF personality test is that its scales do not directly correspond to standard personality scales and it has not been validated in a peer-reviewed journal.

Significance

The secular rise in intelligence across birth cohorts is one of the most widely documented facts in psychology. This finding is important because intelligence is a key predictor of many outcomes such as education, occupation, and income. Although noncognitive skills may be equally important, there is little evidence on the long-term trends in noncognitive skills due to lack of data on consistently measured noncognitive skills of representative populations of successive cohorts. Using test score data based on an unchanged test taken by the population of Finnish military conscripts, we find steady positive trends in personality traits that are associated with high income. These trends are similar in magnitude and economic importance to the simultaneous rise in intelligence.

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The FDF test measures eight traits (see legend of Fig. 1*A*). We conducted an online test using a short version of the test to see how these scales relate to the widely used Five-Factor Model (FFM) (see *SI Appendix* for details). The results from our convenience sample ($n = 231$) suggest that the FDF scales capture three of the FFM scales (extraversion, conscientiousness, and neuroticism) but not agreeableness and openness.

Results

Cohort Trends in Test Scores. Fig. 1*A* shows the evolution of average scores for each of the eight personality traits in our data, measured in SDs of the earliest birth cohort and centered at its mean. All but one of the traits exhibit a clear upward trend. The increase is largest for self-confidence, sociability, and leadership motivation, where averages for the 1976 cohort are about 0.6 SD above the average of the 1962 cohort. Average scores for activity–energy and achievement striving increase about 0.4 SD, whereas deliberation and dutifulness increase about 0.2 SD. The only trait without a clear trend is masculinity. In *SI Appendix*, we show that these trends are unlikely to be driven by changes in selection out of military service, in age at test, or in the validity of test responses. Personality test scores have a structural break after the change in test administration, and there is no consistent trend for the three postchange cohorts.

To put the magnitude of the trends in context, Fig. 1*B* shows the changes in cognitive test scores over the same period. Average scores for all three subtests exhibit secular increases of similar magnitude as seen for personality traits, varying from 0.2 SD for verbal reasoning to 0.6 SD for visuospatial reasoning. General cognitive ability, defined as the sum of cognitive subscores, increased at a rate of 0.018 SD per year, which is in line with previous evidence for positive trends in IQ scores across many countries (5), also known as the "Flynn effect." Cognitive scores also show the end of the Flynn effect, which has been dated at around the 1970s birth cohorts in Finnish (31), Norwegian (32), and Danish conscript data (33).

Predictive Validity. A natural concern in interpreting the rise in any test scores is that later cohorts may have become more motivated or more adept at test-taking without any actual trends in underlying traits. We are unable to measure changes in motivation or in the ability "to game" the test, nor are we able to link test scores to trait-typical behavior (e.g., whether individuals with high sociability scores were highly sociable in real life). However, we can assess the predictive validity of test scores for income in later life. Fig. 2*A* plots the rank correlation of each personality trait with earnings at age 30 (the latest age at which we observe earnings for all cohorts). With the exception of masculinity—the only trait without a clear trend in Fig. 1*A*—all traits show a persistent and strong positive association with earnings, with rank correlations of about 0.1–0.2.

Stochastic Dominance. Test scores are ordinal measures of underlying traits, and treating them as if measured on an interval scale can result in misleading interpretations. In particular, conclusions may depend on arbitrary scaling decisions (34-36). *SI Appendix*, Figs. S2–S5 show that, with the exception of masculinity, the shifts took place across the entire distributions of test scores. That is, distributions of scores of the later cohorts dominate the distributions of earlier cohorts in the sense of first-order stochastic dominance. Thus, our conclusion about positive trends in personality test scores is robust to any monotonic transformation of the raw test scores.

Anchoring Test Scores to Earnings. To obtain a quantitative interpretation for the trends, we convert the test scores to interval scale by anchoring them to later-life earnings. We use average annual earnings at age 30–34, which we observe up to the 1976 birth cohort and which has been shown to be a good proxy for lifetime income (37). We regress these earnings on all personality test scores and use the resulting estimates to predict earnings for each combination of test scores (*SI Appendix*, Table S2). This predicted earnings measure is our anchored personality test score; cognitive test scores are anchored similarly. In addition to summarizing the tests scores on a one-dimensional interval scale, this approach also provides an economic context for our results.

Fig. 3 depicts the means of the anchored test scores across birth cohorts. The trends are very similar for personality and cognitive ability, showing an increase of about €2500 between the 1962 and

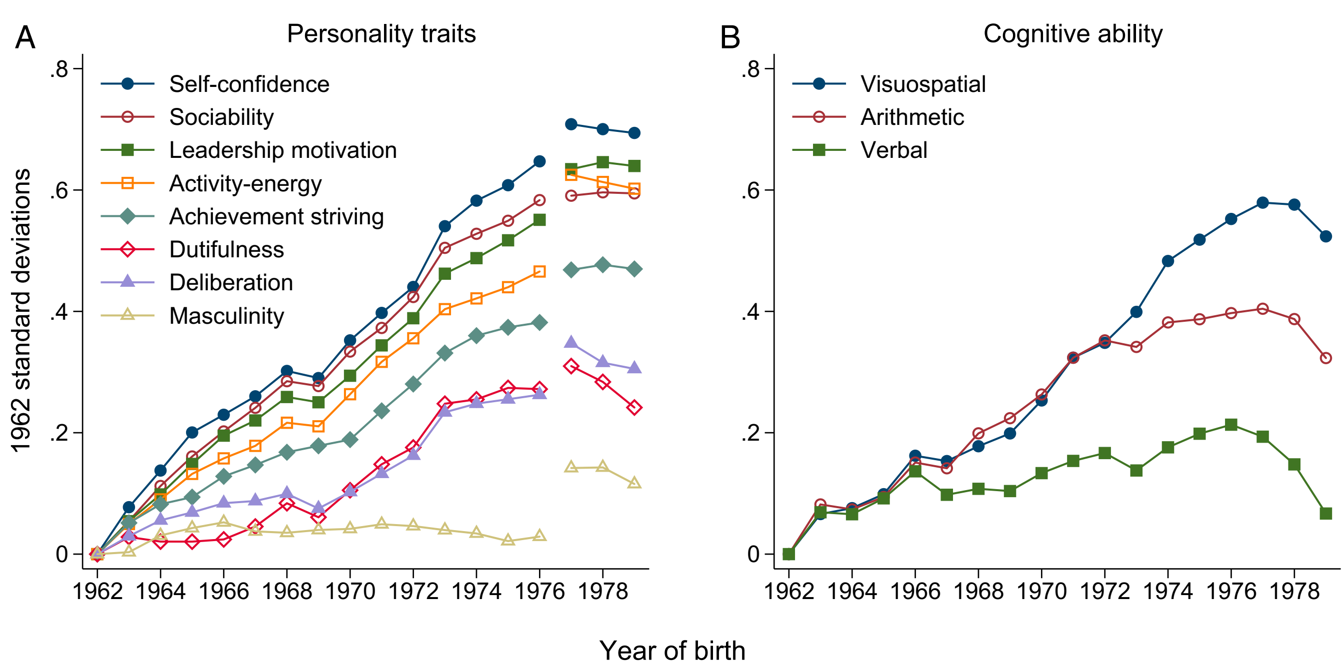

Fig. 1. Average scores for measures of (*A*) personality traits and (*B*) cognitive ability by birth year for native-born military conscripts in Finland. All scores are depicted in base year SDs, with base year means normalized at zero. The break in personality test scores reflects a change in test administration.

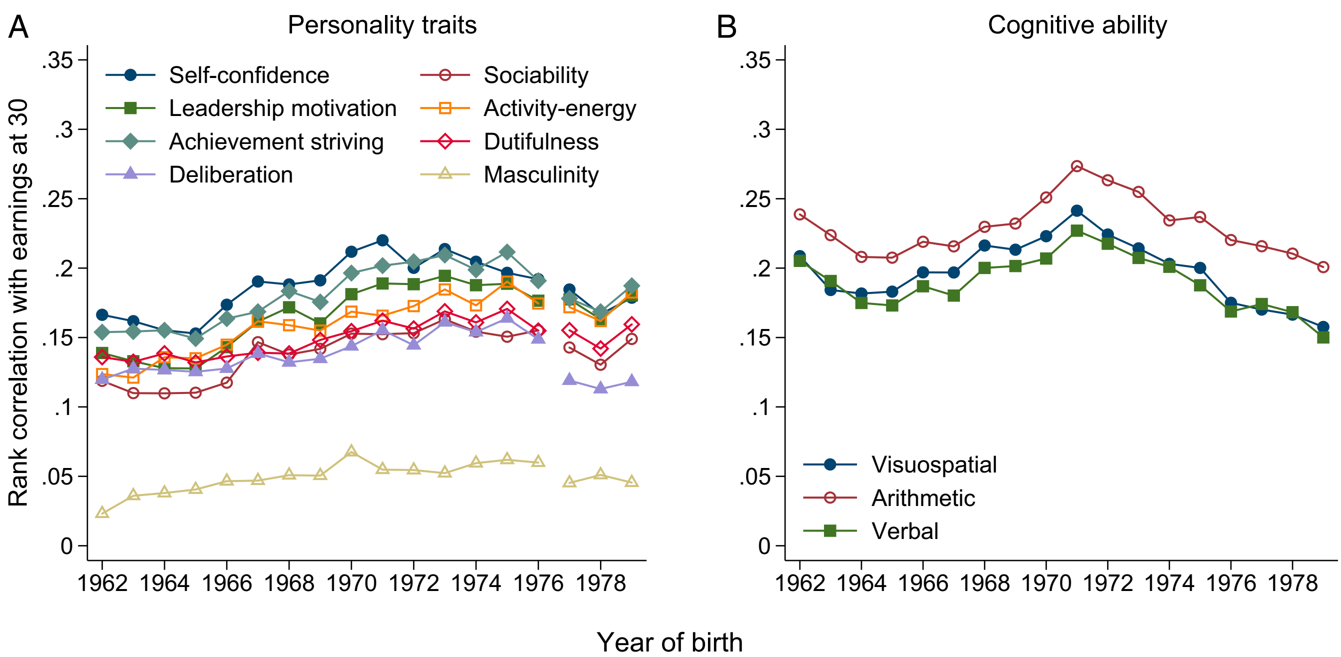

Fig. 2. The relation of earnings and (*A*) personality traits and (*B*) cognitive ability by birth cohort, measured as the within-cohort rank correlation between the test score and annual earnings at age 30. *SI Appendix*, Fig. S1 shows the same relations for average annual earnings at age 30–34, which is a better measure of lifetime earnings but not observed for the last three cohorts. The break in personality test scores reflects a change in test administration.

1976 cohorts for personality and €2200 for cognitive ability. Put differently, based on a time-invariant model for the relation of test scores and earnings, the increase in personality test scores predicts about 12% higher earnings for the 1976 cohort than for the 1962 cohort; based on cognitive test scores, the predicted increase is 10%. In *SI Appendix*, Fig. S7, we show that these trends are very similar when using alternative income measures. Furthermore, anchoring the test scores to completed education yields trends that are qualitatively similar to income-related anchorings, despite the very different scale of measurement.

Although personality traits are correlated with each other and with cognitive abilities, both have independent power in predicting earnings (*SI Appendix*, Table S2). Trends in personality are similar across levels of cognitive ability (*SI Appendix*, Fig. S17). An anchoring regression where both sets of test scores are controlled at the same time results in smaller magnitudes for both trends, namely 7% for personality and 8% for cognitive scores (*SI Appendix*, Fig. S6). For a different approach, *SI Appendix*, Table S5 reports an exploratory factor analysis, which shows that cognitive abilities and personality traits load into distinct factors. Confirmatory factor analysis (*SI Appendix*, Fig. S13) indicates that personality and cognitive factors are both related to earnings, but the correlation between them is only 0.41.

Measurement Error. The trends reported in Fig. 3 may understate cohort trends due to measurement error in individual test scores. We investigate the impact of measurement error in *SI Appendix*. Using brothers' test scores as instrumental variables (IVs) results in about a 9 percentage point higher increase in anchored personality test scores (*SI Appendix*, Fig. S11). For cognitive scores, the same approach yields a 4 percentage point higher increase. However, these instruments are not without problems, as able brothers may be directly helpful for one's earnings (38). Thus, we view the ordinary least squares (OLS)-based trends as conservative and the IV estimates as more likely to be upwards biased; a structural equation model suggests trends in between the two but much closer to the former (*SI Appendix*, Table S9).

Personality and Background Variables. Fig. 4 plots the trend in the anchored personality test scores separately by levels of background variables. It reveals a stable regularity between family background and personality across birth cohorts. Anchored scores are positively correlated with parental income, parental education, and urban childhood environment among all cohorts, whereas their association with the number of siblings is negative. Fig. 4 also shows that the positive trend is visible in every demographic subgroup. For

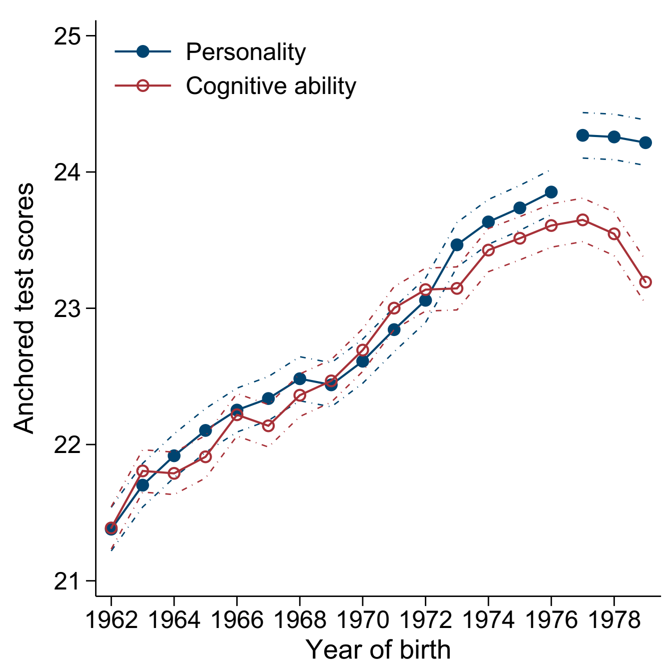

Fig. 3. Average of anchored test scores by birth cohort, with anchoring to average annual earnings at age 30–34 (in 1,000s of 2010 Euros) using the 1962–76 birth cohorts for estimating the prediction model. Dashed lines depict 95% confidence intervals. The break in personality test scores reflects a change in test administration.

example, the test scores of men with parents in the bottom quintile of the income distribution in the last cohort were nearing the level that was seen for those with parents in the top quintile in the earliest cohort in our data.

Trends in personality coincide with trends in background characteristics that are correlated with personality. There have been decreases in family size and increases in parental income, parental education, and urbanization (*SI Appendix*, Table S11). All of these background variables have been evolving to the direction that predicts higher levels of personality traits that are in turn known to predict higher incomes (39, 40). It is therefore natural to ask to which extent the observed cohort trends in personality can be explained as merely reflecting changes in the composition of the population by background characteristics.

The similarity of trends across backgrounds already suggests that changes in parental education, family size, and urbanization cannot fully explain the change in personality traits. Nevertheless, changes in backgrounds explain a sizeable fraction of the trends. We decompose the changes in test scores using the reweighting procedure proposed in ref. 41 (details in *SI Appendix*). In effect, we ask what the distribution of test scores would be if the relationship between background variables and test scores stayed the same as it was in 1962 but the distribution of background variables was the same as it was in 1976.

Table 1 reports the results of this exercise. We find that 33% of the increase in the anchored personality test score can be attributed to changes in background characteristics. The traits most affected by changing backgrounds are achievement striving and dutifulness, for which over 40% of the increase can be attributed to a composition effect. For other personality traits (besides masculinity, which has no clear trend), the composition effect accounts for 14–34% of the increase.

Beneficial trends in background characteristics are more important for explaining changes in cognitive ability than in personality, with 64% of the increase in anchored cognitive test scores attributable to the change in composition. For verbal scores, the change in backgrounds predicts an even larger increase than was actually observed.

Only one previous study has presented evidence on the role of demographic changes behind the Flynn effect. An analysis with sibship size as the only background variable was conducted in Norway (42). There a comparison between birth cohorts of 1938–40 and 1974–85 found that 35% of the increase in verbal scores and 13% of the increase in visuospatial scores can be attributed to the decrease in sibship size (there was no increase in arithmetic scores). If we use sibship size as the only background variable, we explain only 18% of the increase in cognitive ability. *SI Appendix*, Table S13 reports a similar analysis one background variable at a time; it shows that vastly improved parental education levels are the main driver of composition effects.

Conclusions

We find a Flynn effect for personality—that is, a secular rise in personality traits that are associated with higher earnings. The fact that the trend is positive is clear from the way distributions of test scores shift up across birth cohorts. Various methods of quantifying the economic importance of these changes all point toward the trend in personality being similar in magnitude and

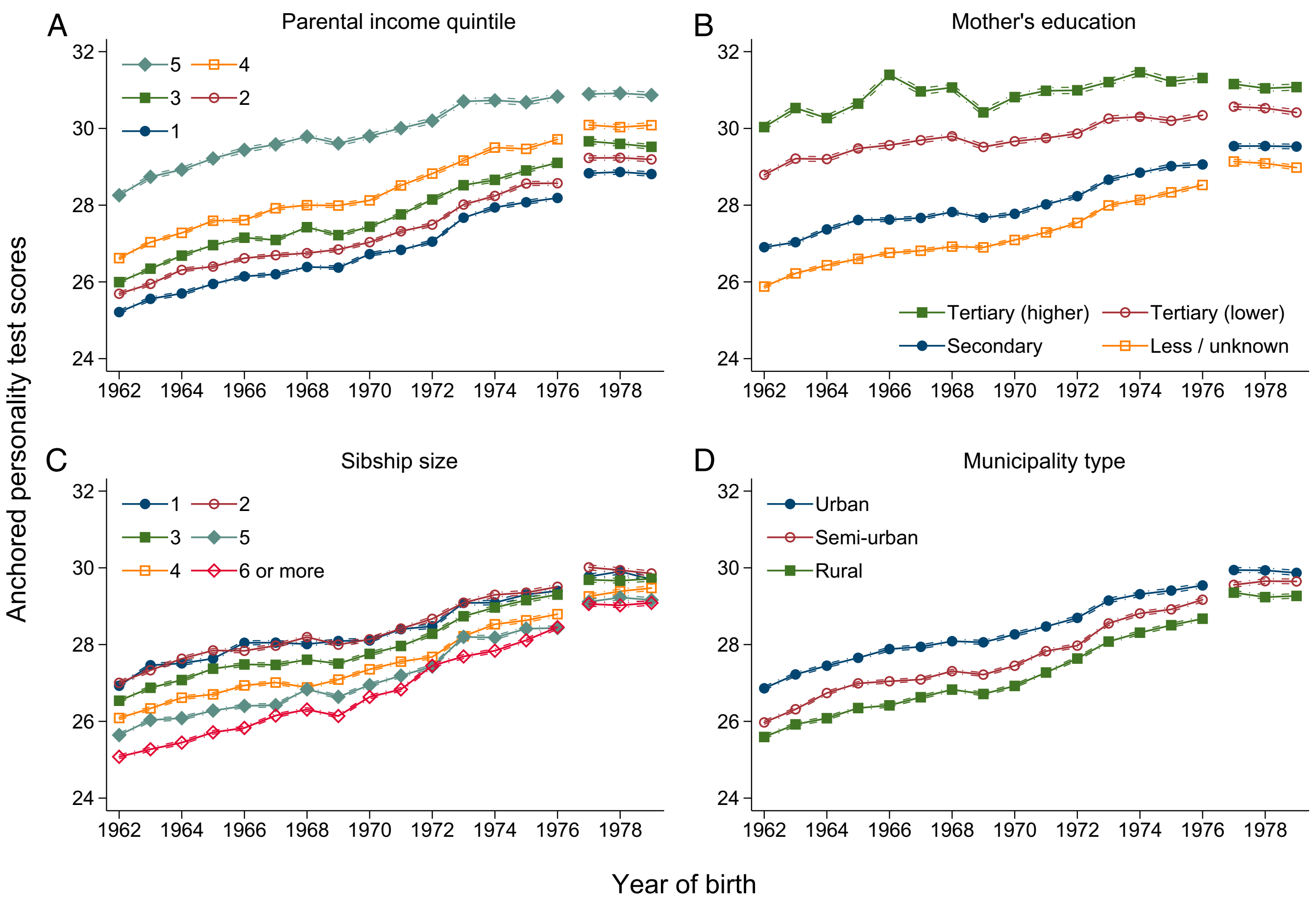

Fig. 4. Evolution of economically valuable personality traits across birth cohorts by (*A*) parental income quintile, (*B*) mother's education level, (*C*) sibship size, and (*D*) urbanization of birth place. Test scores are anchored to earnings at age 30–34. *SI Appendix*, Fig. S18 shows that the broad picture is similar when this analysis is repeated one trait at a time. Dashed lines depict 95% confidence intervals. The break in personality test scores reflects a change in test administration.

Table 1. Cohort trends and demographic backgrounds

Variable	Change between 1962 and 1976 cohorts: Observed	Predicted	Share predicted, %
Personality			
Self-confidence	0.65	0.16	25
Sociability	0.58	0.15	26
Leadership motivation	0.55	0.19	34
Activity-energy	0.47	0.09	20
Achievement striving	0.38	0.17	44
Dutifulness	0.27	0.11	41
Deliberation	0.26	0.04	14
Masculinity	0.03	0.00	−15
All (anchored)	0.57	0.19	33
Cognitive ability			
Visuospatial	0.55	0.25	45
Arithmetic	0.40	0.26	65
Verbal	0.21	0.25	119
All (anchored)	0.44	0.28	64

"Observed" is the actual difference in means between the birth cohorts, and "predicted" is the mean of predicted values for this difference, based on age at test, parental income, mother's and father's levels of education, sibship size, and rural/urban status, using the model estimated for the 1962 cohort. All variables were measured in 1962 SDs. Bootstrapped SEs are below 0.007 for all observed and below 0.015 for all predicted means.

economic importance to the rise in cognitive abilities. The trends in personality are also similar across levels of cognitive ability and across demographic subgroups.

Our results on traits related to extraversion (i.e., sociability and activity–energy) are consistent with studies reporting increasing levels of extraversion (16, 24–26). Our findings for conscientiousness-related traits are in agreement with findings from freshman psychology students at the University of Amsterdam between 1982 and 2007 (25) and from the Baltimore Longitudinal Study of Aging between 1989 and 2004 (43). We also found increasing levels of self-confidence. This trend is in contrast to findings from the Monitoring the Future study (28) but is in agreement with cross-temporal meta-analysis of US college students (17). A positive trend has been reported for narcissism at least in the United States (18). We cannot distinguish self-confidence associated with narcissism from self-esteem; we can only see that this measure of self-confidence predicts high earnings for the person himself.

Growing evidence suggests that the Flynn effect has ended and may have reversed in Western Europe (32, 33, 44–46). The last three birth cohorts in our data coincide with the peak in cognitive test scores in Finland (31). There is no clear trend for personality scores between these cohorts, which suggests that the end of the Flynn effect could also be reflected in personality traits. However, the data on these three birth cohorts are not fully comparable with our main data, and thus, it is not possible to make strong conclusions from them.

The causes of the Flynn effect are still unclear (5), and our data do not reveal the ultimate cause of the cohort trends in personality either. Of course, we cannot distinguish between birth year and year of test as causal factors behind the trends. However, we can rule out trends in personality traits being mere reflections of changes in broadly defined socioeconomic backgrounds. Nevertheless, trends in background variables are indeed favorable and explain about two-thirds of the rise in cognitive ability and one-third of the trends in personality.

Materials and Methods

Psychological Testing in the FDF. FDF has tested all conscripts with a battery of psychological tests since 1955. Initially the test consisted of only a cognitive test that measured reading skills, mathematical skills, and logical reasoning skills. In 1982, the FDF introduced a personality test that measures eight personality traits. Test results are one of the criteria used in selecting conscripts to officer training.

The validity of the test and its predictive power for successful military service have been evaluated in several internal reports of the FDF. The results of these (mainly unpublished) studies have been summarized and the test procedure described in detail in ref. 47. Only those who enter service take the tests; those who are exempted (e.g., on prior health grounds) and those who choose to do nonmilitary service do not take the test. Test results of professional military officers were retracted by the FDF.

Administration of the Test. Both the cognitive test and the personality test are administered in the second week of military service. The tests are organized in standardized group-administered conditions at all FDF units. Between 1995 and 2000, the personality test was administered already at the call-up, on average 18 mo before entering the service. The purpose was to use the test scores in placement of conscripts already before they started their service. However, the results were not widely used for this purpose, and the FDF was concerned that test conditions at local draft boards were not sufficiently standardized. In 2001, the FDF reverted to testing conscripts at the start of service (47). The cognitive test has always been administered in the military service.

The test is a 2-h paper-and-pencil test where conscripts are asked to choose a correct alternative from a list (cognitive ability test) or whether they agree or disagree with statements (personality test). Completed answer sheets are sent to the Finnish Defense Research Agency for optical scanning. The test leaflets were unchanged from 1982 to 2000 but have not been released by the FDF. In 2001, the personality test was revised, and both the content and the results of the new test remain classified.

SI Appendix, Table S1 reports means and SDs for each test score by cohort, and *SI Appendix*, Figs. S2–S5 show the full distributions of the raw scores for both personality and cognitive test. Observed scores vary over the entire range of possible values. The distributions of cognitive test scores are roughly normal but those of personality test scores less so. Ceiling effects may cause attenuation of trends for measures of self-confidence and sociability.

Content of the Personality Test. The test contains between 18 and 33 items for each of the eight personality traits. Altogether there are 218 statements with a response scale of yes/no. The scores are formed by summing up the number of statements to which a person agrees (or, in case of reverse-coded statements, disagrees with). We observe the raw scores but not individual items. Internal reliability varies between 0.6 and 0.9 by trait; average Cronbach alpha is 0.75 (47).

Self-confidence measures the person's self-esteem and beliefs about his abilities (32 items; e.g., whether the person feels to be as good and able as others and can meet other people's expectations). Sociability measures the person's level of gregariousness and preference for socializing with others (33 items; e.g., whether the person likes to host parties and not withdraw from social events). Leadership motivation measures how much the person prefers to take charge in groups and influence other people; it includes 30 items. Activity–energy measures how much the person exerts physical effort in everyday activities and how quickly the person prefers to execute activities (28 items; e.g., whether the person tends to work fast and vigorously and prefers fast-paced work). Achievement striving, dutifulness, and deliberation all represent personality traits that are related to the higher order personality factor conscientiousness. Achievement striving measures how strongly the person wants to perform well and achieve important life goals (24 items; e.g., whether the person is prepared to make personal sacrifices to achieve success). Dutifulness measures how closely the person follows social norms and considers them to be important (18 items; e.g., whether the person would return money if given back too much change at a store). Deliberation measures how much the person prefers to think ahead and plan things before acting (26 items; e.g., whether the person prefers to spend money carefully). Masculinity measures the person's occupational and recreational interests that are traditionally considered as masculine (27 items; e.g., whether the person would like to work as a construction manager).

The FDF questionnaire also includes questions about mental health and questions assessing the validity of the answers. These include four mental health subscales from the Minnesota Multiphasic Personality Inventory (MMPI) but not other measures of normal personality. Of these variables we use only the lie score, which measures socially desirable responding—that is, attempts to give an overly favorable impression of one's conduct. *SI Appendix*, Table S12 shows that trends in test scores cannot be attributed to changes in response validity as measured by the lie score.

Content of the Cognitive Ability Test. Cognitive ability is measured with subtests of verbal, arithmetic, and visuospatial reasoning. Each subtest is composed of 40 multiple-choice questions in order of increasing difficulty. The test–retest reliabilities of the subtests vary between 0.76 and 0.88 (47). Verbal reasoning involves choosing synonyms or antonyms of a given word, selecting a word that belongs to the same category as a given word pair, choosing which word on a list does not belong in the group, and choosing similar relationships between two word pairs. Arithmetic reasoning involves completing a series of numbers that follow a certain pattern, solving short verbal problems, computing simple arithmetic operations, and choosing similar relationships between two pairs of numbers. The visuospatial reasoning task is a set of matrices containing a pattern problem with one removed part, and the participant needs to decide which of the given alternative figures completes the matrix; it is similar to Raven's Progressive Matrices (48).

Register Data. We use register data on the Finnish population compiled by Statistics Finland to obtain adult outcomes and background variables. These data provide information on basic demographics, family situation, living conditions, educational attainment, labor market status, and earnings of all Finnish residents. This information was linked to test scores by Statistics Finland using personal identification numbers and deidentified before being made available to researchers.

Income data are from the Finnish Tax Authority. We measure earnings as the average annual earnings during ages 30–34, where "earnings" is the sum of labor market income and entrepreneurial income; we do not drop zeros. We deflate all values to 2010 Euros using the Statistics Finland CPI. In *SI Appendix*, we also use alternative income measures derived from the same data.

Information about the identity of parents and brothers comes from the Finnish Population Register. Childhood municipality of residence comes from the Population Censuses of 1970, 1975, and 1980. We define childhood municipality as the municipality of residence in the first census after the year of birth. We drop those who are not observed at that point as they are likely to be foreign-born. We use Statistics Finland's Statistical Grouping of Municipalities to divide municipalities into urban, semiurban, and rural. We define sibship size as the number of children with the same biological mother.

Data on educational attainment are from the Register of Completed Education and Degrees maintained by Statistics Finland. These data contain information on the highest educational qualification that the individual has obtained and the date at which the individual received the qualification. We use it to obtain parents' level of education and the eventual level of education for the conscripts.

Permission to use the register data was approved by Statistics Finland (license TK-53-228-14) and by FDF (AJ23378). Personal data were processed following the regulations in Personal Data Act 523/1999 and the guidelines of Finnish Advisory Board on Research Integrity. The use of administrative data in scientific research does not require explicit consent from the subjects in Finland.

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Supporting online material for

Secular Rise in Economically Valuable Personality Traits

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Estimated Flynn effect

Table S1 reports the means and SDs of raw test scores by birth year. Our estimated "Flynn effect" is based on these numbers. Regressing the sum of cognitive test scores of the 1962-1976 cohorts on birth year and a constant yields a trend coefficient of 0.018, with standard error 0.005 (both measured in 1962 SDs per year). With all cohorts included the estimate is 0.012 (0.004).

Test score distributions

In Fig 1, we reported changes in average test scores across birth years. A limitation of these measures is that test scores are rank ordered statistics that have no natural scale. Thus any monotonic transformation of the test score is, in principle, an equally valid measure of performance and these arbitrary scaling decisions may affect conclusions about cohort differences (1,2,3).

We first examine the sensitivity of our conclusions by studying how the distributions of test scores evolve across cohorts. Figs S2 and S3 plot the cumulative distribution functions of the raw scores for three-year birth cohorts. They reveal that the shift in the test scores takes place over the entire distribution for all traits except *masculinity* (for which we do not find trends in averages, either). Figs S4 and S5 show the same distributional shifts using histograms instead of CDFs.

As is clear from these figures, with the exception of *masculinity*, the test score distributions of later years stochastically dominate the test score distributions of the earlier years. In particular, comparing the 1962 and 1976 birth cohorts reveals that the distributions of scores for the latter cohort dominate the earlier distributions, in the sense of first order stochastic dominance (FOSD). A formal test, proposed by (4), fails to reject the null hypothesis of FOSD at any conventional significance level for all subscores except masculinity, while yielding p-values below 10^{-7} for all subscores for the converse hypotheses.

Anchored test scores

In Figs 3 and 4 of the main paper, we reported results for anchored test scores, where we had scaled the raw test scores by average earnings associated with each combination of test score. We construct these measures using a similar approach as (5). We first estimate regressions:

$$y_i = \alpha + \sum_{s=1}^{N_s} P_{is}\beta_s + \sum_{c=1963}^{1976} C_{ic}\theta_c + \varepsilon_i \tag{1}$$

where y_i is the average annual earnings at ages 30-34 of individual i, P_{is} is his subscore s, C_{ic} is an indicator variable for being born in year c (using year 1962 as omitted category), and ε_i is an error term. In our baseline analysis, we estimate equation (1) using data for the 1962–1976 birth cohorts. The resulting estimates for personality test scores are reported in the first column of Table S2. We use these estimates to construct predicted earnings for each individual based on their personality test scores while holding the year of birth fixed-effects fixed at 1962 level. The second column of Table S2 reports corresponding estimates for cognitive ability test scores, which we use to construct anchored scores for cognitive ability in the same way.

Table S2 shows that most personality test scores predict higher later-life earnings also when we condition on other personality tests scores. The exceptions are *sociability* and *activity-energy*, which predict lower income conditional on other personality test scores. Furthermore, *masculinity* does not have statistically significant predicting power once we condition on other personality test scores.

The third column 3 of Table S2 reports results from a specification where we include both personality and cognitive ability tests scores in the anchoring regression. The estimates for personality test scores are quite robust to conditioning for cognitive ability test scores. The exceptions are that *sociability* and *dutifulness* now predict higher income, while *deliberation* predicts lower income.

Fig S6B reports trends corresponding to Fig 3 of the main paper, but now based on anchoring regressions that include simultaneously both personality and cognitive ability test scores (Fig S6A reproduces Fig 3 for reference). More precisely, the average anchored personality test scores are constructed using the estimates reported in Table S2, column 3, and holding cognitive ability test scores constant at 1962 birth cohort average and using the observed personality test scores to predict earnings. Similarly, we present average anchored test scores holding personality test scores at the 1962 average level while allowing cognitive ability test scores to evolve as they did. This approach yields an increase of 7.4% for anchored personality test scores and of 8.4% for anchored cognitive ability test scores.

For simplicity and comparability with studies that only have either cognitive or personality measures available we report in Figure 3 of the main paper trends based on regressions where cognitive skills and personality are anchored separately. However, the conclusions are similar when anchoring is done using both tests at the same time. The growth rate of both cognitive skills and personality test scores has been roughly equal over cohorts that we observe in data.

Alternative anchoring variables

Fig S7 shows that our results are not driven by the choice of model specification or the way we construct our earnings measure. We start by presenting a nonparametric version of Fig 3 in Fig S7A. We have constructed it by first regressing our main anchoring variable (average earnings at age 30-34) on a full set of indicator variables for each possible personality test score and then predicting income for all birth cohorts using the resulting coefficients. The results are closely correlated with those from a linear specification (correlation coefficient 0.92). For cognitive ability, the linear and the nonparametric anchored test scores are even more similar (correlation coefficient 0.99). Furthermore, the trends shown in Fig S7A are very similar to those in Fig 3. Anchored personality scores increased by 11.6% between the 1962 and 1976 birth cohorts according to the linear specification and by 12.1% according to the nonparametric specification. Thus we conclude that the linear specification is sufficient for anchoring the test scores in our context.

Fig S7B presents a version of Fig 3 where we anchor test scores to a broader income measure at age 30–34, which now also includes capital income and most government transfers. The resulting increase in anchored personality test scores between the 1962 and 1976 birth cohorts is 11.1%. The next three panels show similar patters when anchoring test scores to earnings at age 30 (Fig S7C), earnings percentile rank at age 30 (Fig S7D) and a logarithm of earnings at age 30–34 (Fig S7E).

Fig S7F reports results for the annualized discounted earnings from ages 28-48. As above, we do not drop zeros. We use discount rate 3%, and deflate all values to 2010 Euros using the Statistics Finland CPI. The advantage of this earnings measure is that it is a better proxy for lifetime income than our baseline measure of average earnings at age 30–34, but has the drawback of being available only for the 1962 birth cohort. This approach leads to a 9.5% increase in anchored personality test scores. Again, the trend in anchored cognitive ability tests scores is very similar.

Figs S7G and S7H report changes in test scores anchored to educational attainment. They show that changes in personality test scores predict 8.7 percentage points increase in the likelihood of obtaining lower tertiary degree or more (from a baseline of 30.1%). The predicted likelihood of completing an advanced degree increases by 4.8 percentage points (from a baseline of 8.3%). The trends in personality test scores and cognitive ability test scores are very similar to each other, as was the case with income-related anchoring variables.

Coefficients for alternative outcomes

The middle panel of Table S2 reports regression coefficients when using earnings percentile rank at age 30 as the outcome variable. The results are very similar to those above in the baseline specification, with the exception that *sociability* and *deliberation* do not have predictive power, while *masculinity* is now statistically significantly associated with higher income rank. The differences in specifications controlling for cognitive ability test scores are that *self-confidence* is not statistical significant, while *masculinity* is.

The last panel of Table S2 reports results when using an indicator for holding a lower tertiary degree or more. Again, the results are broadly similar to those for earnings. The main difference is that *deliberation* and *masculinity* now predict lower educational attainment in both specifications.

Changes over the distribution of anchored test scores

In addition to documenting changes in average anchored test scores, it is informative to examine whether some parts of the test score distribution change differently than others. Fig S8 plots the CDFs our baseline anchored scores and Table S3 corresponding estimates from quantile regressions. The results show that, while anchored personality test scores increased throughout the distribution, the changes are larger at the bottom of the distribution. For example, between the 1962 and 1976 birth cohorts, the 10^{th} percentile of the test score distribution increased by €3,200, while the 90^{th} percentile increased by €1,340. Similar pattern, though less pronounced, is also present for the cognitive ability test scores, where the corresponding estimates are €2,600 and €1,670 in the 10^{th} and 90^{th} percentiles, respectively.

Exploratory factor analysis

The FDF test score data contain eight personality trait scores and three cognitive skill scores. Table S4 shows that both the cognitive scores and the personality trait scores are strongly correlated within their domains, but the correlations across cognitive and personality domains are only modest.

We performed a simple explorative factor analysis to determine an appropriate way to reduce dimensionality of the test score data. In Fig S9, we plot the eigenvalues of the test score data. Only two first eigenvalues exceed one, suggesting that a two-factor model is a sufficient description of the data. The two first factors also already explain most of the variability in the test scores when principal factor analysis is used.

Table S5 reports factor loadings after an oblique rotation where the factors are allowed to be correlated. In a two-factor model, the cognitive test scores and the personality test scores load on distinct factors. Masculinity is only weakly related to other scores. It has large uniqueness and a factor loading of only 0.22.

As an alternative specification, we retained three factors. In a three-factor model, the consciousness-related scores “deliberation” and “dutifulness” load on a separate factor. The other five personality test scores and the three cognitive test scores still load on distinct factors, and masculinity has a low factor loading and large uniqueness.

Measurement error

The personality and cognitive ability tests are likely to measure the underlying traits with some error. This measurement error may stem from several sources. The test items may not fully capture the underlying personality traits. Some individuals may perform particularly poorly or particularly well in tests taken on a given day. Individuals also may make idiosyncratic errors in each test.

Measurement error causes a bias in the estimated coefficients of the anchoring regressions where the test scores are used as explanatory variables. In a simplest univariate case with classical measurement error, the regression coefficients would be attenuated towards zero. As a result also the differences across cohorts in the anchored test scores would be smaller than the differences in the underlying traits.

Furthermore, measurement error may be larger in personality tests than in cognitive tests (6) and therefore cause a larger downward bias in regressions where personality test scores are used as explanatory variables. Earlier work has shown that such bias may be large and substantially affect the comparisons between different demographic groups, particularly if the reliability of the test varies across groups (5).

To assess the likely direction and magnitude of bias caused by measurement error, we first simulate the effects of additional measurement error. We take i.i.d. random draws from a normal distribution with variance equal to 25, 50, 75 and 100 percent of the variance in the observed test scores, and add these additional errors to the observed test scores. We then re-estimate the anchoring equations. The results reported in Table S6 illustrate the that individual coefficients change to varying directions; adding error to all test scores increases some coefficients while decreasing others. As displayed in Fig S10 the aggregate effect of additional error is a reduction of cohort differences. For example, the difference between the youngest and the oldest cohort in anchored personality test scores declines from 11.6% when observed test scores are used to 9.6% when additional measurement error corresponding to 50% of original variance is added to each score. The corresponding decline in anchored cognitive test scores is from 10.4% to 8.2%.

In a univariate regression the effects of classical measurement error can be easily corrected if a ratio of variance of the true unobserved score and the variance of the observed erroneous score (reliability ratio) is known. The coefficient of erroneously measured variable is simply inflated by the reliability ratio. The method can be extended to a multivariate case as long as measurement errors are independent.

Unfortunately FDF has only reported a range of test-retest reliabilities in test scores rather than separate reliability ratios for each scale (7). Item-level data that would allow the estimation of scale-specific internal reliabilities are not available. However, as we discuss in detail below, instrumental variables and structural equation models can be used to adjust the estimates so that the effects of measurement error are taken into account (if the assumptions underlying these methods are valid). We emphasize that these adjustments only affect the estimates of the magnitude of cohort trends. The best evidence for the existence of cohort trends was shown above in section *Test score distributions* and in Figs S2-S5, where we demonstrate that test score distributions of later cohorts stochastically dominate those of earlier cohorts.

Instrumental variables estimates

One approach for correcting for measurement error is to combine multiple measurements using instrumental variables (IV) framework. In order for this approach to yield consistent estimates, we need instrumental variables that (i) are strongly correlated with the test scores (*first-stage*), and (ii) do not have an independent impact on the outcomes (*exclusion restriction*).

We use brother and twin test scores as instruments. 42 percent of men in our data have at least one brother (defined as a man born to the same mother) for whom we also observe the test scores. We also have 2,385 twin pairs (brothers born on same date) in data. We pick randomly one of the brothers or one of the twins to the estimation sample and use his brother's or his twin brother's scores as an instrument. In cases with more than two brothers in a family we only use one randomly chosen brother pair from each family.

Test scores within brother and twin pairs are highly correlated. The first eight columns of panels A, Tables S7 and S8, report the first-stage estimates i.e. regress each test score in turn on all the test scores of the brother. Panel B of Tables S7 and S8 report the corresponding results for twin data. The F-statistics in these regressions range between 181 and 957 in the brother sample and between 12 and 54 in the twin brother sample. It is also noteworthy that same trait coefficients are clearly larger than coefficients of other instruments.

Column 9 of Tables S7 and S8 report the IV-estimates. These coefficients are substantially larger than the OLS estimates using same brother or twin samples (column 10). Furthermore, OLS estimates from the brother and twin samples are quite similar to OLS estimates using the full sample (Column 11).

Panels A of Figs S11 and S12 report the resulting average anchored test scores by birth cohorts for personality traits. Point estimates based on OLS estimates from full data, brother data and twin data are rather similar, showing a €2,200–€2,500, or 10–12% increase in comparison to the 1962 baseline, in the anchored personality test scores. In comparison, anchored personality test scores using IV estimates suggest a €4,700, or 21%, increase in brother data and a €5100, or 22%, increase in the twin data. The results related to cognitive test scores are similar but the difference between the OLS and IV-estimates is smaller. Anchored cognitive test scores increase by €2200 when anchoring is based on OLS estimates, by €3300 when anchoring is based on IV estimates from the brother data and by €3400 when anchoring is based on IV estimates from the twin data.

The difference between OLS- and IV-based anchored test scores is consistent with measurement error leading to a substantial attenuation bias in the OLS estimates. However, it is also consistent with the exclusion restriction being violated. Brother's personality traits could have a direct impact on earnings or brother's personality could be correlated with unobserved factors that are shared by brothers and that have an effect on earnings.

Structural equations model

An alternative approach for examining the importance of measurement error is to use a structural equation model that combines a measurement model linking latent skills to test scores and a structural model linking latent skills to earnings.

Based on the exploratory factor analysis discussed above, we assume that there are two underlying unobserved latent factors, one related to cognitive skills and one related to personality. We treat the three cognitive test scores as error-ridden proxies of latent cognitive skills and the eight personality test scores as error-ridden proxies of latent non-cognitive skills. We allow for a possible correlation between these latent skills and assume that both the cognitive skills and personality are associated with earnings. We scale the latent variables by constraining the path from the latent variables on earnings to equal one.

More formally, the structural equation linking latent skills to earnings is

$$y_{it} = \alpha_t + \theta_{it}^k + \varepsilon_{it}$$

where y_{it} indicates later-life earnings of person i from cohort t, α_t is a cohort-specific constant and θ_{it}^k a latent index of trait *k*. Note that we are using a normalizing restriction and set the coefficients of latent traits in the structural equation to 1. The latent traits are related to observed test scores by measurement equations

$$P_{it}^s = \lambda_s^k \theta_{it}^k + \nu_{it}$$

where P_{it}^s is the *s*th observed test score related to latent trait *k* with s=1,2,3 for the cognitive test and s = 1, …, 8 for the personality test. The association between test scores and latent traits is described by factor loadings λ_s^k. ν_{it} is measurement error, i.e., variation in test scores not related to the variation in latent traits. We assume that these measurement errors are uncorrelated normal random variables.

Fig S13 describes the structure of the model in a path diagram and reports the estimated factor loadings as well as the estimates of correlation between latent factors.

We estimate the factor loadings (the effect of latent variables on observed test scores) and the error variances (variances of the observed test scores not explained by the latent variables) by fitting the model using the same data (men born between 1962–1976) and earnings measure (average earnings at ages 30–34) as for our regression-based analyses discussed above. The two-factor model provides a reasonably good fit to the data (CFI=0.83, RMSEA=0.11). The correlation between cognitive and non-cognitive latent factors is 0.41, suggesting that there are two correlated but distinct latent factors.

In columns 5-8 of Table S9 we report the differences in means of latent cognitive and personality factors by cohort. For comparison we also report, in columns 1-4, the corresponding cohort differences estimated using regression analysis.

Columns 5 and 6 of Table S9 report cohort trends from a model where personality test scores and cognitive test scores are anchored separately to later earnings. According to the estimates, mean of the latent personality factor increased between the 1962 and 1976 birth cohorts by an amount that corresponds to €2,546 higher earnings; the analogous figure for mean of latent cognitive factor is €2,328. These results are similar to our main results (Fig. 3), which are presented for ease of comparison in columns 1 and 2. The corresponding changes in our baseline anchored test scores are €2,474 for personality and €2,219 for cognitive skills.

The last two columns of Table S9 report results from a model corresponding to Fig S6, where both the cognitive skills and personality are anchored simultaneously to later earnings. The increase in the mean latent personality factor now corresponds to €1,481 and in the mean cognitive factor to €1,856. The corresponding regression-based results, reported in columns 3 and 4 (and in Fig S6B), are €1,586 and €1,793.

Selectivity in test score data

Finland is one of the few countries that have retained compulsory conscription system until present. All men are required to participate in either a military or a civilian service and roughly 80% choose the military service. Nevertheless, sample selectivity could affect the test scores, if selectivity into military service changes over time. We next analyze the effects of selectivity using data that cover the full population of men in these cohorts.

For those born between 1964 and 1976, we have test score data for 80% of men and this fraction remains roughly stable over time. For the earlier birth cohorts born in 1962 and 1963, we observe test scores for 66% and 76%, respectively. This smaller share in is due to men who started their service as "volunteers" (at an earlier age) before the test database was created in 1982.

Fig S14 reports the share of men serving in the military by their later income (measured as within-cohort earnings percentile rank at age 30). It shows that having served in the military is less common among the men who later appear in the bottom quintile of income distribution. However, apart from the early-1960s cohort, the selectivity pattern remains rather constant over time.

Table S10 reports results from two approaches examining the extent to which changes in selectivity into military service may affect the trends in the test scores. For reference, the first columns in panels A and B, report the changes between the 1962 and the 1976 birth cohorts without a selection correction. The following two columns report corresponding changes after reweighting the data so that observed characteristics remain constant over time. The two rightmost columns report lower and upper bounds for the change in the test scores allowing changes in selectivity also with respect to unobserved characteristics. We next describe both approaches in detail.

We use inverse probability reweighting (IPW) for constructing the results reported in columns 2 and 3. We denote the potential test score of the ith individual as r_i. The test scores are only observed for those men who served in the military. Let z_i = 1 if r_i is observed and z_i = 0 if r_i is not observed.

We first estimate the likelihood of having a non-missing test score $\hat{e} = P(z_i = 1|X_i)$ as a function of observed characteristics. We then reweight the data using these predicted probabilities, or propensity scores (8), yielding an estimator

$$L = \frac{1}{N}\sum_{i=1}^{N}\frac{z_i r_i}{\hat{e}_i}$$

This way the observations that are underrepresented in the available data due to larger than average fraction of missing observations in categories defined by observed characteristics are inflated by giving them a higher weight. As long as selectivity is based on observed characteristics only, this method produces unbiased estimates of population parameters.

In the current context, we first estimate $\hat{e}$ using a logit model separately in each cohort to predict whether a person has non-missing test score data. In the first specification, we use the total parental income, classified as deciles within each birth cohort, and father's and mother's education classified to four levels as explanatory variable. In the second specification we also add individual's own completed education and his earnings at age 30, again classified as deciles. We then use predicted values from these regressions to calculate weights for each person and calculate reweighted cohort averages as described above. We report these reweighted changes between birth cohorts 1962 and 1976, i.e. $\hat{L}_{1976} - \hat{L}_{1962}$, in the second and the third columns of panels A and B Table S10.

Overall, the baseline and selection corrected estimates are very similar to each other with the anchored personality test scores growing 4–10% slower and anchored cognitive ability test scores 7–15% slower in the selection corrected series than in the raw data. In terms of individual measures, selection correction has the largest impact on *deliberation* (6–16% slower growth), *dutifulness* (7–17%) and *verbal* (13–28%).

A limitation of the IPW approach is that it corrects for changes in selectivity that are due to characteristics observable in our data. It is naturally also possible that selectivity has changed in dimensions that are not included in our data and therefore cannot be corrected by reweighting by observed characteristics. Given that our data do not contain any variables that could be plausibly used as instruments to correct for changes in selection on unobservable characteristics, we adopt a bounding approach based on trimming the upper or lower part of the test score distribution as in (9) and (10).

The basic idea is the following. For the oldest 1962 birth cohort we have test score data for 66% of the male population. In comparison, for the 1976 birth cohort we have non-missing data for 80% of the male population. We construct a lower bound of changes in test scores by making an extreme assumption that the "additional" 14% of the population observed in the 1976 birth cohort are those at the top of the observed 1976 test score distribution. Hence by dropping the fraction corresponding to 14% of the population from the top of the 1976 test score distribution, we can calculate a conservative lower bound for the increase in the average scores. Similarly assuming that the additional 14% of population are at the bottom of the 1976 test score distribution and dropping this fraction from the bottom of the 1976 test score distribution yields a conservative upper bound for the increase in the test scores. The key assumption behind this bounding exercise is that the changes in the fraction of men serving in the military have a monotonous effect on the likelihood of any individual person to perform his military service.

The fourth and fifth columns of panels A and B, Table S10, report the results for this bounding exercise. The estimates suggest that anchored personality test scores increased between €1,426 and €3,990 and anchored cognitive ability test scores by €1,109 and €3,394.

We note that the 1962 birth cohort is a particularly challenging starting point, because we do not observe test scores for those who started service before 1982. As a robustness check, panels C and D, Table S10, report similar analysis as above, but using 1964 birth cohort as the starting point. The IPW approach now yields changes in anchored personality and cognitive ability test scores that are 1–5% and 3–8% smaller than in the raw data, respectively. Furthermore, changing the starting point by two years yields substantially tighter bounds suggesting that anchored personality test scores grew by €1,895–€2,232 and anchored cognitive ability scores by €1,403–€2,145.

Age at test

According to Conscription Act (452/1950) all male citizens of Finland were required to attend the military call-up during the year they turned 19. At the call-up they were assigned a date when they should report for service. Up until 1989 conscripts were assigned to service in the year following the call-up date, i.e., during the calendar year when they turn 20. It was also possible to apply to serve as a volunteer from age 17 onwards and to request postponing service up to age 30 due to reasons related to e.g. on-going education.

In 1988 the Conscription Act was amended and the call-up date moved to the year when the men turned 18. At the call-up the men were assigned to service within two years after the call-up date, i.e., in the years when they turned 19 or 20. As a result, the fraction of men entering military service at age 19 is higher starting from the 1971 birth cohort. In the government's proposal to the Parliament (HE 76/88) the amendment was motivated by the decrease in the size of draft cohorts and as an attempt to lessen disruptions to education by assigning men to service at an age when 75% on men finish their secondary education. Rules related to volunteering to early service and to postponing service remained essentially intact.

Table S11 shows that while the fraction tested at ages 18 and 19 increases at the time when the call-up date was moved, most men were tested at age 20 throughout the birth cohorts we examine. The table also reveals that postponing service by several years is rare: only 4% of men are 22 or older when taking the test.

Studies where the same test was given to same individuals at sparse intervals show that there are age effects on personality test scores (*3*). Therefore changes in the age of taking the test across cohorts could bias the estimated trends in cohort mean scores. Fig S15 presents the trends in anchored test scores by age at taking the test. Those taking the test at older age tend to get higher scores. However, these differences cannot be interpreted as age effects, because those deciding to take the military service at an unusual age are likely to differ from the rest of the population also in other dimensions. Nevertheless, Fig S15 show that the trends in the average test scores are unlikely to be driven by the slight decrease in the average age of taking the test, because trends are consistent across birth cohorts in each age category, with the only anomalies occurring in the under-19 category when their cohort share was below 10%.

Another way to see that changes in the test taking age are unlikely to drive our results is to estimate trends in personality traits, while keeping age at test constant. We do this using a simple regression adjustment, where we estimate

$$P_{is} = \alpha_s + \sum_{c=1963}^{1976} C_{ic}\beta_{cs} + \sum_{a=18}^{22} A_{ia}\gamma_{as} + \varepsilon_{is} \tag{2}$$

where P_{is} is subscore s of individual i, α_s is a constant, C_{ic} is an indicator variable taking value one if individual i was born in year c and zero otherwise (using birth cohort 1962 as omitted category) and A_{ia} is an indicator variable taking value one if he takes the test at age a and zero otherwise (categories are: "18 or less" (omitted category), "19", "20", "21" and "22 or more"). The parameters β_{cs} measure the difference in average test scores in trait s between birth cohort c and birth cohort 1962, while keeping the age-at-test distribution constant. We estimate equation 2 by running separate regressions for each personality trait s.

The results reported in Table S12, columns 2–3, show that the trends keeping test taking age constant are very similar as the baseline trends. The only large difference (in percentage terms) is for Masculinity, the only trait without a clear trend.

Validity of test responses

Another possible explanation for the secular increase in personality scores is that young men have become more adept at giving socially desirable answers. In this case the trends in personality traits could reflect systematic changes in measurement error.

A related concern is that as the same test is used for successive cohorts, test questions could be leaked and the content of the test could become more widely known over time. The test results are not published and generally not even revealed to the conscripts themselves. The test booklet is labeled as confidential and even sample questions are not publicly available. Yet, it is impossible to rule out the passing of information on test contents by earlier test takers to younger cohorts. However, incentives for gaming the test are not obvious. The conscripts are aware that the test is used as one of the criteria in selecting men to officer training but do not know how the test is scored. The scoring algorithm that FDF uses was published for the first time in (7).

One way of detecting such changes is to use the Lie-score from the Minnesota Multiphasic Personality Inventory (MMPI), which is also included in the FDF test. Lie-score measures attempts to give an overly favorable impression of one's conduct; high scores suggest that the person is attempting to "fake good".

As above, we use two approaches to examine whether the changes in Lie-scores are sufficiently large to explain the changes in the measured personality traits. First, Fig S16 reports anchored test scores by quintiles of the Lie-score. The quintiles are defined over all birth cohorts, i.e., the cutoff points for the underlying Lie-score remain constant, while the share of a birth cohort falling into each quintile changes over time. Those who score high in the Lie-score tend to have higher personality test scores and lower cognitive ability test scores. Importantly, however, we document clear upward trends in test scores within each Lie-score quintile.

Table S12, columns 4-5, reports results from similar regressions as those used above for keeping age at test constant over time. That is, we regress the personality test scores on a vector of year of birth indicator variables and a vector of Lie-score results (Lie-score of 20 and more are aggregated into one category). The trends are slightly less pronounced once we condition on Lie-scores. The largest difference between the adjusted and unadjusted trends are in *deliberation* and *dutifulness*, where adjusted increase between the 1962 and 1976 birth cohorts is 0.18–0.19 standard deviations in comparison to 0.26–0.27 standard deviations suggested by the unadjusted trends. For other personality measures, the adjusted changes in the measures are 5–10% smaller than unadjusted ones. Thus the trends in personality test scores do not appear to be driven by changes in the attempts of young men to give an overly favorable impression of themselves.

Cognitive ability and personality test scores

As an additional robustness check, we extend our analysis on the extent of which trends in personality traits are simply a reflection of a rise in cognitive ability. Above, we already reported results from anchoring personality and cognitive ability test scores jointly on later-life earnings. Table S12, columns 6–7, reports regressions estimates similar to those used for examining age at test and Lie-scores above. That is, we regress the personality test scores on a vector of year of birth indicator variables and a vector of cognitive ability test score results (40 indicator variables for each subtest). The adjusted trends in personality test scores are slightly less pronounced than the baseline trends, but remain economically and statistically significant.

Fig S17A reports trends in anchored personality scores by the quintiles of the anchored cognitive ability test scores. It shows an upward trend in test scores within each cognitive ability quintile. Thus we conclude that the trends in personality traits are a separate phenomenon from the trend in cognitive ability.

Trends in background variables

We now turn to the role of background variables in explaining trends in personality traits and cognitive ability. In order to understand the extent to which the trends in traits reflect changes in background variables, such as parental education, sibship size, or urbanization, we estimate a hypothetical distribution of test scores that would have prevailed if the 1962 cohort of conscripts had had the same distribution of background variables as the 1976 cohort of conscripts. This counterfactual distribution of test scores – when compared to the actual distribution of test scores of the 1976 birth cohort – provides a measure of how much of the between-cohort differences in traits can be attributed to differences in background variables.

Our decomposition follows the semi-parametric DFL methodology (11). More formally, let $f_t(p)$ denote the observed density of trait p for cohort t. We denote the full vector of observable characteristics with $\boldsymbol{X}$. Then the conditional density of p of the 1962 cohort, given its background characteristics, can be written as:

$$\begin{aligned} f_{62}(p) &= \int dF(p, \boldsymbol{X} | t_{p,x} = 62) \\ &= \int f(p | \boldsymbol{X}, t_p = 62) dF(\boldsymbol{X} | t_x = 62) \end{aligned} \tag{7}$$

where $F(p, \boldsymbol{X} | t_{p,x} = 62)$ is the joint distribution of p and $\boldsymbol{X}$ of the cohort born in 1962. Following this notation, we can write the hypothetical, or counterfactual, density of the traits of the 1962 cohort with the distribution of $\boldsymbol{X}$ at their 1976 values as:

$$\begin{aligned} f(p; t_p = 62, t_x = 76) &= \int f(p | \boldsymbol{X}, t_p = 62) dF(\boldsymbol{X} | t_x = 76) \\ &= \int f(p | \boldsymbol{X}, t_p = 62) \Psi_x(\boldsymbol{X}) dF(\boldsymbol{X} | t_x = 62) \end{aligned} \tag{8}$$

where the reweighting function, $\Psi_x(\boldsymbol{X})$, is defined as:

$$\Psi_x(\boldsymbol{X}) = \frac{dF(\boldsymbol{X}|t_x = 76)}{dF(\boldsymbol{X}|t_x = 62)} \tag{9}$$

This is simply the ratio of the probability mass at each point of $\boldsymbol{X}$ for the cohort born in 1976 relative to the cohort born in 1962. Applying Bayes' rule $\Psi_x(\boldsymbol{X})$ can be written as:

$$\Psi_x(\boldsymbol{X}) = \frac{P(t_x = 76|\boldsymbol{X})}{P(t_x = 62|\boldsymbol{X})}\frac{P(t_x = 62)}{P(t_x = 76)} \tag{10}$$

which implies that $\Psi_x(\boldsymbol{X})$ can be estimated using the pooled data of the 1962 and 1976 cohorts. The procedure starts by estimating a probit model where the probability of belonging to a cohort $t = 62{,}76$ is regressed on background characteristics $\boldsymbol{X}$**:**

$$P(t_x = t|\boldsymbol{X}) = P\big(\varepsilon > -\beta H(\boldsymbol{X})\big) = 1 - \Phi(-\beta H(\boldsymbol{X})) \tag{11}$$

where $\Phi(\cdot)$ is the cumulative normal distribution and $H(\boldsymbol{X})$ is a vector of background characteristics that is a function of $\boldsymbol{X}$. The unconditional probabilities $P(t_x = t)$ are equal to the weighted number of observations in the cohort t.

The set of background characteristics that we use in our analysis consist of indicator variables for age at test (18 or younger, 19, 20, or 21 or older), for the education level of the mother and the father of the conscript (secondary or less, lower tertiary, upper tertiary, unknown, or missing), for municipality type at childhood (rural, semi-urban, urban) and for sibship size (six or more siblings are aggregated into one category; we also include a dummy for the information on sibship size missing).

Fig S19 plots kernel estimates of the observed distributions of the personality and cognitive ability indices for the 1962 and 1976 cohorts. We use these distributions to construct the results reported in Tab 1 of the main paper for anchored personality test scores. First, we report the difference in the average tests scores between the *observed* test score distribution of the 1962 birth cohort (solid line) and the *observed* test score distribution of the 1976 birth cohort (dashed line). Next, we report the difference in the average tests scores between the *observed* 1962 test score distribution (solid line) and an average of the *counterfactual* distribution where we reweight the 1962 test score distribution to correspond to the 1976 distribution of background characteristics (dotted line). This comparison answers the question: how different would the average test scores for the 1962 birth cohort had been, if the 1962 birth cohort had had the same characteristics as the 1976 birth cohort and the association between background characteristics and test scores had remained at the level observed for the 1962 birth cohort. Finally, we report the ratio between the predicted and the observed change in average test scores, i.e. the share of the observed change in average test scores that can be attributed to changes in background characteristics.

Table S13 examines how much of the changes in average test scores can be attributed to each background characteristic. The first column shows the observed difference in the average test scores between the 1962 and 1976 birth cohorts. The remaining columns report results similar to those in Table 1, but now using only one background characteristic at a time. The results suggest that changes in test age, rural/urban status and sibship size explain quite little of the changes in average test scores, while much larger share can be attributed to changes parental education.

The Relation of the FDF test and the Five Factor Model

In modern personality psychology, the Five Factor Model of personality is one of the most robust and widely used models of personality structure (12). The five higher-order personality traits of the model include extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience. Extraversion is related to sociability, assertiveness, and positive emotionality. Neuroticism is expressed as low emotional stability, low self-esteem, and heightened psychological vulnerability. Agreeableness reflects the person's cooperativeness, level of empathy, and general trust in other people. Conscientiousness characterizes the person's degree of self-discipline, self-efficacy, and orderliness. Openness to Experience can be observed in the person's intellectual adventurousness, curiosity, and artistic interests.

In order to see how the Finnish Defense Forces (FDF) personality traits relate to traits of the Five Factor Model (FFM), we administered online a short version of the FDF and a 60-item FFM personality test to a sample of 231 participants who were recruited via email lists of university students and people who had participated in open university courses at the University of Helsinki. The data were collected for the revision of our manuscript per a reviewer's request over a two-week period in January 2017. The mean age of the sample was 28.6 (SD=9.1), 87.5% were women, 75.2% were full-time students, and 19.5% had a full-time employment. We did not have access to the full FDF measure used in the main analysis but we had a shortened version that included 6 items per scale (48 items in total). The FFM traits were measured with a 60-item FFM measure used in previous Finnish studies (13-15). The participants rated each item on a 5-point scale ranging from 1=Strongly disagree to 5=Strongly agree. Of the 108 items, 46 items were reverse coded. Given the very small number of missing values in the data (n=125 missing responses of all the possible 108 items × 231 participants = 24,948 responses in total), all missing values in the items were imputed using the mean value of the item in the sample. We examined (i) the pairwise correlations between all the traits, (ii) how traits of the FFM predicted traits of the FDF, and (iii) how traits of the FDF predicted traits of the FFM.

Table S14 shows the pairwise correlations between all the traits. Table S15 shows multivariate models for each of the FDF traits. Sociability, leadership motivation, and activity–energy were strongly related to higher extraversion. Achievement striving, deliberation, and dutifulness were most strongly related to higher conscientiousness. Self-confidence correlated most strongly with lower neuroticism, and also with higher extraversion and higher conscientiousness. These associations provide convergent validity for the FDF traits, as the FDF traits match closely with the underlying contents of the Five Factor traits. The most marked correlations with agreeableness included negative correlations with leadership motivation and achievement striving, which may reflect the less considerate and cooperative tendencies associated with social dominance and competitiveness. Openness to experience had only moderate correlations with higher dutifulness and higher achievement striving.

Table S16 shows regression models in which each of the Five Factor traits is predicted by the FDF traits. As indicated by the proportions of variance explained, the FDF personality traits capture much of the variance in Extraversion, Conscientiousness, and Neuroticism, whereas variances in Agreeableness and Openness to Experience were less well captured.

In sum, the results from our test sample indicate that the FDF traits show convergent validity with standard measures of the Five Factor personality traits. As suggested by their labels, most of the FDF traits are related to extraversion and conscientiousness. In addition, self-confidence correlated strongly with lower neuroticism. Lower agreeableness was reflected in higher leadership motivation and achievement striving. It must be emphasized that we only used the short versions of the FDF traits, which may have weakened their psychometric properties, such as reliability, and even these results are based on a convenience sample.

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	Year of birth								
	1962	1963	1964	1965	1966	1967	1968	1969	1970
A: Personality									
Self-	19.9	20.4	20.8	21.2	21.4	21.6	21.9	21.8	22.2
confidence	(6.6)	(6.6)	(6.5)	(6.4)	(6.4)	(6.4)	(6.3)	(6.3)	(6.1)
Sociability	17.8	18.2	18.7	19.1	19.4	19.7	20.1	20.0	20.5
	(8.1)	(8.2)	(8.1)	(8.1)	(8.1)	(8.0)	(7.9)	(7.9)	(7.8)
Leadership	12.2	12.6	12.9	13.3	13.6	13.8	14.1	14.1	14.4
motivation	(7.6)	(7.7)	(7.7)	(7.8)	(7.9)	(7.9)	(7.9)	(7.9)	(7.8)
Activity-	14.5	14.8	15.0	15.2	15.4	15.5	15.7	15.7	16.0
energy	(5.4)	(5.4)	(5.4)	(5.4)	(5.5)	(5.5)	(5.4)	(5.4)	(5.3)
Achievement	12.3	12.5	12.7	12.7	12.9	13.0	13.1	13.1	13.2
striving	(5.0)	(5.1)	(5.1)	(5.1)	(5.1)	(5.1)	(5.1)	(5.1)	(5.0)
Dutifulness	10.4	10.5	10.4	10.4	10.5	10.5	10.7	10.6	10.8
	(3.7)	(3.7)	(3.7)	(3.7)	(3.8)	(3.8)	(3.8)	(3.8)	(3.7)
Deliberation	15.5	15.7	15.8	15.9	16.0	16.0	16.1	16.0	16.1
	(5.4)	(5.4)	(5.4)	(5.4)	(5.4)	(5.4)	(5.4)	(5.5)	(5.4)
Masculinity	18.4	18.4	18.5	18.5	18.5	18.5	18.5	18.5	18.5
	(2.9)	(3.0)	(2.9)	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)	(2.9)
Anchored	21.4	21.7	21.9	22.1	22.3	22.4	22.5	22.5	22.7
test score	(4.5)	(4.6)	(4.6)	(4.6)	(4.6)	(4.6)	(4.6)	(4.6)	(4.6)
B: Cognitive ability									
Visuo-	23.3	23.7	23.8	23.9	24.3	24.2	24.4	24.5	24.8
spatial	(5.9)	(5.8)	(5.9)	(5.8)	(5.8)	(5.8)	(5.8)	(5.7)	(5.7)
Arithmetic	18.2	18.8	18.8	18.9	19.4	19.3	19.7	19.9	20.2
	(7.9)	(8.0)	(8.1)	(8.0)	(8.0)	(7.9)	(8.0)	(8.0)	(7.9)
Verbal	21.9	22.4	22.4	22.6	22.9	22.6	22.7	22.7	22.9
	(7.5)	(7.5)	(7.5)	(7.4)	(7.4)	(7.4)	(7.4)	(7.4)	(7.3)
General (sum)	42.6	50.0	52.2	52.9	48.0	50.6	53.8	54.2	53.8
	(33.6)	(32.0)	(31.0)	(30.8)	(33.9)	(32.5)	(31.4)	(31.3)	(32.1)
Anchored	21.4	21.8	21.8	21.9	22.2	22.1	22.3	22.4	22.7
test score	(4.9)	(4.9)	(5.0)	(4.9)	(4.9)	(4.9)	(4.9)	(4.9)	(4.8)
C: Lie-score	5.8	5.8	5.9	5.9	6.0	5.9	5.8	5.7	5.9
	(3.9)	(3.8)	(3.8)	(3.8)	(3.8)	(3.7)	(3.8)	(3.8)	(3.8)
Observations	26,676	30,781	31,774	31,243	31,194	30,211	29,767	27,693	26,570

Table S1: Means and standard deviations (in parentheses) of raw test scores. Anchored test scores are the predicted values of the regressions reported in the first and second column of Table S2.

	Year of birth								
	1971	1972	1973	1974	1975	1976	1977	1978	1979
A: Personality									
Self-	22.5	22.8	23.5	23.8	23.9	24.2	24.9	24.8	24.8
confidence	(5.9)	(5.7)	(5.5)	(5.3)	(5.2)	(5.0)	(4.2)	(4.2)	(4.3)
Sociability	20.8	21.2	21.9	22.1	22.2	22.5	22.8	22.9	22.8
	(7.7)	(7.5)	(7.3)	(7.3)	(7.2)	(7.1)	(6.7)	(6.7)	(6.8)
Leadership	14.8	15.1	15.7	15.8	16.1	16.3	17.2	17.2	17.2
motivation	(7.7)	(7.6)	(7.6)	(7.5)	(7.5)	(7.4)	(6.9)	(6.9)	(6.9)
Activity-	16.2	16.5	16.7	16.8	16.9	17.1	18.2	18.1	18.0
energy	(5.2)	(5.1)	(5.0)	(5.0)	(4.9)	(4.8)	(4.3)	(4.3)	(4.4)
Achievement	13.4	13.7	13.9	14.1	14.1	14.2	14.7	14.8	14.8
striving	(4.9)	(4.8)	(4.8)	(4.7)	(4.7)	(4.6)	(4.2)	(4.2)	(4.2)
Dutifulness	10.9	11.0	11.3	11.3	11.4	11.4	11.6	11.5	11.4
	(3.7)	(3.7)	(3.7)	(3.6)	(3.6)	(3.6)	(3.4)	(3.3)	(3.3)
Deliberation	16.3	16.4	16.8	16.9	16.9	17.0	17.6	17.4	17.4
	(5.4)	(5.3)	(5.2)	(5.2)	(5.2)	(5.1)	(4.8)	(4.8)	(4.8)
Masculinity	18.5	18.5	18.5	18.5	18.4	18.5	18.9	18.9	18.9
	(2.8)	(2.8)	(2.8)	(2.8)	(2.7)	(2.7)	(2.6)	(2.6)	(2.6)
Anchored	22.9	23.1	23.6	23.7	23.8	24.0	24.4	24.4	24.4
test score	(4.5)	(4.4)	(4.3)	(4.2)	(4.1)	(4.0)	(3.6)	(3.6)	(3.6)
B: Cognitive ability									
Visuo-	25.2	25.4	25.7	26.2	26.4	26.6	26.8	26.7	26.4
spatial	(5.5)	(5.5)	(5.5)	(5.4)	(5.3)	(5.3)	(5.3)	(5.4)	(5.6)
Arithmetic	20.7	20.9	20.9	21.2	21.2	21.3	21.4	21.2	20.7
	(7.9)	(7.8)	(7.8)	(7.7)	(7.6)	(7.7)	(7.6)	(7.6)	(7.6)
Verbal	23.1	23.2	22.9	23.2	23.4	23.5	23.4	23.0	22.4
	(7.1)	(7.1)	(7.0)	(6.9)	(6.9)	(6.8)	(6.9)	(6.8)	(6.9)
General (sum)	53.0	54.2	54.5	55.3	55.5	55.3	55.5	54.7	52.4
	(33.1)	(32.8)	(32.7)	(33.0)	(33.1)	(33.5)	(33.4)	(33.5)	(33.6)
Anchored	23.0	23.1	23.1	23.4	23.5	23.6	23.6	23.5	23.2
test score	(4.7)	(4.7)	(4.7)	(4.7)	(4.6)	(4.6)	(4.6)	(4.6)	(4.6)
C: Lie-score	5.8	5.9	6.4	6.5	6.4	6.5	6.9	6.8	6.7
	(3.8)	(3.8)	(4.0)	(4.0)	(4.1)	(4.1)	(4.1)	(4.0)	(4.0)
Observations	24,766	24,310	23,663	25,847	27,568	27,460	25,986	25,363	24,431

Table S1: (cont') Means and standard deviations (in parentheses) of raw test scores. Anchored test scores are the predicted values of the regressions reported in the first and second column of Table S2.

	Earnings at age 30–34			Earnings percentile rank at age 30			Lower tertiary degree or more		
A: Personality									
Self-confidence	1.15	.	0.75	0.007	.	0.001	0.068	.	0.049
	(0.05)		(0.05)	(0.001)		(0.001)	(0.001)		(0.001)
Sociability	-0.25	.	0.54	0.001	.	0.013	-0.087	.	-0.050
	(0.04)		(0.04)	(0.001)		(0.001)	(0.001)		(0.001)
Leadership motivation	1.99	.	0.76	0.027	.	0.009	0.120	.	0.064
	(0.04)		(0.04)	(0.001)		(0.001)	(0.001)		(0.001)
Activity-energy	1.92	.	0.30	0.031	.	0.007	0.097	.	0.024
	(0.04)		(0.04)	(0.001)		(0.001)	(0.001)		(0.001)
Achievement striving	0.78	.	1.09	0.015	.	0.019	0.030	.	0.045
	(0.03)		(0.03)	(0.001)		(0.001)	(0.001)		(0.001)
Dutifulness	-0.31	.	0.43	-0.004	.	0.007	-0.056	.	-0.023
	(0.04)		(0.04)	(0.001)		(0.001)	(0.001)		(0.001)
Deliberation	0.08	.	-0.26	0.000	.	-0.005	0.035	.	0.018
	(0.04)		(0.04)	(0.001)		(0.001)	(0.001)		(0.001)
Masculinity	0.03	.	-0.02	0.004	.	0.004	-0.034	.	-0.036
	(0.03)		(0.03)	(0.000)		(0.000)	(0.001)		(0.001)
B: Cognitive ability									
Visuospatial	.	1.39	1.11	.	0.02	0.02	.	0.02	0.01
		(0.04)	(0.04)		(0.00)	(0.00)		(0.00)	(0.00)
Verbal	.	0.96	0.45	.	0.01	0.00	.	0.09	0.07
		(0.04)	(0.04)		(0.00)	(0.00)		(0.00)	(0.00)
Arithmetic	.	3.18	2.86	.	0.04	0.04	.	0.13	0.12
		(0.04)	(0.04)		(0.00)	(0.00)		(0.00)	(0.00)
R^2	0.111	0.132	0.153	0.045	0.045	0.045	0.045	0.045	0.045
N	413,203	407,770	402,165	411,192	402,348	400,231	417,331	411,804	406,134

Table S2: Anchoring test scores. Regression coefficients and robust standard errors (in parentheses) from regressing later-life outcomes on personality test scores, cognitive ability test scores, and both. All regressions also control for year of birth fixed-effects. Test scores are scaled by the 1962 standard deviations. Earnings are in thousands of 2010 Euros. Earnings percentile is calculated within birth cohort of native-born men.

	A. *Personality*						B. *Cognitive ability*					
		Quantile						Quantile				
Coef.	Mean	.10	.25	.50	.75	.90	Mean	.10	.25	.50	.75	.90
1963	0.34	0.22	0.30	0.41	0.45	0.33	0.41	0.36	0.45	0.40	0.37	0.44
	(0.04)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)	(0.04)	(0.06)	(0.07)	(0.06)	(0.05)	(0.05)
1964	0.56	0.48	0.59	0.69	0.67	0.46	0.39	0.24	0.38	0.38	0.42	0.51
	(0.04)	(0.06)	(0.05)	(0.06)	(0.05)	(0.05)	(0.04)	(0.06)	(0.07)	(0.06)	(0.05)	(0.06)
1965	0.76	0.64	0.78	0.94	0.91	0.60	0.51	0.57	0.60	0.50	0.44	0.59
	(0.04)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)	(0.04)	(0.06)	(0.07)	(0.06)	(0.06)	(0.05)
1966	0.91	0.65	0.96	1.15	1.10	0.77	0.82	0.77	0.99	0.83	0.77	0.87
	(0.04)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)	(0.04)	(0.06)	(0.07)	(0.06)	(0.05)	(0.06)
1967	1.00	0.71	1.07	1.30	1.21	0.83	0.74	0.79	0.83	0.75	0.67	0.72
	(0.04)	(0.07)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.06)	(0.07)	(0.06)	(0.05)	(0.06)
1968	1.15	0.87	1.24	1.50	1.33	0.90	0.96	0.90	1.08	1.03	0.87	0.92
	(0.04)	(0.07)	(0.06)	(0.05)	(0.06)	(0.05)	(0.04)	(0.06)	(0.07)	(0.06)	(0.05)	(0.07)
1969	1.11	0.73	1.22	1.46	1.34	0.87	1.06	1.14	1.25	1.10	0.94	1.04
	(0.04)	(0.07)	(0.06)	(0.05)	(0.05)	(0.05)	(0.04)	(0.06)	(0.06)	(0.06)	(0.05)	(0.06)
1970	1.29	1.12	1.50	1.68	1.41	0.94	1.28	1.32	1.53	1.38	1.17	1.16
	(0.04)	(0.07)	(0.06)	(0.07)	(0.06)	(0.05)	(0.04)	(0.06)	(0.07)	(0.06)	(0.05)	(0.06)
1971	1.54	1.44	1.82	1.97	1.60	0.98	1.59	1.83	1.93	1.68	1.34	1.34
	(0.04)	(0.07)	(0.06)	(0.06)	(0.05)	(0.04)	(0.04)	(0.06)	(0.06)	(0.06)	(0.05)	(0.06)
1972	1.77	1.88	2.15	2.21	1.74	1.01	1.72	1.95	2.11	1.78	1.45	1.40
	(0.04)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)	(0.04)	(0.07)	(0.07)	(0.06)	(0.05)	(0.06)
1973	2.19	2.35	2.63	2.69	2.12	1.32	1.73	2.00	2.20	1.83	1.47	1.35
	(0.04)	(0.07)	(0.06)	(0.06)	(0.05)	(0.05)	(0.04)	(0.08)	(0.07)	(0.06)	(0.05)	(0.06)
1974	2.36	2.65	2.91	2.84	2.17	1.31	2.00	2.37	2.50	2.08	1.70	1.57
	(0.04)	(0.07)	(0.06)	(0.06)	(0.05)	(0.05)	(0.04)	(0.07)	(0.07)	(0.06)	(0.05)	(0.06)
1975	2.47	2.86	3.07	2.97	2.23	1.34	2.08	2.57	2.63	2.16	1.72	1.59
	(0.04)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)	(0.04)	(0.07)	(0.07)	(0.06)	(0.05)	(0.06)
1976	2.59	3.20	3.25	3.05	2.26	1.34	2.18	2.60	2.75	2.26	1.83	1.67
	(0.04)	(0.07)	(0.06)	(0.06)	(0.05)	(0.04)	(0.04)	(0.05)	(0.06)	(0.06)	(0.05)	(0.06)
1977	3.04	4.25	4.03	3.42	2.35	1.30	2.22	2.77	2.78	2.26	1.82	1.72
	(0.03)	(0.07)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.07)	(0.07)	(0.06)	(0.05)	(0.06)
1978	3.03	4.20	4.04	3.41	2.25	1.29	2.11	2.65	2.65	2.18	1.77	1.62
	(0.04)	(0.06)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.07)	(0.07)	(0.06)	(0.05)	(0.06)
1979	2.97	4.16	3.95	3.35	2.24	1.24	1.77	2.25	2.23	1.81	1.45	1.37
	(0.04)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.07)	(0.07)	(0.06)	(0.05)	(0.06)
Cons.	21.38	15.38	18.07	21.33	24.78	27.52	21.39	14.71	17.78	21.61	25.03	27.61
	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)

Table S3: Changes in anchored test scores. Estimates from OLS ("Mean") and quantile regressions, where anchored test scores are regressed on year of birth indicators (using 1962 as the omitted category) and a constant. Each entry measures changes in comparison to the 1962 birth cohort. Bootstrapped standard errors (in parentheses) are constructed using 250 replications.

	Self-confidence	Sociability	Leadership	Activity-energy	Achievement	Dutifulness	Deliberation	Masculinity	Anchored	Visuospatial	Arithmetic	Verbal	Anchored
A: Personality													
Self-confidence	1.00												
Sociability	0.71	1.00											
Leadership	0.66	0.76	1.00										
Activity-energy	0.63	0.60	0.68	1.00									
Achievement	0.50	0.48	0.70	0.61	1.00								
Dutifulness	0.51	0.44	0.56	0.50	0.55	1.00							
Deliberation	0.42	0.20	0.32	0.39	0.39	0.64	1.00						
Masculinity	0.21	0.12	0.10	0.28	0.11	0.03	0.10	1.00					
Anchored	0.82	0.67	0.84	0.74	0.87	0.70	0.59	0.19	1.00				
B: Cognitive ability													
Visuospatial	0.32	0.20	0.29	0.19	0.31	0.24	0.16	0.03	0.36	1.00			
Arithmetic	0.33	0.20	0.30	0.19	0.35	0.26	0.16	0.04	0.38	0.66	1.00		
Verbal	0.33	0.20	0.30	0.18	0.34	0.28	0.17	0.01	0.38	0.60	0.71	1.00	
Anchored	0.36	0.22	0.33	0.21	0.38	0.29	0.18	0.04	0.42	0.81	0.96	0.81	1.00

Table S4: Correlations of the test scores.

	Two factors			Three factors			
	Factor 1	Factor 2	Uniq.	Factor 1	Factor 2	Factor 3	Uniq.
Visuospatial	**0.74**	0.00	0.45	**0.75**	0.00	-0.02	0.45
Verbal	**0.79**	0.01	0.37	**0.80**	-0.01	0.00	0.37
Arithmetic	**0.84**	-0.02	0.31	**0.85**	-0.01	-0.03	0.31
Leadership motivation	0.02	**0.85**	0.26	0.03	**0.86**	0.00	0.22
Activity-Energy	-0.11	**0.84**	0.37	-0.11	**0.71**	0.17	0.37
Achievement	0.14	**0.68**	0.44	0.14	**0.45**	0.29	0.43
Self-Confidence	0.08	**0.76**	0.36	0.09	**0.72**	0.07	0.35
Deliberation	-0.01	**0.54**	0.71	-0.05	-0.14	**0.84**	0.45
Sociability	-0.09	**0.81**	0.40	-0.06	**1.00**	-0.23	0.29
Dutifulness	0.04	**0.69**	0.49	0.01	0.13	**0.71**	0.35
Masculinity	-0.05	0.22	0.96	-0.05	0.24	-0.02	0.96

Table S5: Factor loadings. Principle factor analysis, oblique rotation, loadings > 0.4 indicated with bold. See section *Exploratory factor analysis* for details.

	Added measurement error				
	0%	25%	50%	75%	100%
A: Personality					
Self-confidence	1.15	0.95	0.86	0.79	0.78
	(0.05)	(0.03)	(0.03)	(0.02)	(0.02)
Sociability	-0.25	0.19	0.33	0.36	0.40
	(0.04)	(0.03)	(0.03)	(0.02)	(0.02)
Leadership	1.99	1.48	1.25	1.09	0.96
motivation	(0.04)	(0.03)	(0.03)	(0.02)	(0.02)
Activity-	1.92	1.21	0.95	0.85	0.78
energy	(0.04)	(0.03)	(0.03)	(0.02)	(0.02)
Achievement	0.78	0.71	0.62	0.58	0.55
striving	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
Dutifulness	-0.31	0.12	0.28	0.35	0.33
	(0.04)	(0.03)	(0.03)	(0.02)	(0.02)
Deliberation	0.08	0.38	0.45	0.48	0.48
	(0.04)	(0.03)	(0.02)	(0.02)	(0.02)
Masculinity	0.03	0.07	0.08	0.07	0.09
	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
R^2	0.111	0.106	0.102	0.099	0.097
N	413,203	413,203	413,203	413,203	413,203
B: Cognitive ability					
Visuospatial	1.39	1.39	1.27	1.22	1.16
	(0.04)	(0.03)	(0.02)	(0.02)	(0.02)
Verbal	0.96	1.20	1.23	1.13	1.11
	(0.04)	(0.03)	(0.03)	(0.02)	(0.02)
Arithmetic	3.18	2.41	2.04	1.82	1.60
	(0.04)	(0.03)	(0.03)	(0.02)	(0.02)
R^2	0.132	0.123	0.116	0.111	0.106
N	407,770	407,770	407,770	407,770	407,770

Table S6: Adding simulated i.i.d. measurement error. Regression coefficients and robust standard errors (in parentheses) from regressing average earnings at age 30–34 on test scores. All regressions also control for year of birth fixed-effects. The amount of measurement error is described as a percentage of the variance of the observed test scores. Test scores are scaled by the (observed) 1962 standard deviations. Earnings are in thousands of 2010 Euros. See section *Measurement error* for details.

	First-stage								IV estimates	OLS estimates	
	Leader-ship	Activity-energy	Achie-vement	Self-confidence	Deli-beration	Socia-bility	Duti-fulness	Mascu-linity	Brother sample	Brother sample	Full sample
A: Brothers											
Leadership motivation	0.26	0.10	0.14	0.10	0.03	0.13	0.10	-0.03	-0.54	1.32	1.15
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(1.50)	(0.12)	(0.05)
Activity-energy	-0.01	0.09	-0.01	-0.01	0.00	-0.01	-0.01	0.05	-4.78	-0.17	-0.25
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(1.34)	(0.10)	(0.04)
Achievement striving	0.05	0.04	0.13	0.03	0.02	0.03	0.05	0.00	7.23	1.94	1.99
	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(1.23)	(0.09)	(0.04)
Self-confidence	0.06	0.04	0.06	0.14	0.03	0.04	0.03	0.00	3.29	1.98	1.92
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(1.10)	(0.10)	(0.04)
Deliberation	-0.04	0.00	-0.02	-0.01	0.12	-0.03	0.03	0.01	2.87	0.78	0.78
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(1.11)	(0.08)	(0.03)
Sociability	-0.03	-0.03	-0.05	-0.02	-0.04	0.07	-0.03	0.00	3.75	-0.51	-0.31
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(1.34)	(0.11)	(0.04)
Dutifulness	0.04	0.02	0.05	0.02	0.05	0.01	0.13	-0.02	-1.17	0.02	0.08
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(1.30)	(0.09)	(0.04)
Masculinity	-0.04	0.01	-0.03	-0.02	-0.01	-0.02	-0.03	0.13	1.17	0.00	0.03
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.77)	(0.06)	(0.03)
N	71,489	71,489	71,489	71,489	71,489	71,489	71,489	71,489	71,489	71,489	413,203
R^2	0.12	0.07	0.09	0.10	0.04	0.09	0.07	0.02	0.006	0.114	0.111
F-stat for excl. instruments	957.1	477.6	734.3	526.8	328.3	542.6	546.6	180.7	.	.	.

Table S7: Anchoring personality test scores using brothers' test scores as instrumental variables. First-stage, IV and OLS coefficients and robust standard errors (in parentheses) from regressing later-life outcomes on personality test scores. All regressions also control for year of birth fixed-effects. Test scores are scaled by the 1962 standard deviations. See Appendix section *Measurement error* for details.

	First-stage								IV estimates	OLS estimates	
	Leader-ship	Activity-energy	Achie-vement	Self-confidence	Deli-beration	Socia-bility	Duti-fulness	Mascu-linity	Twins sample	Twins sample	Full sample
B: Twins											
Leadership motivation	0.32	0.12	0.13	0.09	0.00	0.17	0.07	0.04	-3.88	0.36	1.15
	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(4.52)	(0.67)	(0.05)
Activity-energy	-0.01	0.13	0.01	0.00	-0.02	0.01	-0.02	0.06	2.23	0.48	-0.25
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(4.24)	(0.52)	(0.04)
Achievement striving	0.06	0.05	0.19	0.03	0.02	0.03	0.07	-0.02	6.88	1.65	1.99
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(4.32)	(0.49)	(0.04)
Self-confidence	0.02	0.04	-0.02	0.23	0.02	0.05	0.01	0.02	5.35	1.30	1.92
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(3.04)	(0.61)	(0.04)
Deliberation	-0.01	0.05	0.03	0.04	0.24	-0.03	0.07	0.06	1.72	0.22	0.78
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(3.51)	(0.47)	(0.03)
Sociability	0.04	0.00	-0.01	-0.02	-0.03	0.17	-0.02	-0.05	1.02	0.16	-0.31
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(4.22)	(0.55)	(0.04)
Dutifulness	0.03	-0.02	0.07	-0.01	0.07	-0.02	0.20	-0.09	-2.82	0.60	0.08
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(5.21)	(0.47)	(0.04)
Masculinity	-0.04	0.01	0.01	-0.03	0.00	-0.04	-0.04	0.21	-1.99	0.12	0.03
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(2.46)	(0.36)	(0.03)
N	2,351	2,351	2,351	2,351	2,351	2,351	2,351	2,351	2,351	2,351	413,203
R^2	0.19	0.14	0.14	0.17	0.11	0.16	0.12	0.07	-0.004	0.115	0.111
F-stat for excl. instruments	54.0	35.3	43.7	34.5	30.3	42.1	35.5	11.9	.	.	.

Table S7: (cont') Anchoring personality test scores using twin brothers' test scores as instrumental variables. First-stage, IV and OLS coefficients and robust standard errors (in parentheses) from regressing later-life outcomes on personality test scores. All regressions also control for year of birth fixed-effects. Test scores are scaled by the 1962 standard deviations. See Appendix section *Measurement error* for details.

	First-stage			IV estimates	OLS estimates	
	Visuo-spatial	Verbal	Arith-metic	Brother/Twins sample	Brother/Twins sample	Full sample
A: Brothers						
Visuospatial	0.20	0.05	0.06	3.08	1.35	1.40
	(0.00)	(0.00)	(0.00)	(0.54)	(0.09)	(0.04)
Verbal	0.08	0.28	0.11	-1.46	0.95	0.97
	(0.01)	(0.00)	(0.01)	(0.49)	(0.10)	(0.04)
Arithmetic	0.12	0.12	0.31	5.21	3.18	3.17
	(0.01)	(0.01)	(0.01)	(0.53)	(0.10)	(0.04)
N	69,435	69,423	69,437	69,421	69,421	404,291
R^2	0.16	0.18	0.20	0.11	0.13	0.13
F-stat for excl. instruments	3376.0	4787.8	5169.7	.	.	.
B: Twins						
Visuospatial	0.31	0.05	0.03	3.53	1.69	1.40
	(0.03)	(0.03)	(0.03)	(1.61)	(0.45)	(0.04)
Verbal	0.14	0.43	0.14	-1.04	1.03	0.97
	(0.03)	(0.03)	(0.03)	(1.59)	(0.46)	(0.04)
Arithmetic	0.11	0.13	0.45	3.16	2.34	3.17
	(0.03)	(0.03)	(0.03)	(1.65)	(0.51)	(0.04)
N	2,245	2,244	2,245	2,351	2,351	413,203
R^2	0.28	0.34	0.35	0.00	0.11	0.11
F-stat for excl. instruments	221.1	318.4	346.2	.	.	.

Table S8: Anchoring cognitive ability test scores using brothers' (panel A) or twin brothers' (panel B) test scores as instrumental variables. First-stage, IV and OLS coefficients and robust standard errors (in parentheses) from regressing later-life outcomes on personality test scores. All regressions also control for year of birth fixed-effects. Test scores are scaled by the 1962 standard deviations. See Appendix section *Measurement error* for details.

	OLS				SEM			
	Anchored separately		Anchored jointly		Anchored separately		Anchored jointly	
	Personality	Cognitive	Personality	Cognitive	Personality	Cognitive	Personality	Cognitive
1962 (baseline)	0	0	0	0	0	0	0	0
1963	323	419	185	348	292	466	164	394
1964	539	401	337	327	506	440	289	366
1965	724	522	457	421	719	587	409	484
1966	874	831	652	663	870	911	578	740
1967	959	750	590	597	980	798	540	632
1968	1,104	974	702	793	1,157	1,023	657	813
1969	1,059	1,079	663	882	1,098	1,122	624	887
1970	1,232	1,305	786	1,058	1,326	1,365	754	1,077
1971	1,464	1,613	938	1,314	1,562	1,679	892	1,329
1972	1,679	1,749	1,081	1,427	1,779	1,827	1,015	1,449
1973	2,087	1,758	1,329	1,440	2,164	1,806	1,238	1,433
1974	2,255	2,039	1,416	1,659	2,294	2,119	1,313	1,684
1975	2,357	2,126	1,495	1,719	2,411	2,228	1,393	1,771
1976	2,474	2,219	1,586	1,793	2,546	2,328	1,481	1,856

Table S9: Mean differences of regression-anchored test scores (see Fig. 3) and of factor means by cohort in comparison to the average of the 1962 birth cohort. Anchoring variable is earnings at age 30–34 in 2010 euros.

		IPW		Bounds	
	Baseline	Spec. 1	Spec. 2	Lower	Upper
A: Changes in personality between 1962–1976					
Self-confidence	0.65	0.63	0.60	0.50	0.91
Sociability	0.58	0.57	0.55	0.39	0.87
Leadership motivation	0.55	0.53	0.51	0.27	0.86
Activity-energy	0.47	0.46	0.44	0.29	0.79
Achievement striving	0.38	0.36	0.33	0.08	0.67
Dutifulness	0.27	0.25	0.23	0.06	0.67
Deliberation	0.26	0.25	0.22	0.07	0.63
Masculinity	0.03	0.03	0.03	-0.29	0.38
Anchored test score	2,588	2,486	2,335	1,426	3,990
B: Changes in cognitive ability between 1962–1976					
Visuospatial	0.55	0.53	0.50	0.30	0.80
Arithmetic	0.40	0.37	0.33	0.15	0.66
Verbal	0.21	0.18	0.15	-0.04	0.48
Anchored test score	2,176	2,015	1,842	1,109	3,394
C: Changes in personality between 1964–1976					
Self-confidence	0.51	0.51	0.49	0.50	0.51
Sociability	0.47	0.47	0.46	0.46	0.47
Leadership motivation	0.45	0.45	0.44	0.43	0.47
Activity-energy	0.38	0.37	0.36	0.36	0.38
Achievement striving	0.30	0.29	0.28	0.28	0.30
Dutifulness	0.25	0.24	0.23	0.24	0.25
Deliberation	0.21	0.20	0.18	0.19	0.22
Masculinity	0.00	0.00	-0.01	-0.01	0.00
Anchored test score	2,025	2,002	1,923	1,895	2,232
D: Changes in cognitive ability between 1964–1976					
Visuospatial	0.48	0.47	0.45	0.38	0.57
Arithmetic	0.32	0.31	0.29	0.25	0.39
Verbal	0.15	0.14	0.12	0.07	0.23
Anchored test score	1,782	1,732	1,633	1,403	2,145

Table S10: Selectivity. The first column reports changes in average test scores between the 1962 and 1976 birth cohorts. Test scores are scaled by the 1962 standard deviations. Other columns report the corresponding changes adjusted for changes in selection into military service. See section *Selectivity in test score data* for details.

	Year of birth					
	1962–64	1965–67	1968–70	1971–73	1974–76	1977–79
A: Age at test						
18 or less	0.06	0.09	0.09	0.13	0.24	0.99
19	0.48	0.49	0.47	0.49	0.52	0.01
20	0.37	0.35	0.36	0.30	0.18	0.00
21	0.04	0.03	0.04	0.04	0.03	0.00
22 or more	0.05	0.04	0.05	0.04	0.03	0.00
B: Mother's level of education						
Secondary	0.23	0.28	0.33	0.38	0.41	0.44
Tertiary (lower)	0.09	0.11	0.14	0.17	0.21	0.23
Tertiary (higher)	0.01	0.02	0.03	0.04	0.05	0.06
Less / unknown	0.67	0.59	0.51	0.41	0.33	0.27
C: Father's level of education						
Secondary	0.19	0.23	0.27	0.31	0.35	0.38
Tertiary (lower)	0.10	0.12	0.14	0.17	0.18	0.20
Tertiary (higher)	0.04	0.05	0.06	0.07	0.08	0.09
Less / unknown	0.66	0.60	0.53	0.45	0.39	0.33
D: Municipality type						
Urban	0.59	0.61	0.63	0.64	0.65	0.64
Semi-urban	0.18	0.17	0.17	0.18	0.17	0.18
Rural	0.23	0.21	0.20	0.18	0.17	0.18
E: Sibship size						
1	0.08	0.10	0.12	0.12	0.11	0.10
2	0.31	0.36	0.40	0.44	0.44	0.43
3	0.27	0.27	0.27	0.27	0.27	0.29
4	0.16	0.14	0.12	0.10	0.10	0.11
5	0.08	0.06	0.05	0.03	0.03	0.03
6 or more	0.10	0.07	0.05	0.04	0.04	0.04
Annual earnings at age 30	19,220	20,730	24,000	26,360	28,410	29,190
Annual earnings at age 30–34	21,490	24,160	26,930	29,380	31,400	.
Parental income	32,956	38,086	41,006	44,912	47,688	49,989
Individuals	120,337	115,517	104,428	92,013	100,794	99,303
... with test scores	89,231	92,648	84,030	72,739	80,875	75,780
Share with test scores	0.74	0.80	0.80	0.79	0.80	0.76

Table S11: Means of background variables and later-life outcomes by three-year birth cohorts. Municipality type is based on the municipality of residence in the first census year after the year of birth. Sibship size is the number of children with the same biological mother. Earnings are measured as the sum of annual labor market income and entrepreneurial income. Parental income is measured as the sum of father's and mother's annual earnings, taxable transfers, and capital income, and averaged over the period when the child was 10–25 years old. Earnings and income are measured in year 2010 Euros.

		Conditional on					
	Baseline	Age at test (%)		Lie-score (%)		Cognitive ability (%)	
A: Personality							
Self-confidence	0.65	0.66	*-2*	0.60	*8*	0.53	*18*
Sociability	0.58	0.58	*0*	0.55	*5*	0.51	*12*
Leadership motivation	0.55	0.56	*-2*	0.51	*7*	0.43	*22*
Activity-energy	0.47	0.45	*4*	0.42	*11*	0.40	*15*
Achievement striving	0.38	0.38	*0*	0.36	*5*	0.24	*37*
Dutifulness	0.27	0.31	*-15*	0.19	*30*	0.17	*37*
Deliberation	0.26	0.28	*-8*	0.18	*31*	0.20	*23*
Masculinity	0.03	-0.02	*167*	0.03	*0*	0.02	*33*
Anchored test score	0.57	0.58	*-2*	0.52	9	0.43	*25*
B: Cognitive ability							
Visuospatial	0.55	0.58	*-4*	0.56	*-2*	.	.
Arithmetic	0.40	0.43	*-9*	0.41	*-4*	.	.
Verbal	0.21	0.25	*-19*	0.24	*-10*	.	.
Anchored test score	0.44	0.48	*-8*	0.46	*-4*	.	.

Table S12: Robustness checks. The first column reports changes in average test scores between the 1962 and 1976 birth cohorts. Other columns report changes adjusted for changes in age at test, Lie-scores, and cognitive ability test scores (see sections *Age at test, Validity of test responses,* and *Cognitive ability and personality test scores* for details). Each supercolumn reports the conditional change and the percentage of baseline change attributable to each adjustment (in *italics*). Test scores are scaled by the 1962 standard deviations.

		Predicted change in test score due to changes in:									
	Baseline	Age at test		Mother's education		Father's education		Municipality type		Sibship size	
A: Personality											
Self-confidence	0.65	-0.04	*-6*	0.12	*19*	0.10	*16*	0.02	*3*	0.05	*8*
Sociability	0.58	-0.02	*-3*	0.09	*16*	0.08	*14*	0.02	*3*	0.05	*8*
Leadership motivation	0.55	-0.04	*-8*	0.14	*25*	0.12	*22*	0.02	*4*	0.05	*9*
Activity-energy	0.47	-0.02	*-4*	0.07	*14*	0.05	*11*	0.01	*1*	0.02	*5*
Achievement striving	0.38	-0.03	*-8*	0.11	*30*	0.11	*28*	0.01	*4*	0.04	*11*
Dutifulness	0.27	-0.04	*-15*	0.10	*36*	0.09	*31*	0.00	*2*	0.03	*12*
Deliberation	0.26	-0.03	*-11*	0.04	*16*	0.04	*14*	0.00	*-2*	0.02	*8*
Masculinity	0.03	0.02	*68*	-0.04	*-134*	-0.02	*-68*	0.00	*-4*	0.01	*23*
Anchored test score	0.57	-0.04	*-8*	0.14	*24*	0.12	*21*	0.02	*3*	0.05	*9*
B: Cognitive ability											
Visuospatial	0.55	-0.04	*-6*	0.14	*30*	0.12	*26*	0.02	*4*	0.05	*12*
Arithmetic	0.40	-0.03	*-14*	0.16	*47*	0.14	*40*	0.02	*5*	0.07	*19*
Verbal	0.21	-0.06	*-26*	0.19	*88*	0.16	*72*	0.02	*9*	0.08	*37*
Anchored test score	0.44	-0.06	*-13*	0.19	*45*	0.15	*38*	0.02	*5*	0.08	*18*

Table S13: DFL decomposition of the changes in test scores one variable at a time. The first column reports the actual observed difference between the means of the 1976 and 1962 cohort distributions. Other columns report the difference between the mean of the counterfactual distribution that would have prevailed if the 1962 cohort had had the same distribution of that particular background characteristic as the 1976 cohort; this difference is reported both in standard deviation units and as a percentage share of the total observed change for that particular trait.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Extraversion												
2. Neuroticism	**-0.55**											
3. Conscientiousness	**0.14**	**-0.15**										
4. Agreeableness	**0.38**	**-0.26**	0.12									
5. Openness to Experience	**0.28**	-0.09	-0.02	**0.22**								
6. Leadership motivation	**0.59**	**-0.35**	**0.15**	0.06	**0.22**							
7. Activity–Energy	**0.47**	**-0.38**	**0.34**	0.10	**0.08**	**0.32**						
8. Achievement striving	0.10	0.03	**0.40**	**-0.19**	**0.12**	**0.22**	**0.14**					
9. Self-confidence	**0.52**	**-0.64**	**0.28**	**0.31**	**0.07**	**0.36**	**0.34**	0.05				
10. Deliberation	**-0.43**	**0.34**	**0.47**	**-0.15**	**-0.22**	**-0.24**	-0.08	**0.24**	**-0.20**			
11. Sociability	**0.78**	**-0.43**	0.04	**0.26**	**0.24**	**0.70**	**0.36**	0.05	**0.48**	**-0.42**		
12. Dutifulness	0.08	-0.11	**0.30**	**0.20**	**0.21**	**0.15**	0.04	**0.27**	**0.21**	0.08	0.00	
13. Masculinity	-0.01	-0.11	0.10	-0.10	-0.15	0.02	**0.22**	0.00	0.11	0.09	-0.09	0.02

Table S14: Pearson correlation coefficients between Finnish Defence Forces (FDF) and Five Factor Model (FFM) traits in a convenience sample of 231 participants. Correlations printed in bold are statistically significant ($p<0.05$). See section *The Relation of the FDF test and the Five Factor Model* for details.

	Leadership motivation	Activity–Energy	Achievement striving	Self-confidence	Deliberation	Sociability	Dutifulness	Masculinity
Extraversion	0.606	0.394	0.186	0.220	-0.355	0.800	-0.108	-0.034
	(0.067)	(0.071)	(0.073)	(0.062)	(0.061)	(0.053)	(0.079)	(0.083)
Conscientiousness	0.085	0.282	0.438	0.168	0.545	-0.061	0.293	0.090
	(0.053)	(0.057)	(0.058)	(0.049)	(0.048)	(0.042)	(0.062)	(0.066)
Neuroticism	-0.049	-0.150	0.133	-0.467	0.217	-0.003	-0.073	-0.154
	(0.063)	(0.066)	(0.069)	(0.058)	(0.057)	(0.050)	(0.074)	(0.078)
Agreeableness	-0.216	-0.116	-0.310	0.101	0.004	-0.041	0.139	-0.108
	(0.057)	(0.060)	(0.062)	(0.052)	(0.052)	(0.045)	(0.067)	(0.071)
Openness to	0.083	-0.015	0.158	-0.047	-0.088	0.022	0.205	-0.131
Experience	(0.055)	(0.058)	(0.060)	(0.050)	(0.050)	(0.043)	(0.065)	(0.068)
N	231	231	231	231	231	231	231	231
R^2	0.389	0.325	0.276	0.487	0.498	0.62	0.159	0.06

Table S15: Multivariate regression models predicting the Finnish Defence Forces (FDF) personality traits with Five Factor Model (FFM) traits in a convenience sample of 231 participants. Values are standardized beta coefficients (and their standard errors) of 8 multivariate linear regression models predicting each of the FDF trait with all FFM traits. See section *The Relation of the FDF test and the Five Factor Model* for details.

	Extraversion	Conscienti-ousness	Neuroticism	Agreeableness	Openness to Experience
Leadership motivation	0.033	0.033	-0.083	-0.232	0.021
	(0.055)	(0.069)	(0.071)	(0.086)	(0.091)
Activity-Energy	0.190	0.265	-0.169	0.040	0.038
	(0.043)	(0.054)	(0.055)	(0.067)	(0.071)
Achievement striving	0.056	0.191	0.056	-0.241	0.096
	(0.041)	(0.052)	(0.054)	(0.065)	(0.069)
Self-confidence	0.144	0.238	-0.514	0.205	-0.100
	(0.045)	(0.057)	(0.058)	(0.071)	(0.074)
Deliberation	-0.157	0.489	0.201	0.020	-0.189
	(0.043)	(0.055)	(0.056)	(0.067)	(0.071)
Sociability	0.553	0.002	0.019	0.322	0.162
	(0.061)	(0.078)	(0.080)	(0.096)	(0.101)
Dutifulness	0.034	0.146	-0.013	0.249	0.214
	(0.040)	(0.051)	(0.052)	(0.063)	(0.067)
Masculinity	-0.017	-0.034	-0.030	-0.108	-0.126
	(0.039)	(0.050)	(0.051)	(0.062)	(0.065)
N	231	231	231	231	231
R^2	0.692	0.508	0.485	0.242	0.155

Table S16: Multivariate regression models predicting the Five Factor Model (FFM) personality traits with Finnish Defence Forces (FDF) personality traits in a convenience sample of 231 participants. Values are standardized beta coefficients (and their standard errors) of 5 multivariate linear regression models predicting each of the FFM traits with all the FDF traits. See section *The Relation of the FDF test and the Five Factor Model* for details.

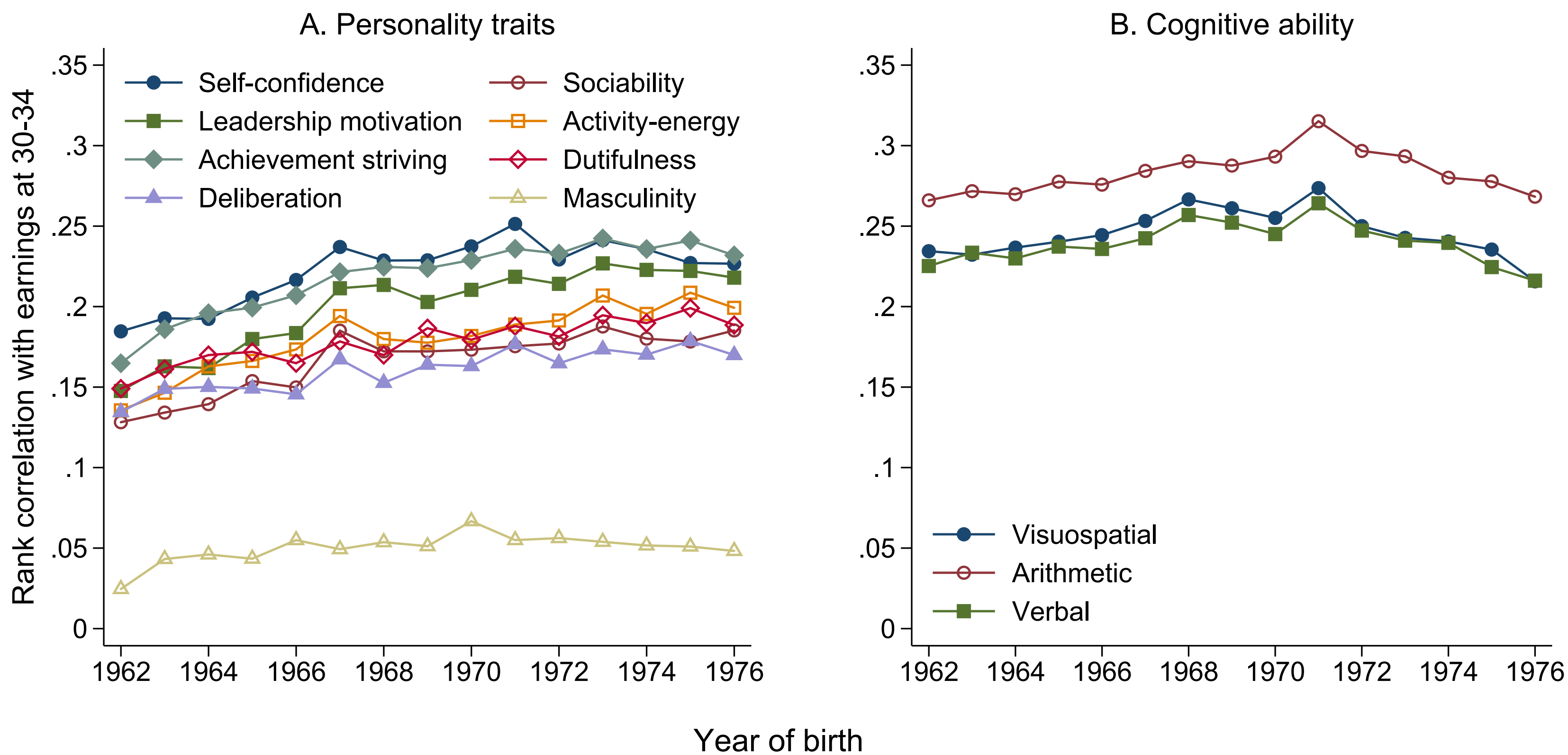

Figure S1: The relation of earnings and (**A**) personality traits and (**B**) cognitive ability by birth cohort. The relations are measured as the within-cohort rank correlation between the test score and earnings at age 30–34.

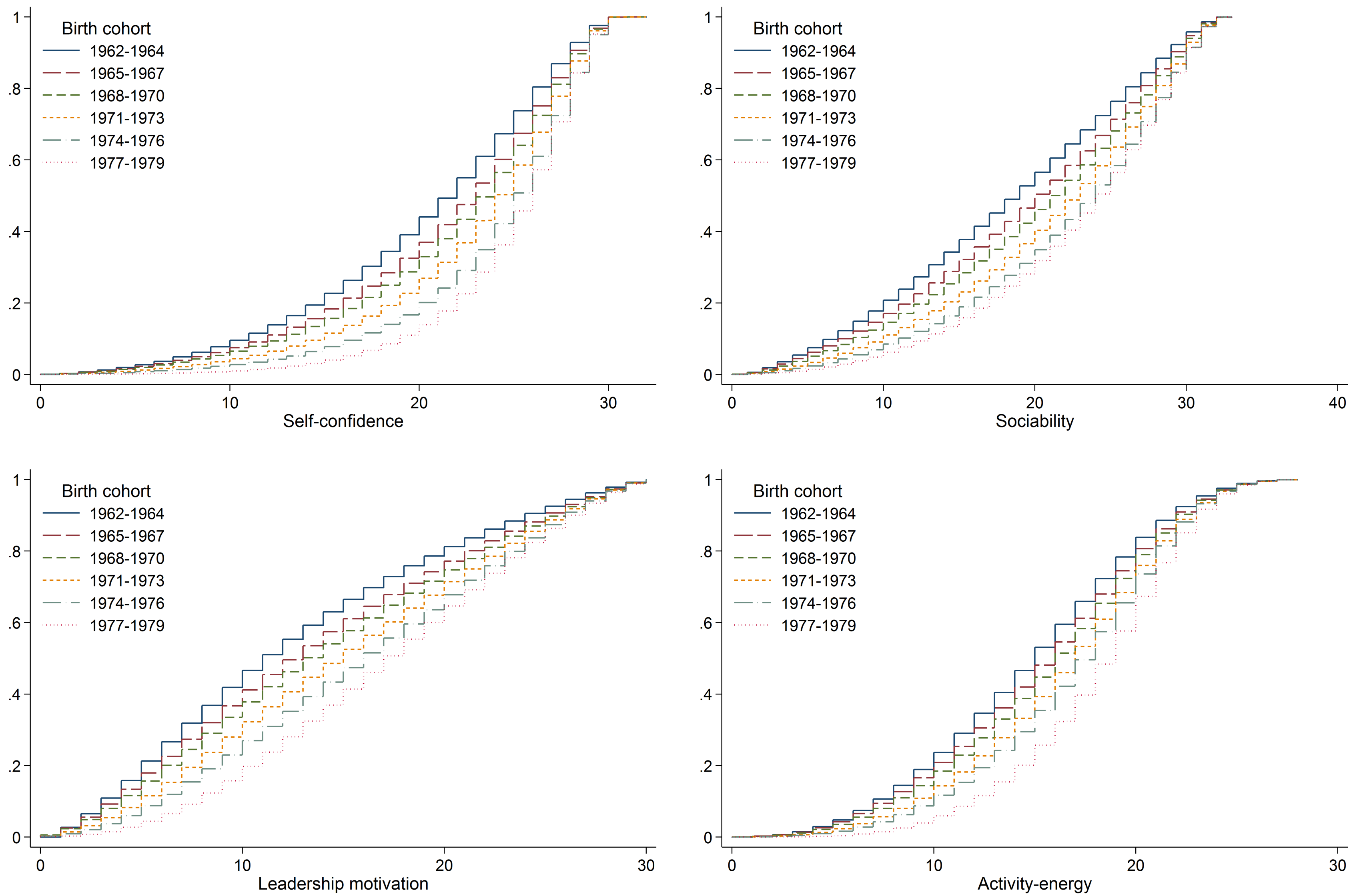

Figure S2: (1) CDFs of the raw personality test scores by birth cohort

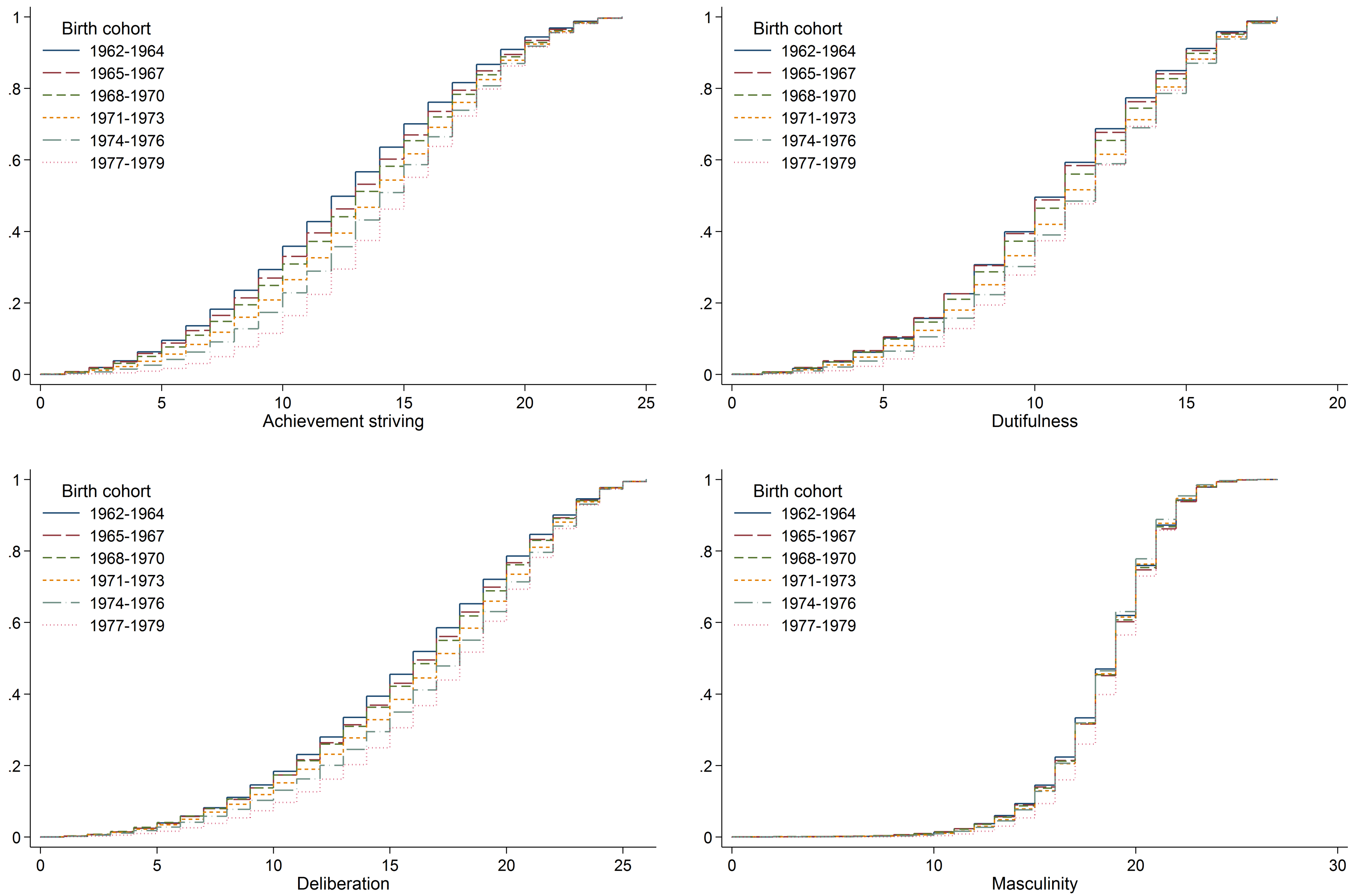

Figure S2: (2) CDFs of the raw personality test scores by birth cohort

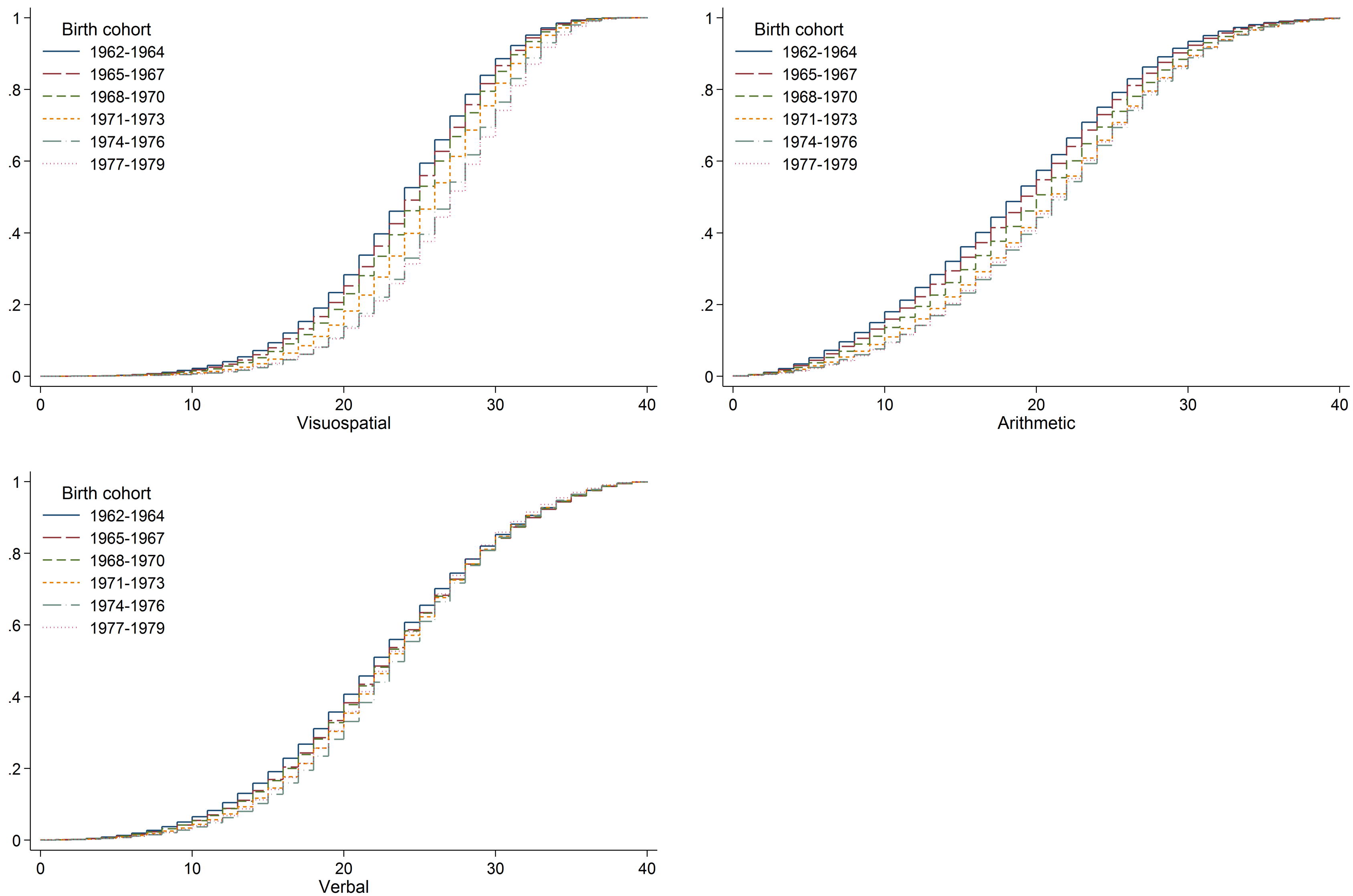

Figure S3: CDFs of the raw cognitive ability test scores by birth cohort

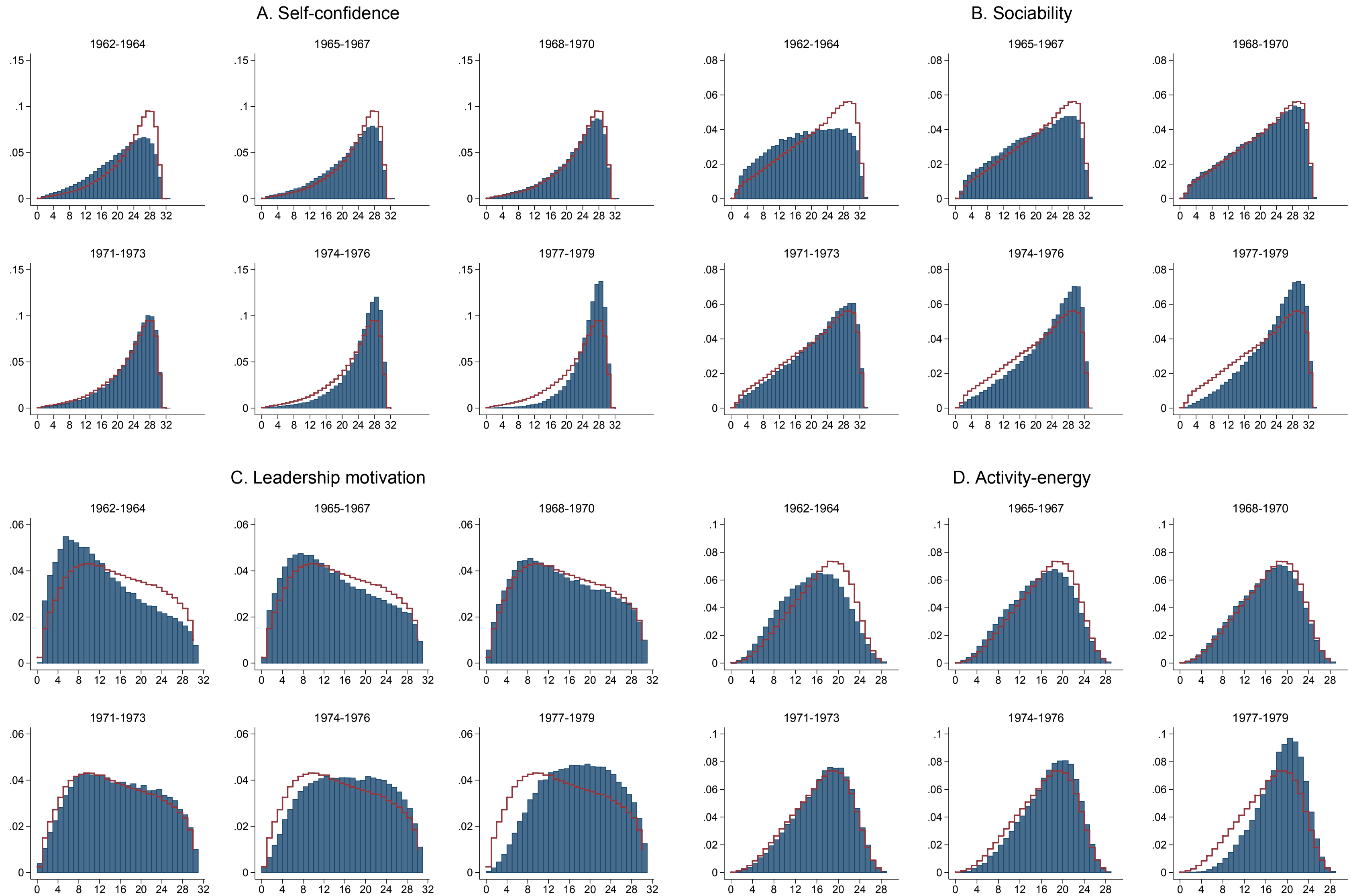

Figure S4: (1) Distributions of the raw personality test scores by birth cohort. The red curves depict the distributions for the 1962–1976 cohorts.

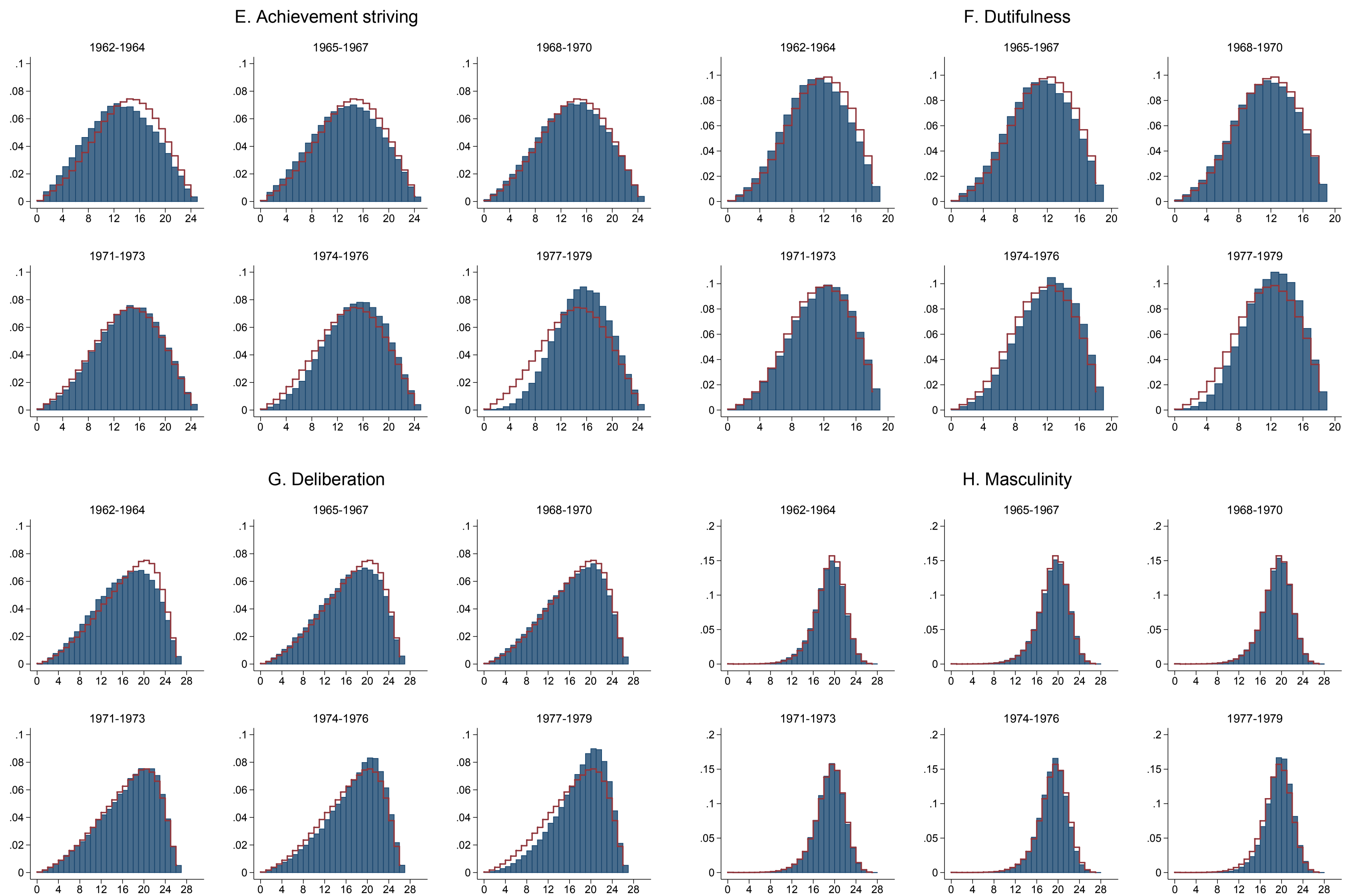

Figure S4: (2) Distributions of the personality test raw scores by birth cohort. The red curves depict the distributions for the 1962–1976 cohorts.

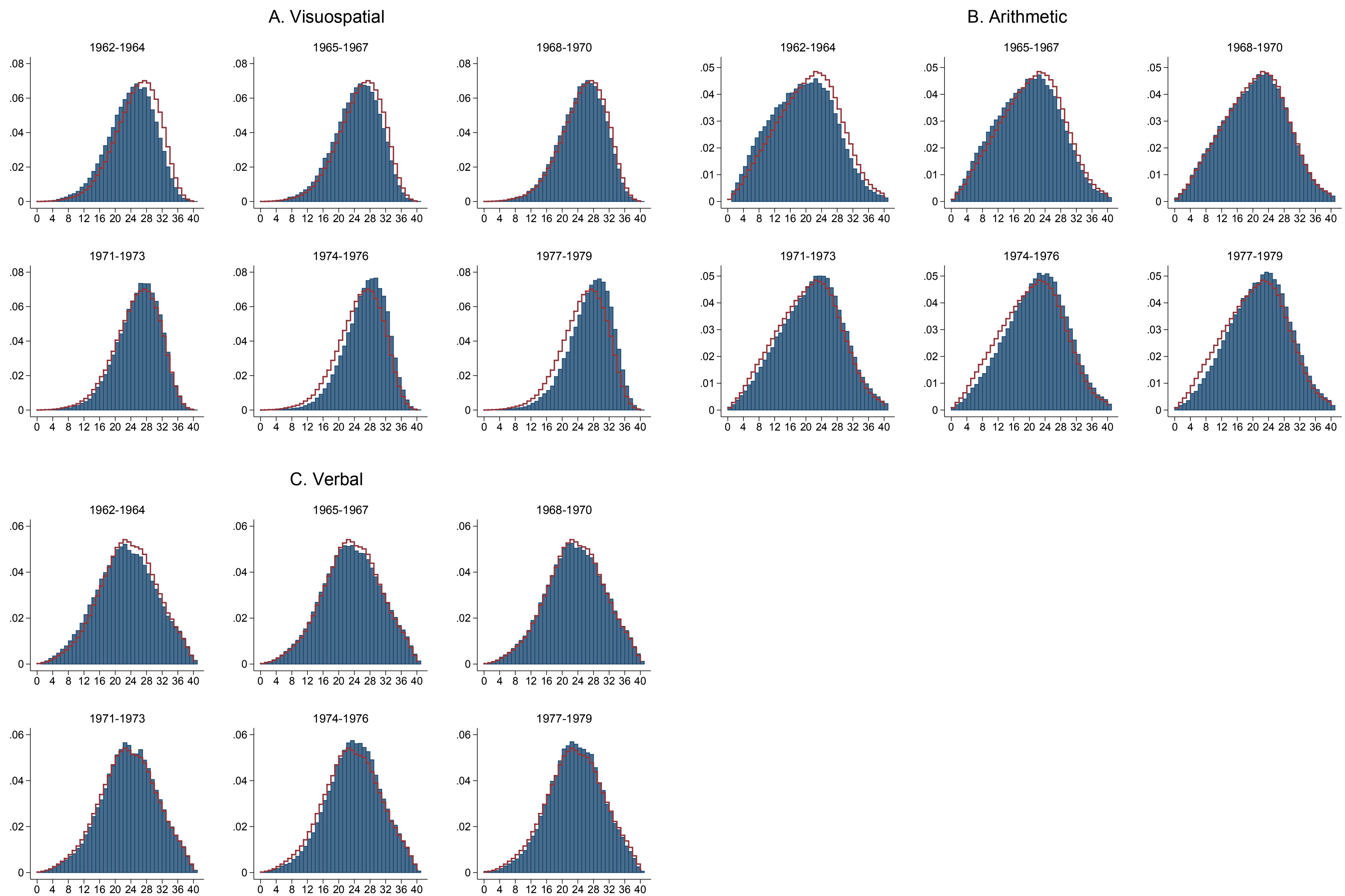

Figure S5: Distributions of the raw cognitive ability test scores by birth cohort. The red curves depict the distributions for the 1962–1976 cohorts.

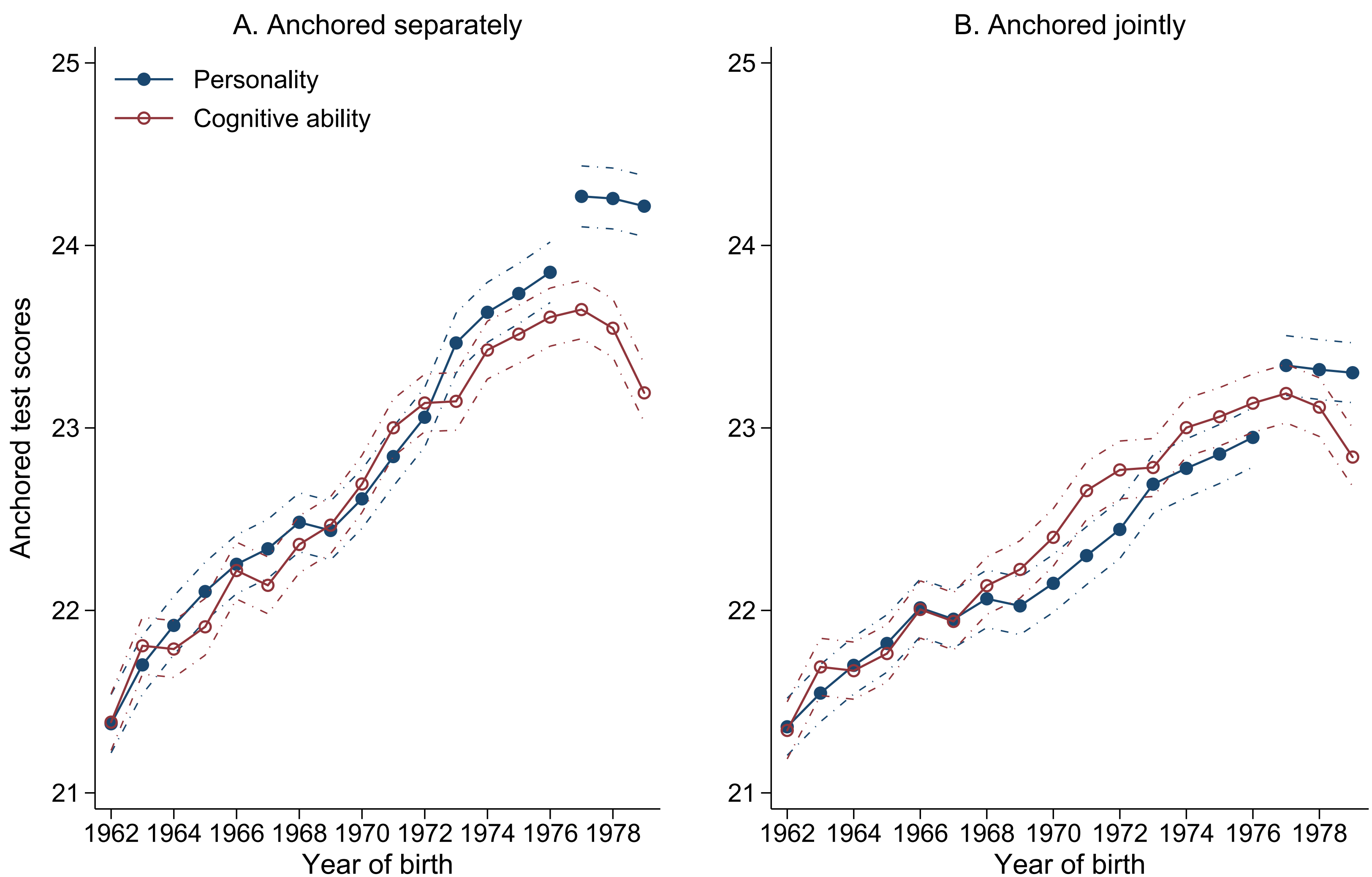

Figure S6: Anchored test scores based on (A) separate regressions and (B) joint regressions of the test scores. See section *Anchored test scores* for details. Panel A reproduces Fig 3 of the main text for reference.

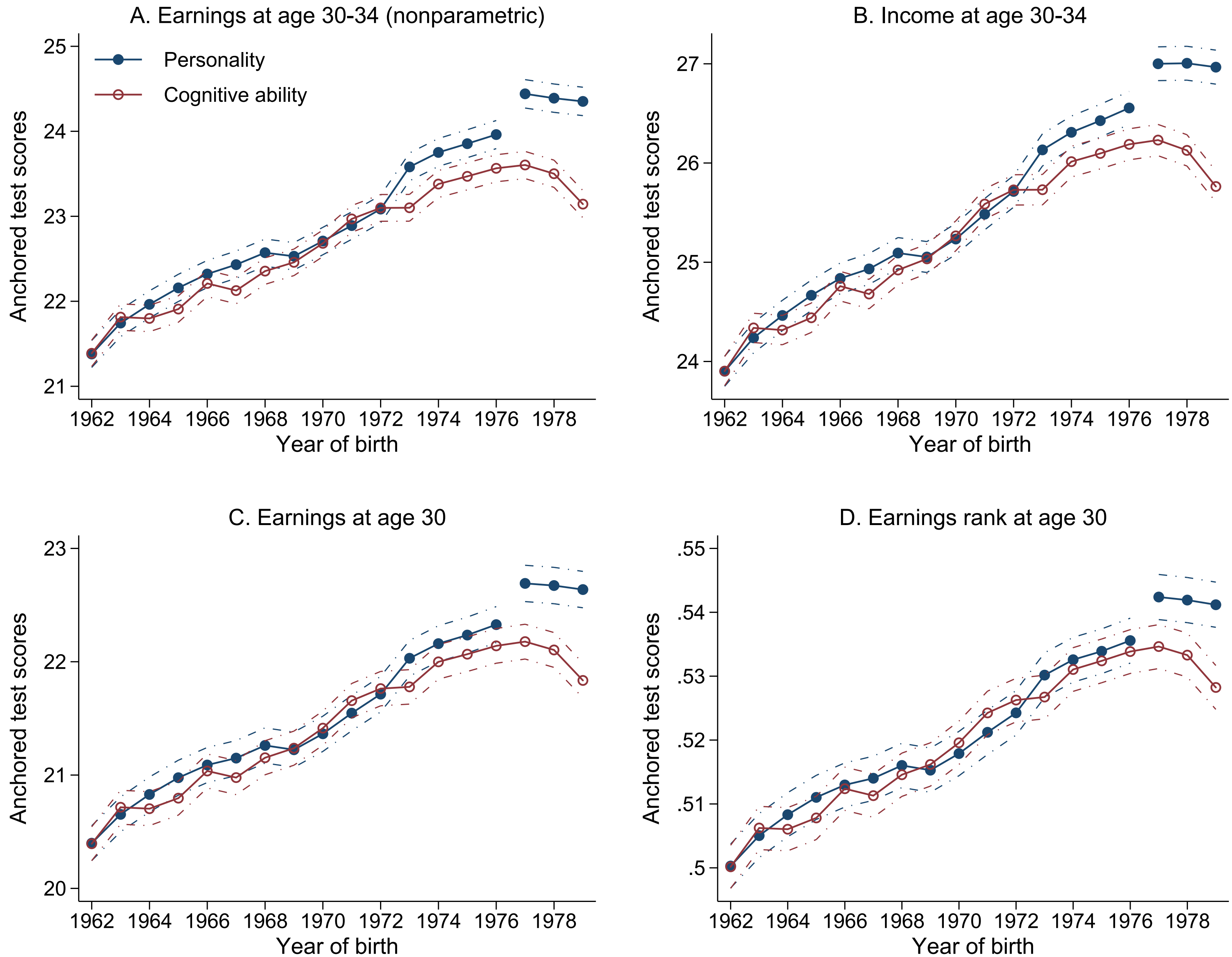

Figure S7: Anchored test scores using alternative anchoring variables. See section *Alternative anchoring variables.*

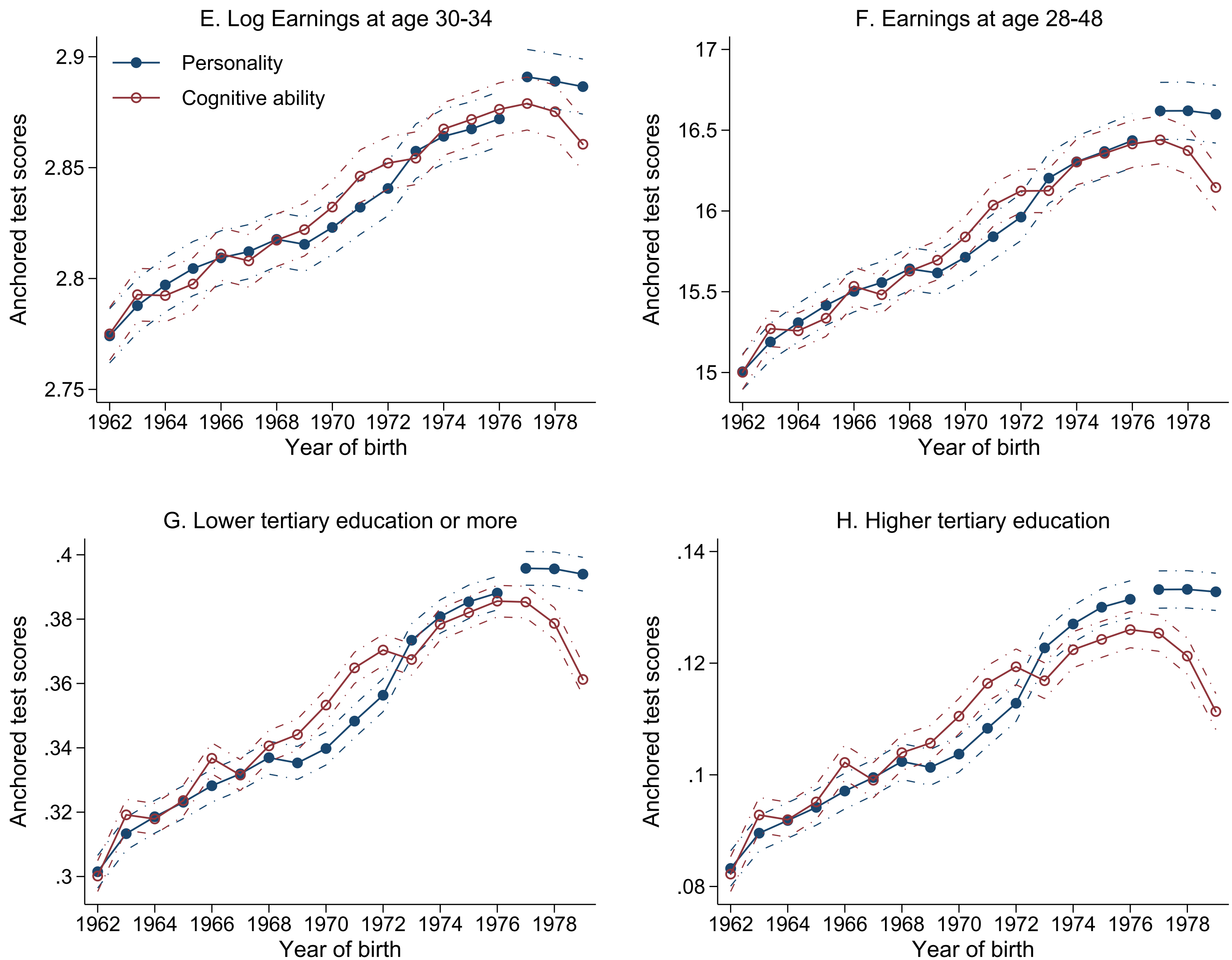

Figure S7: (cont') Anchored test scores using alternative anchoring variables. See section *Alternative anchoring variables.*

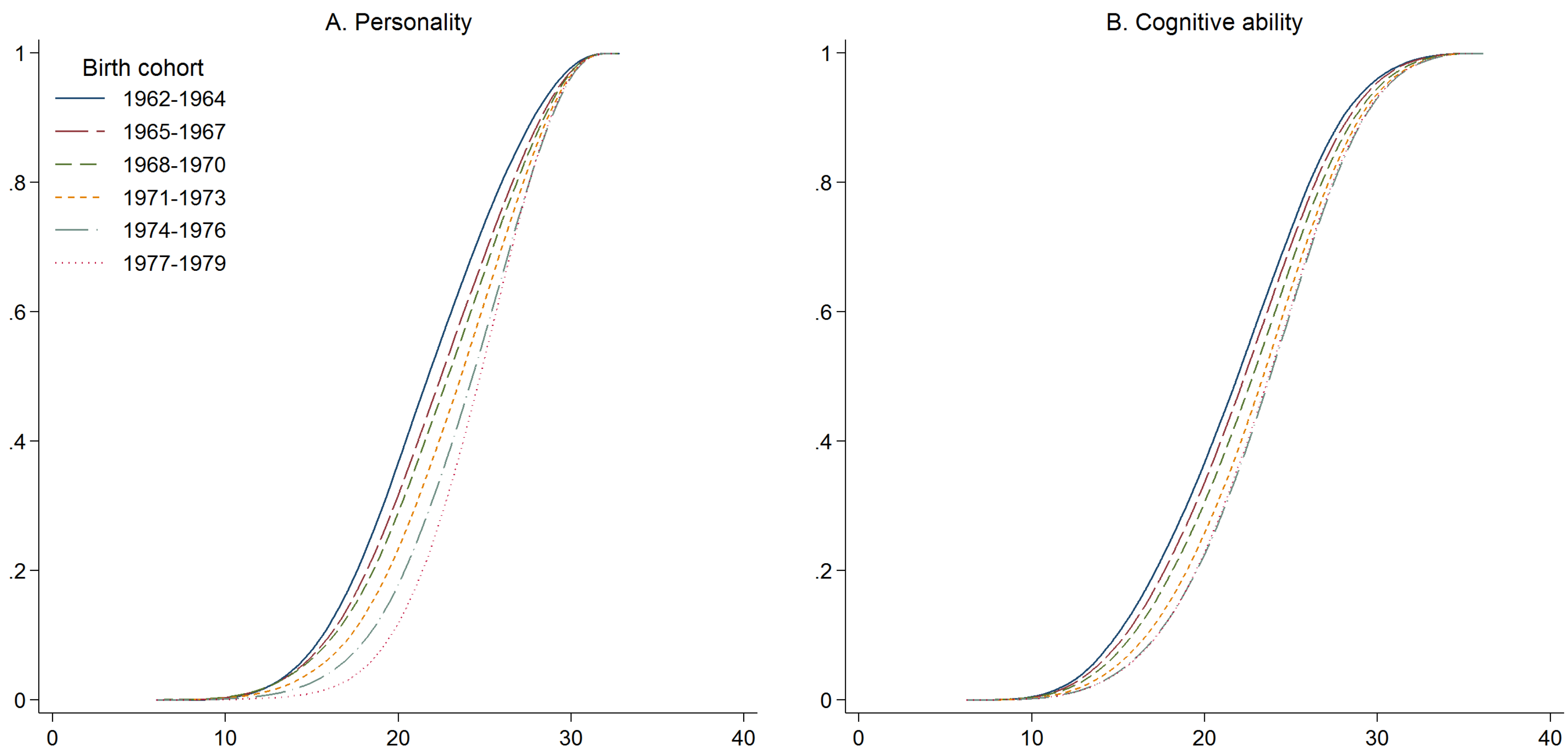

Figure S8: CDFs of anchored test scores. The cohort means of these scores are reported in Fig 3 of the main text.

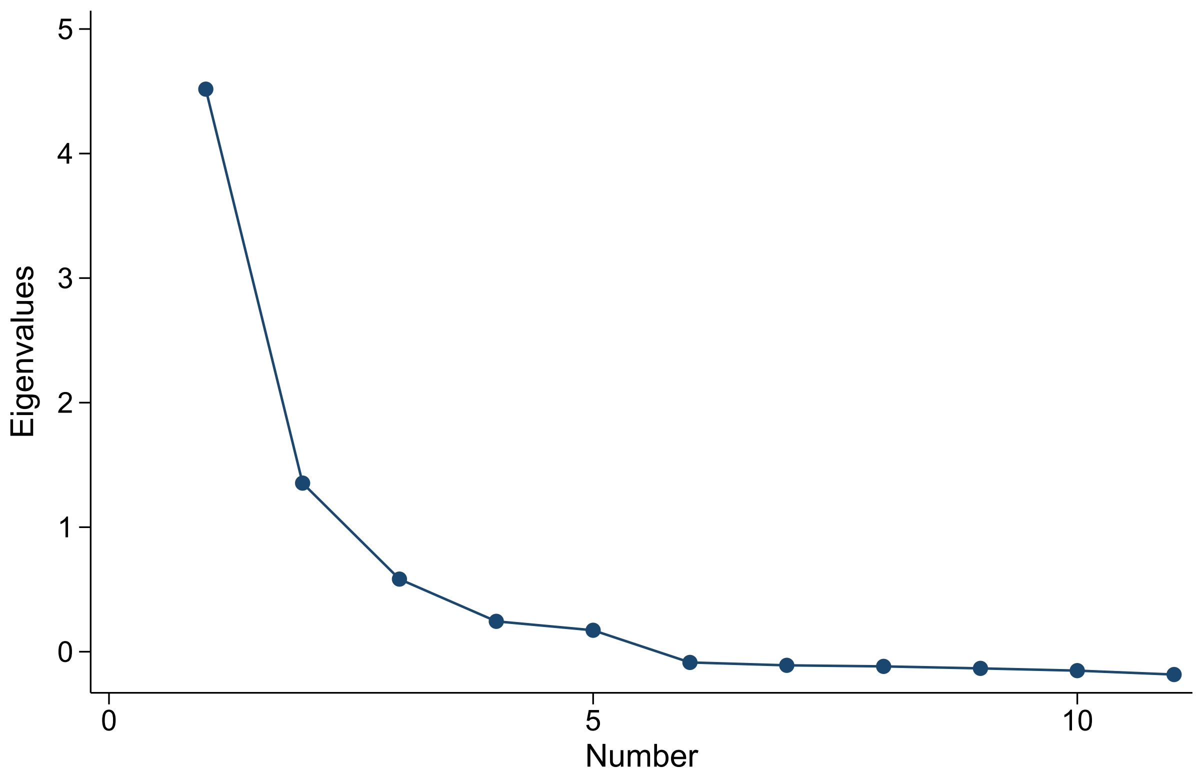

Figure S9: Eigenvalue plot of results from exploratory factor analysis of the test score data. See section *Exploratory factor analysis* for details.

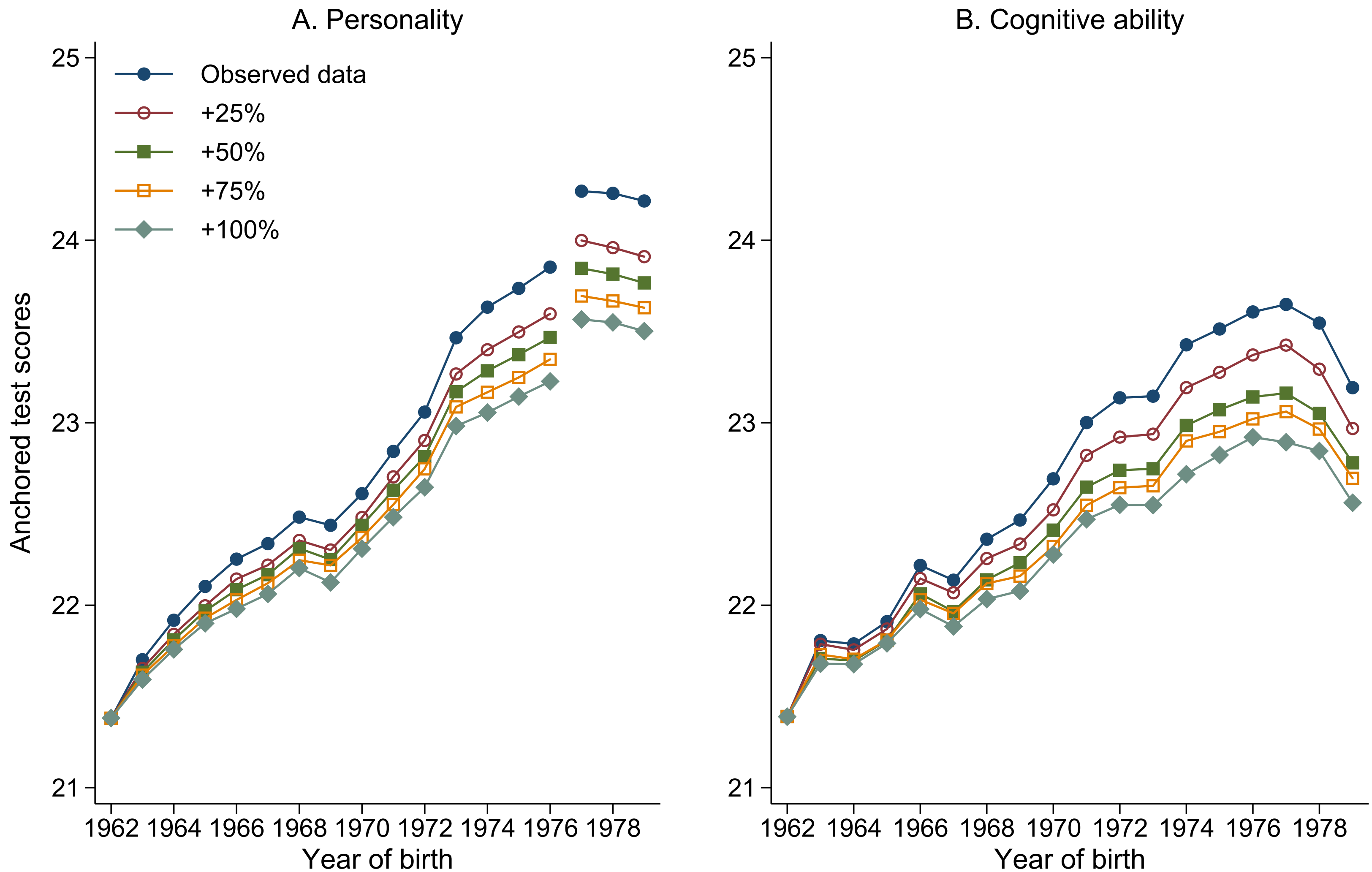

Figure S10: Trends in anchored test scores after adding measurement error to the observed test scores. The measurement error is i.i.d, normally distributed, and measured as a percentage of the variance of the observed test scores. See section *Measurement error* for details.

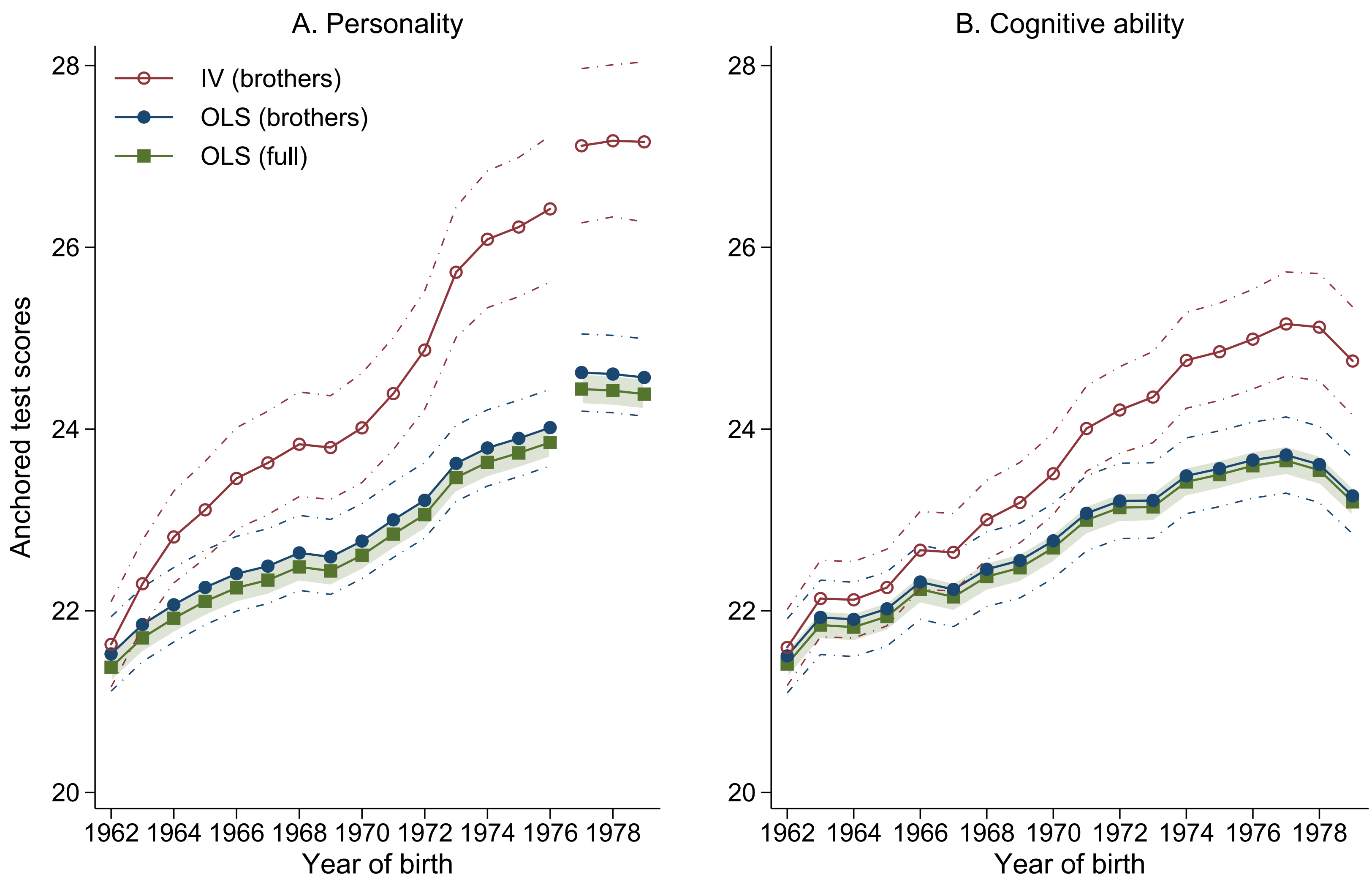

Figure S11: Trends in achored test scores based on IV estimates (brothers). See section *Instrumental variables estimates* for details.

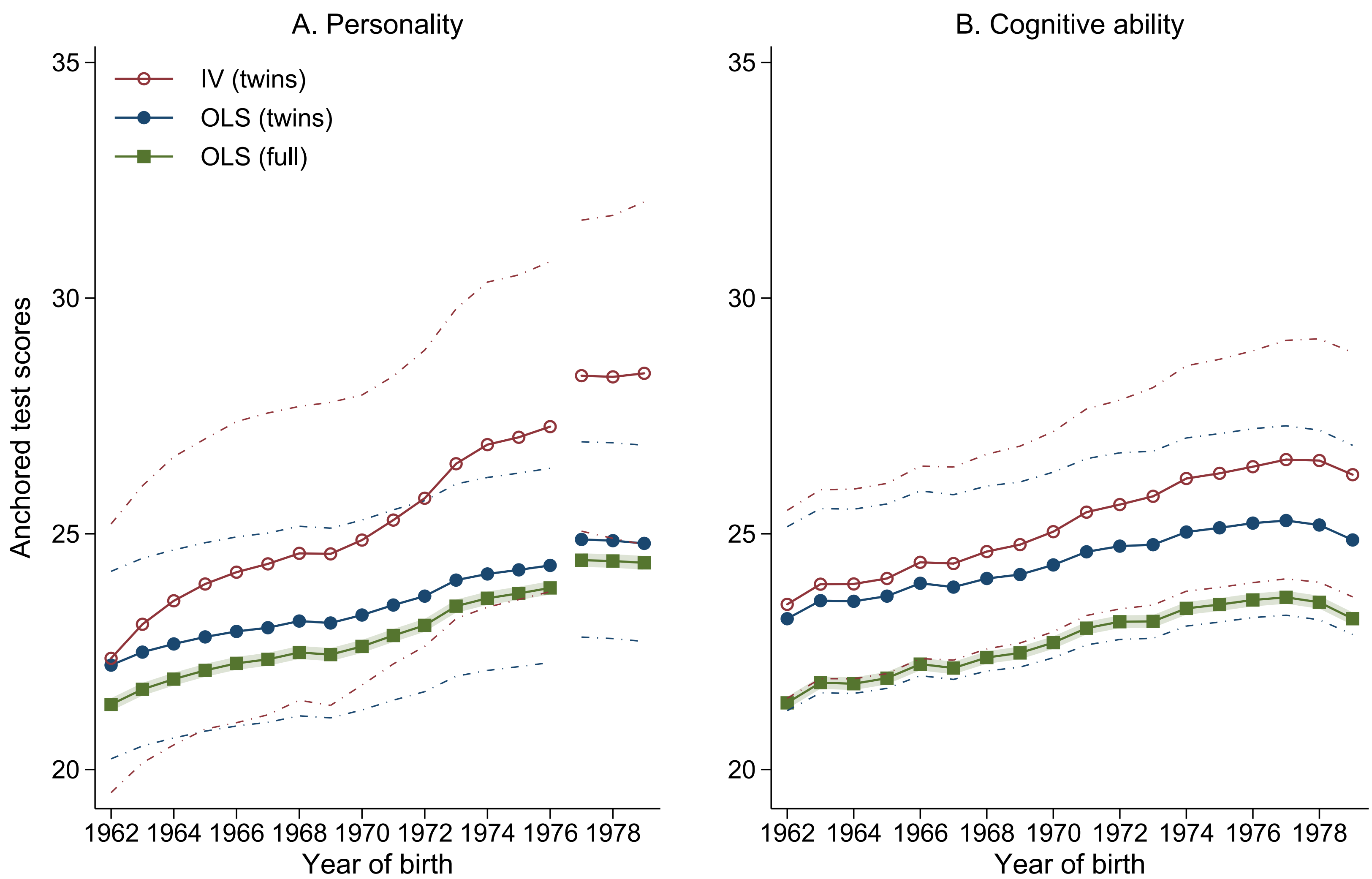

Figure S12: Trends in achored test scores based on IV estimates (twins). See section *Instrumental variables estimates* for details.

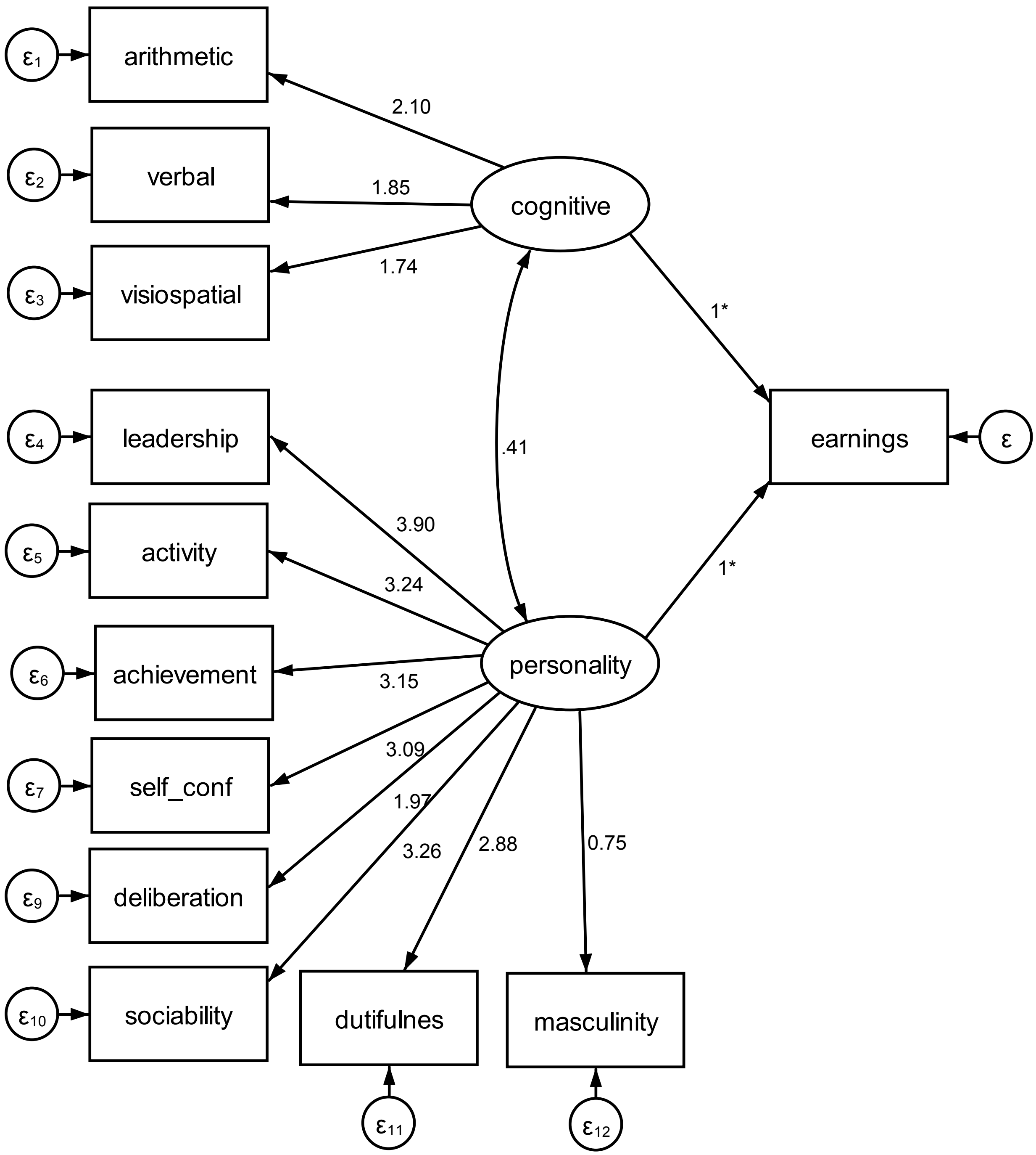

Figure S13: Path diagram of factor structure; see section *Structural equations model* for details.

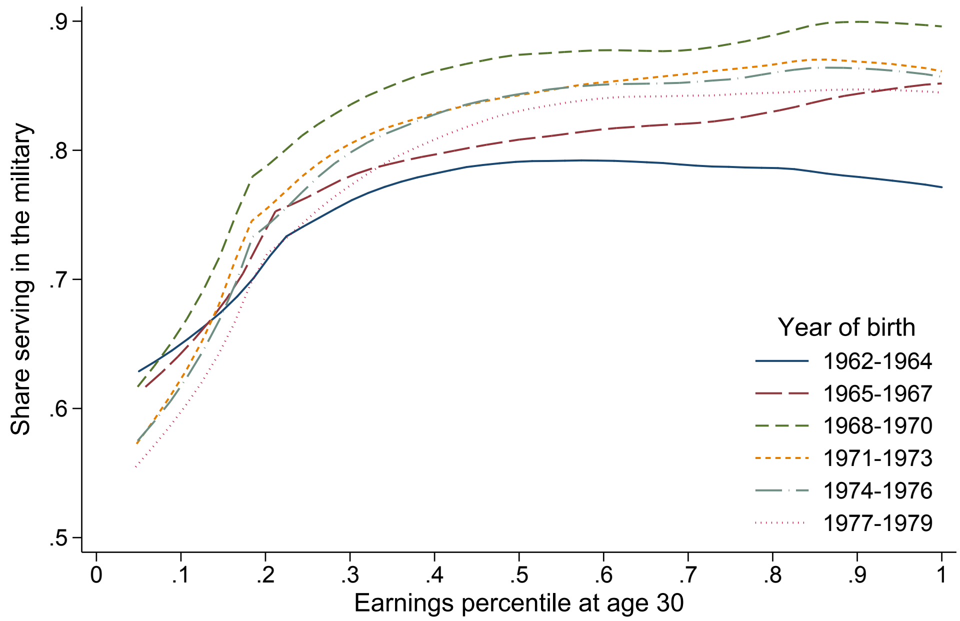

Figure S14: Selection of men to the FDF test data by later-life income. See section *Selectivity in test score data* for details.

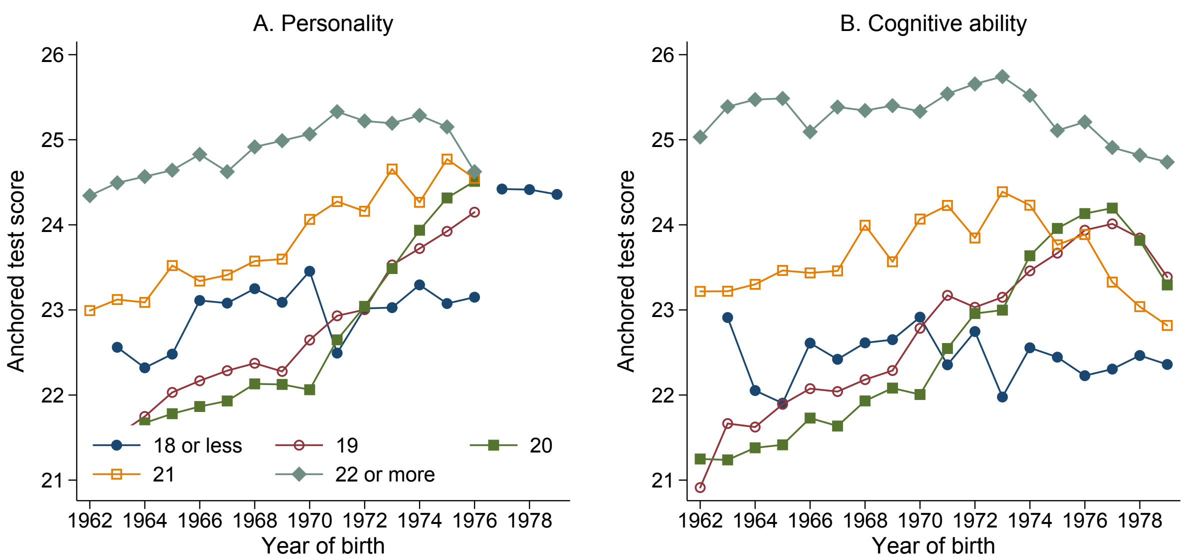

Figure S15: Trends in anchored test scores by age at test.

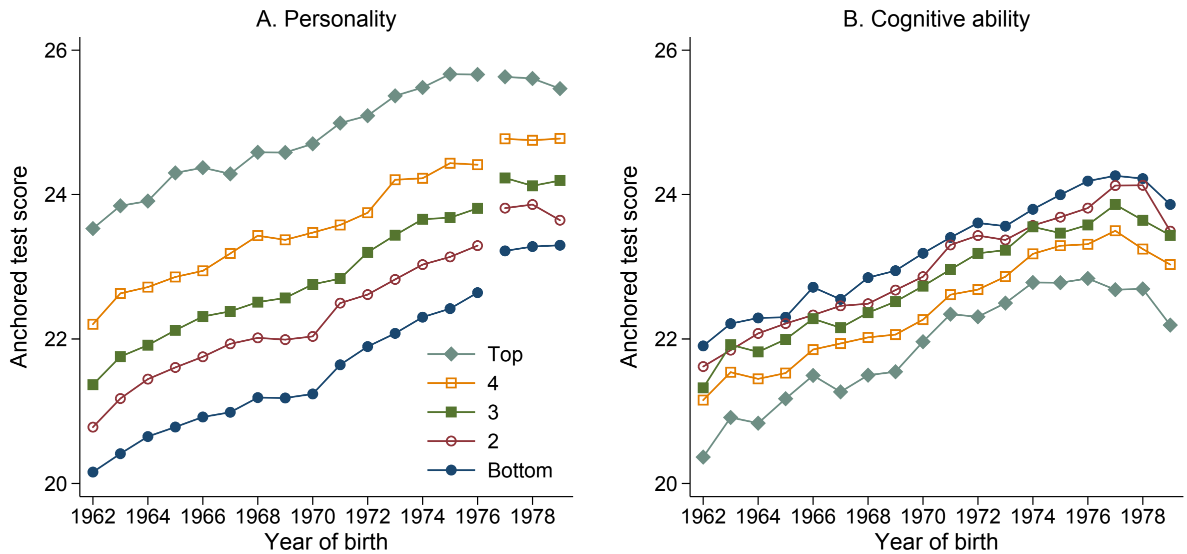

Figure S16: Trends in anchored test scores by quintiles of the Lie-score

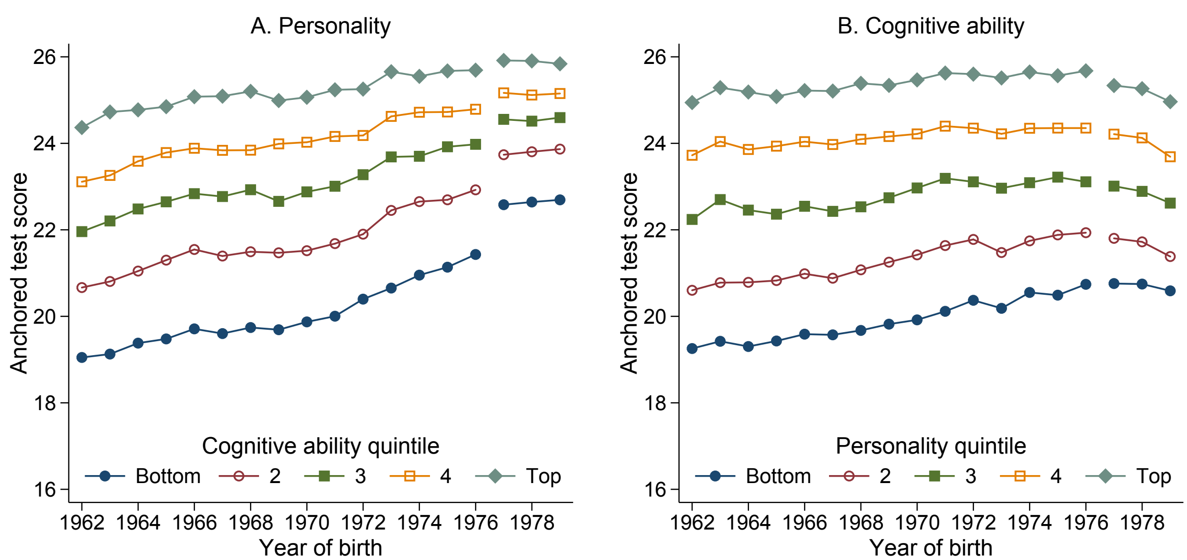

Figure S17: Trends in (A) anchored personality test scores by quintiles of anchored cognitive ability test scores and (B) anchored cognitive ability test scores by quintiles of anchored personality test scores .

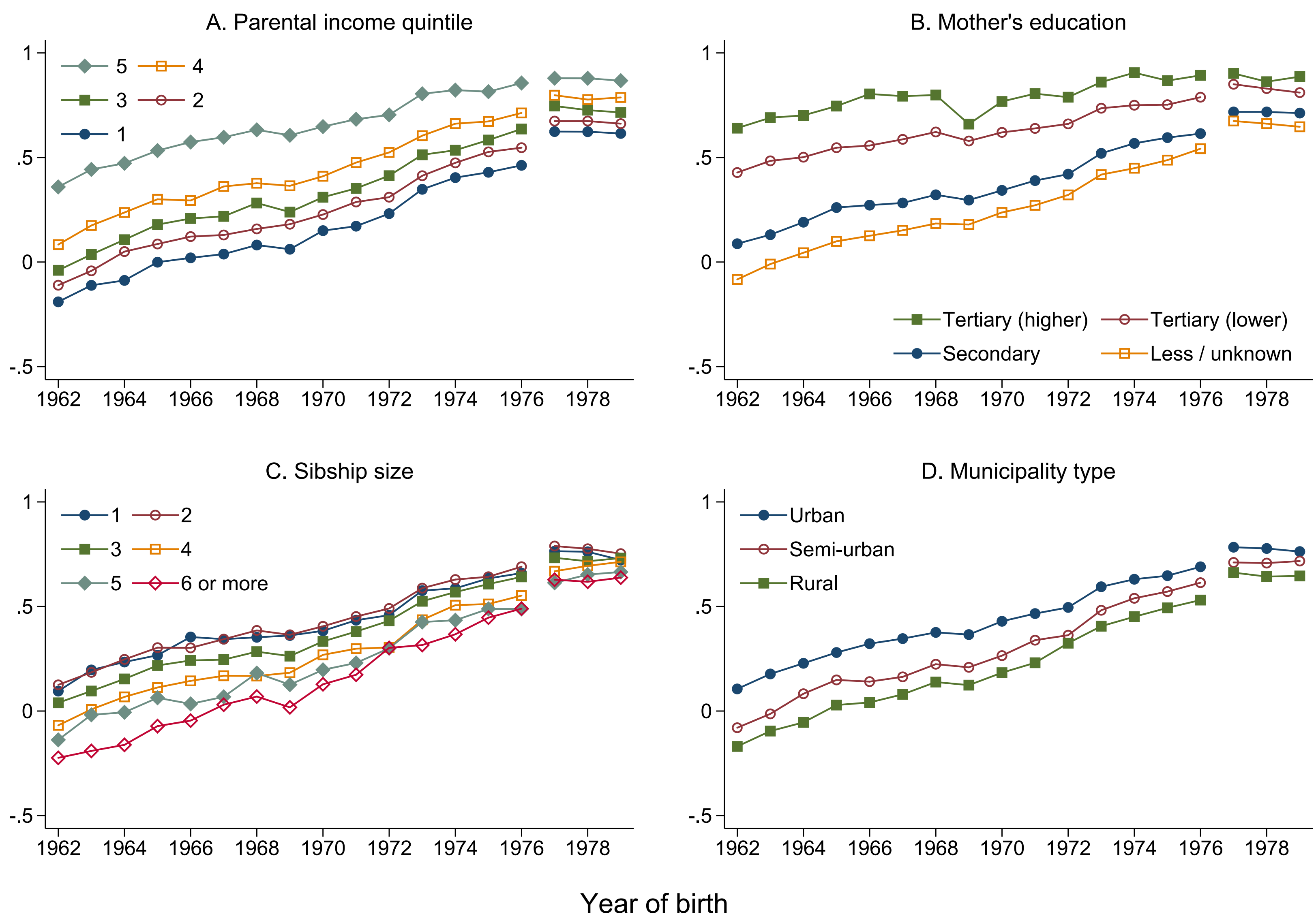

Figure S18: (1) Evolution of *Self-confidence* across birth cohorts by (**A**) parental income quintile, (**B**) mother's education, (**C**) sibship size, and (**D**) urbanization of birth place.

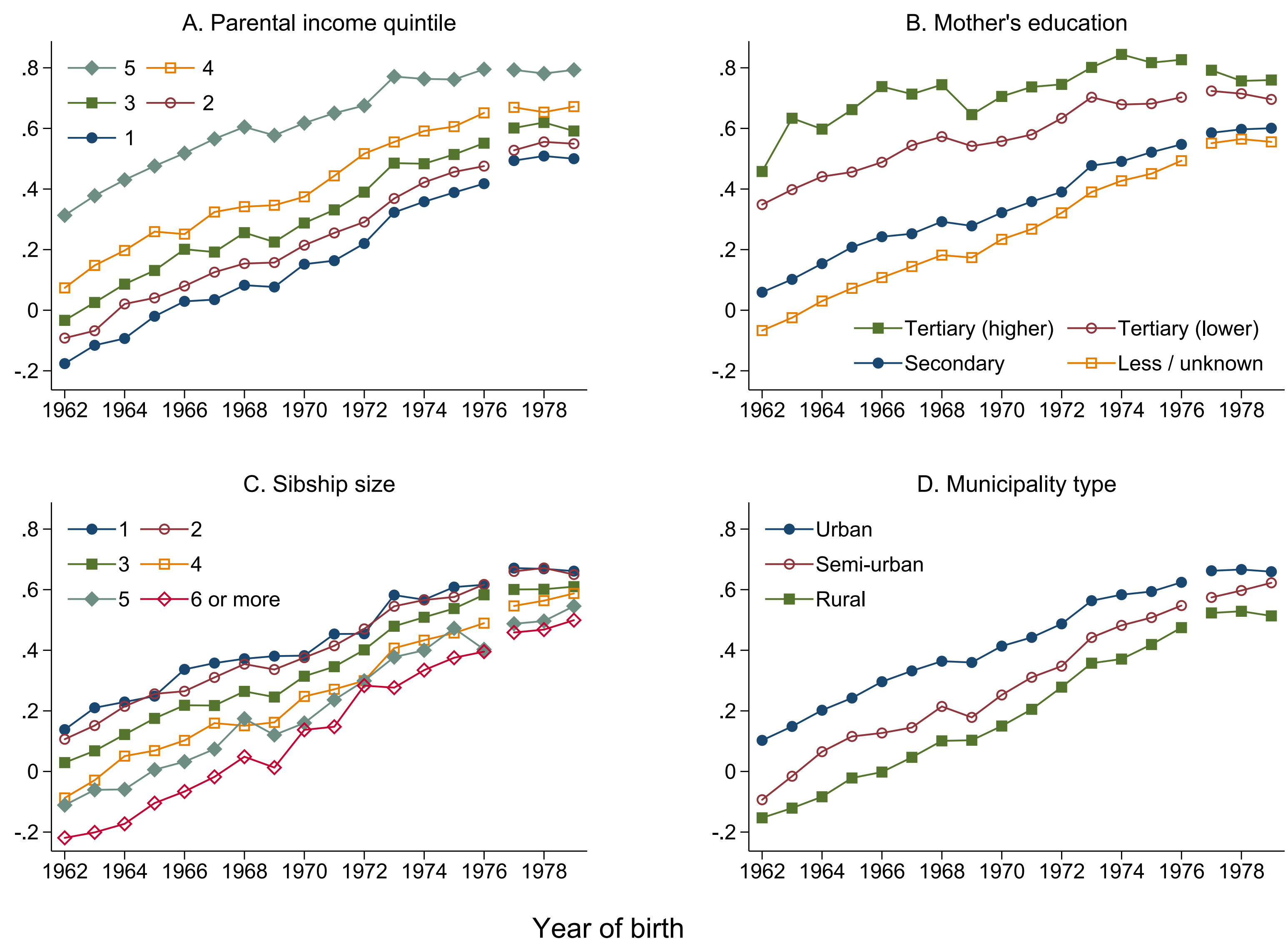

Figure S18: (2) Evolution of *Sociability* across birth cohorts by (**A**) parental income quintile, (**B**) mother's education, (**C**) sibship size, and (**D**) urbanization of birth place.

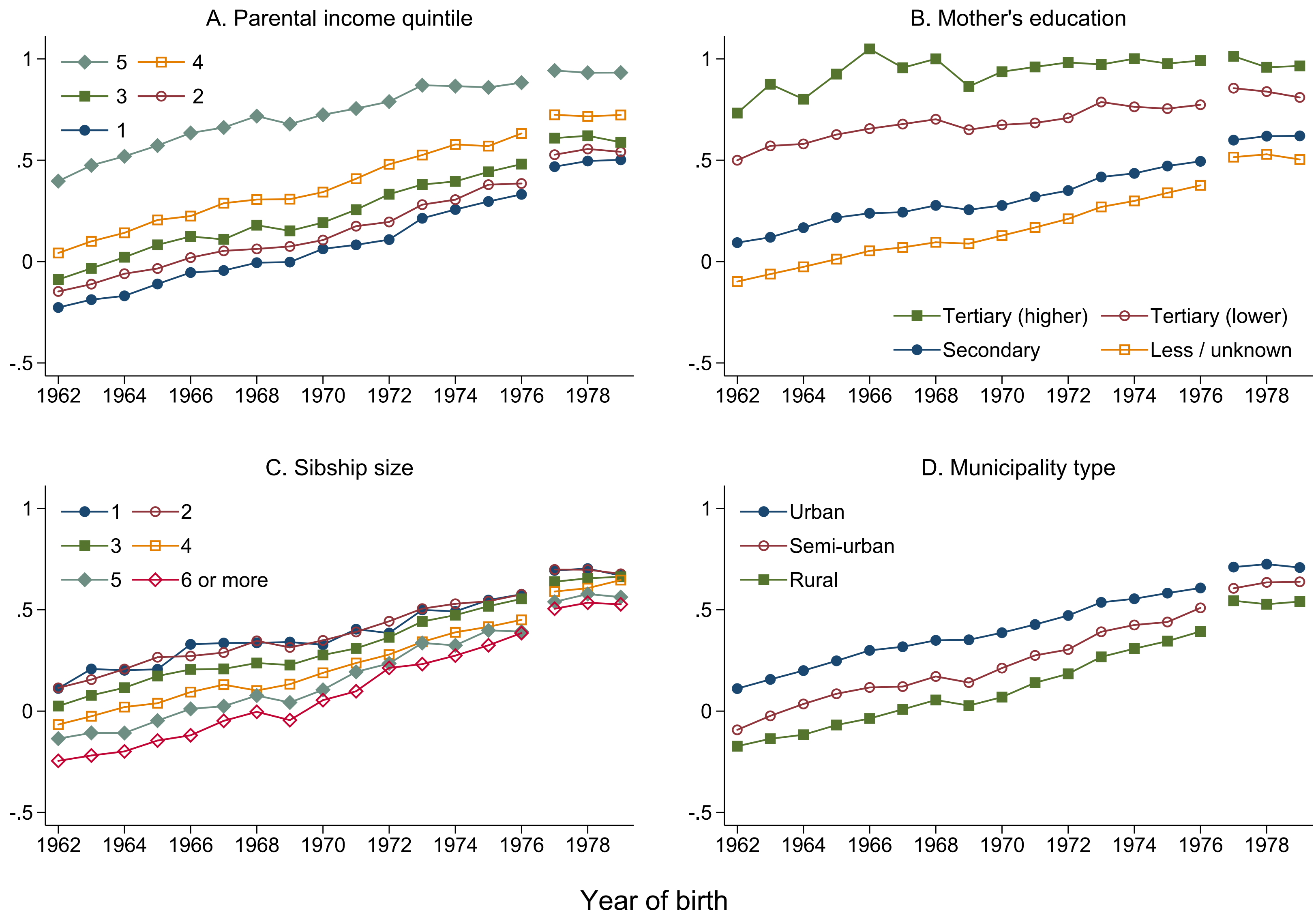

Figure S18: (3) Evolution of *Leaderhsip motivation* across birth cohorts by (**A**) parental income quintile, (**B**) mother's education, (**C**) sibship size, and (**D**) urbanization of birth place.

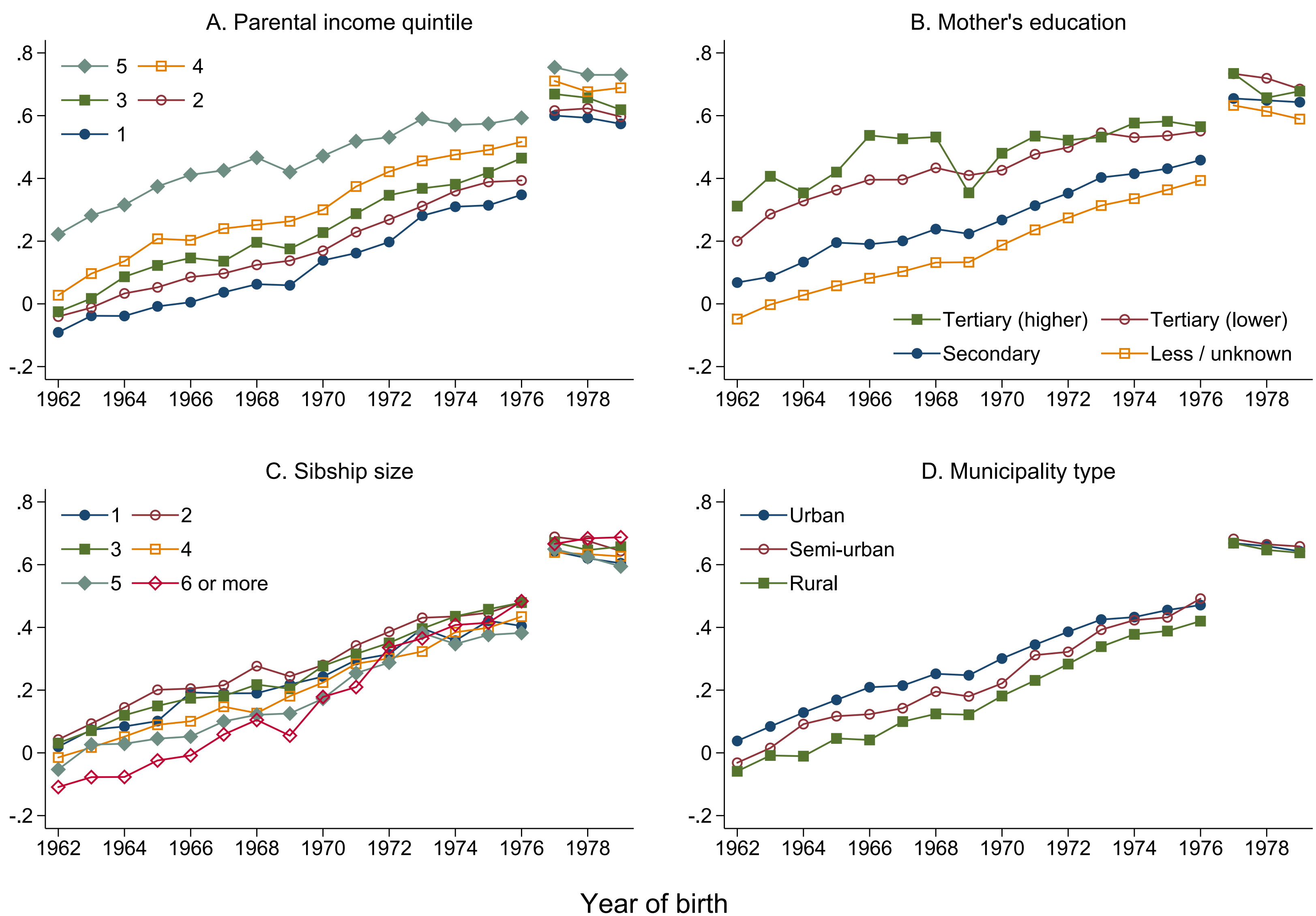

Figure S18: (4) Evolution of *Activity-energy* across birth cohorts by (**A**) parental income quintile, (**B**) mother's education, (**C**) sibship size, and (**D**) urbanization of birth place.

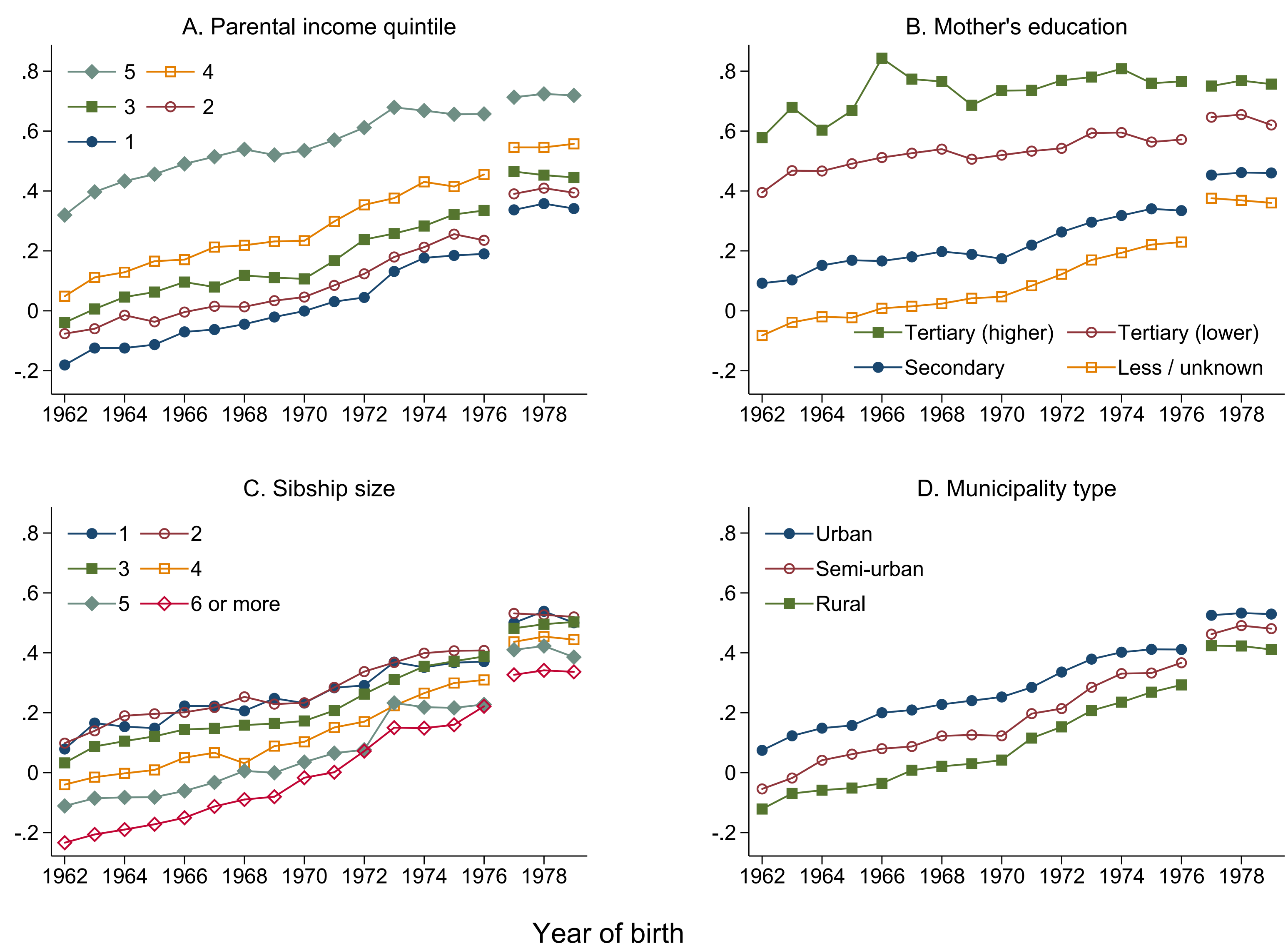

Figure S18: (5) Evolution of *Achievement striving* across birth cohorts by (**A**) parental income quintile, (**B**) mother's education, (**C**) sibship size, and (**D**) urbanization of birth place.

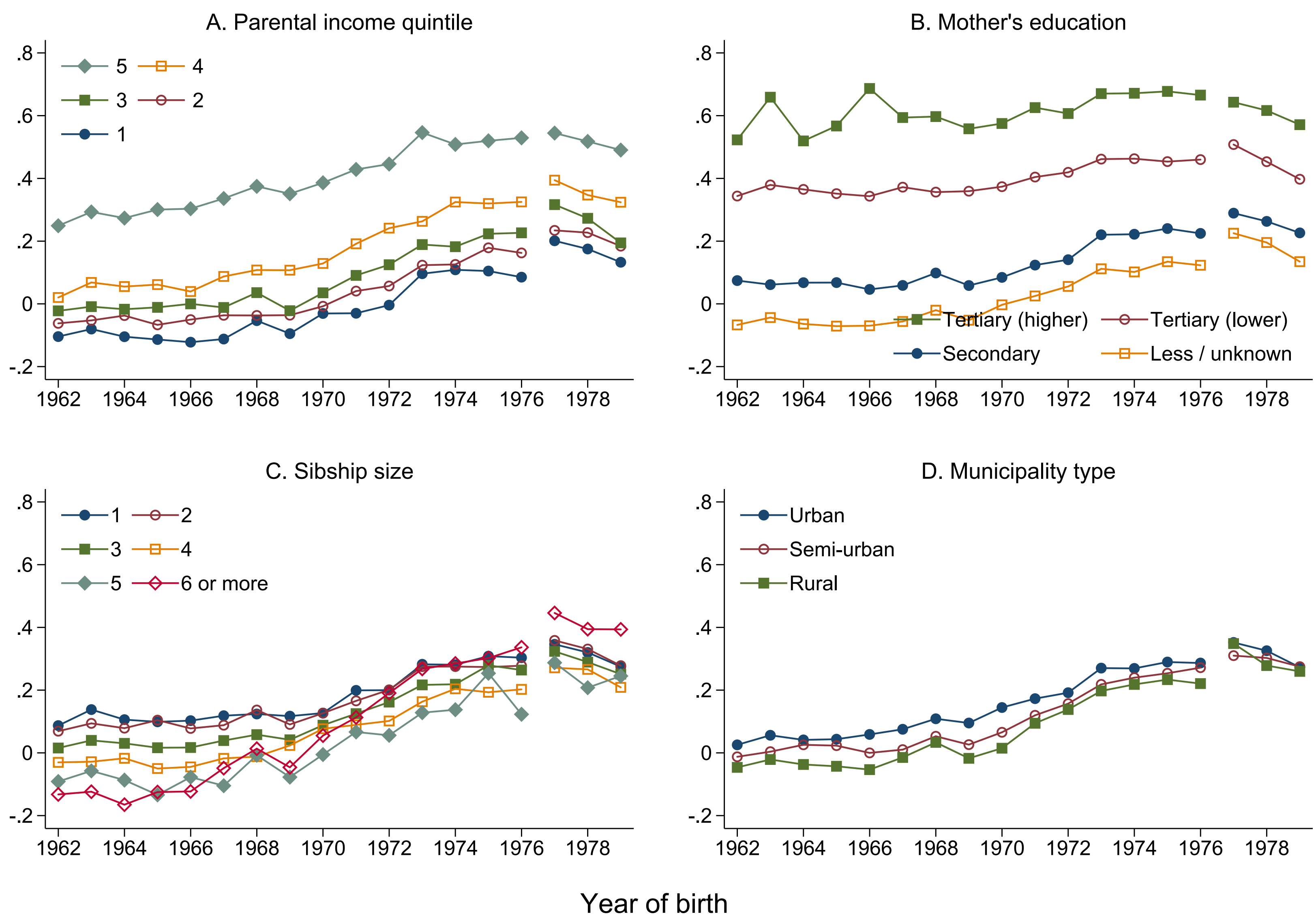

Figure S18: (6) Evolution of *Dutifulness* across birth cohorts by (**A**) parental income quintile, (**B**) mother's education, (**C**) sibship size and (**D**) urbanization of birth place.

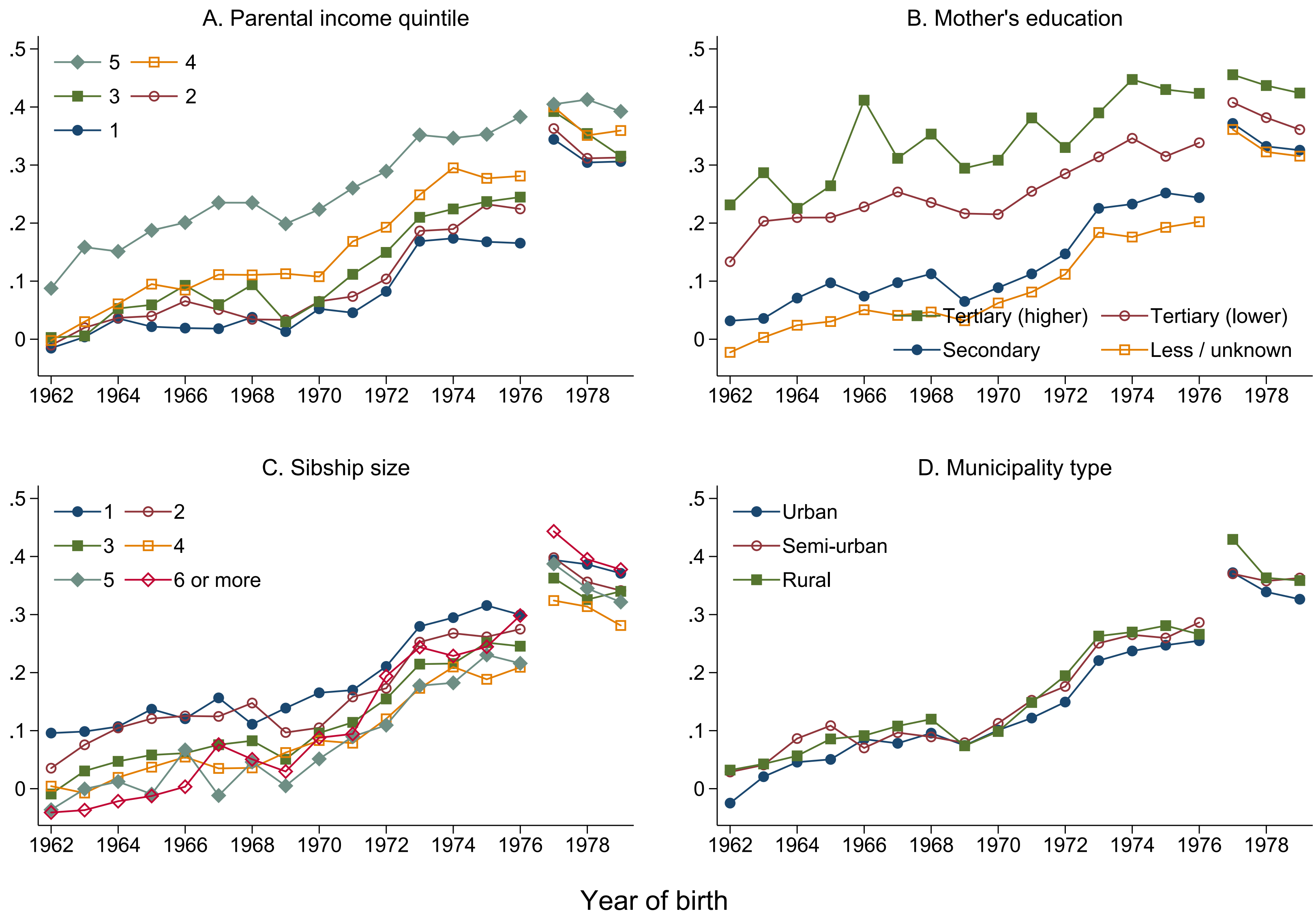

Figure S18: (7) Evolution of *Deliberation* across birth cohorts by (**A**) parental income quintile, (**B**) mother's education, (**C**) sibship size, and (**D**) urbanization of birth place.

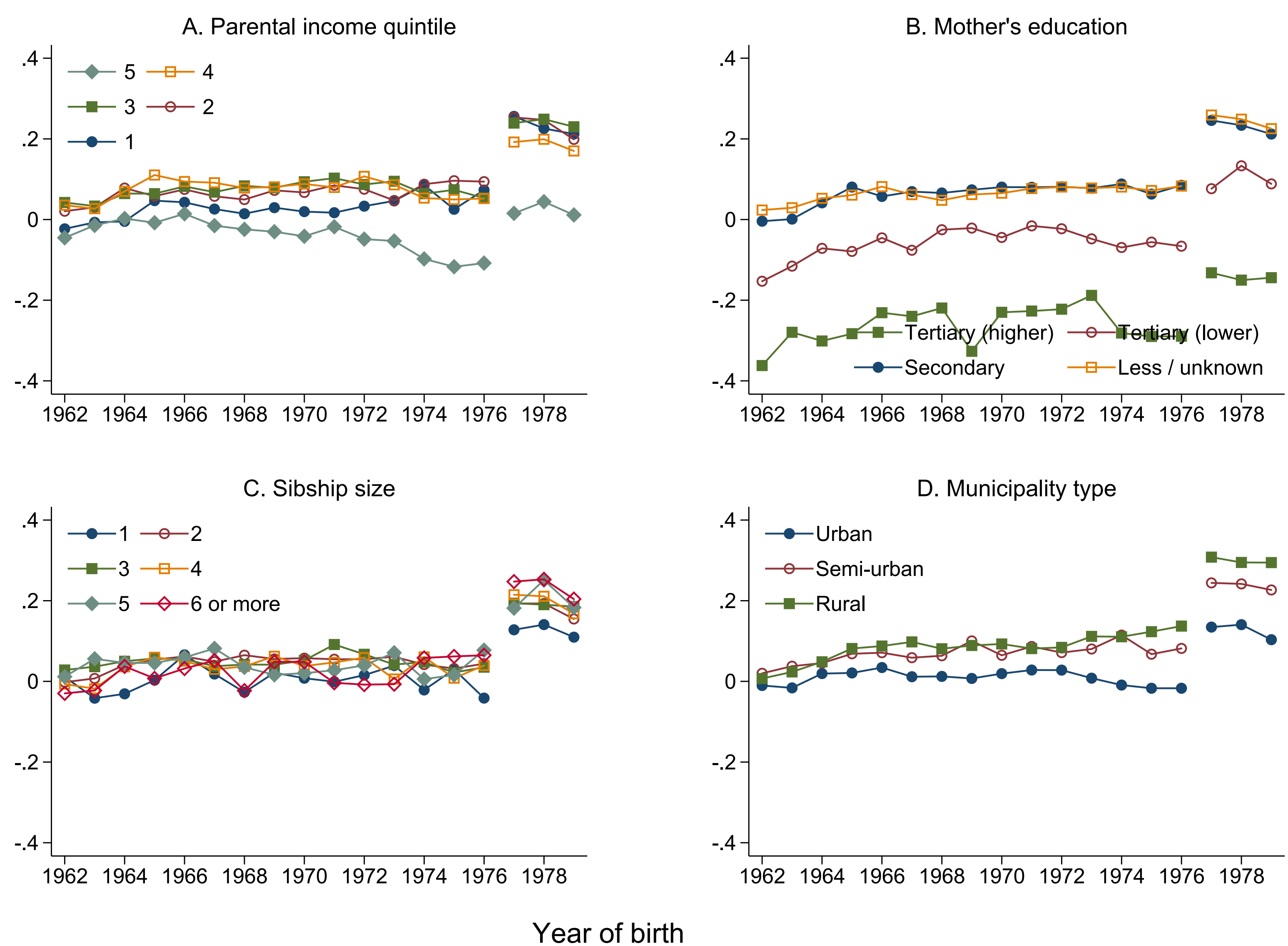

Figure S18: (8) Evolution of *Masculinity* across birth cohorts by (**A**) parental income quintile, (**B**) mother's education, (**C**) sibship size, and (**D**) urbanization of birth place.

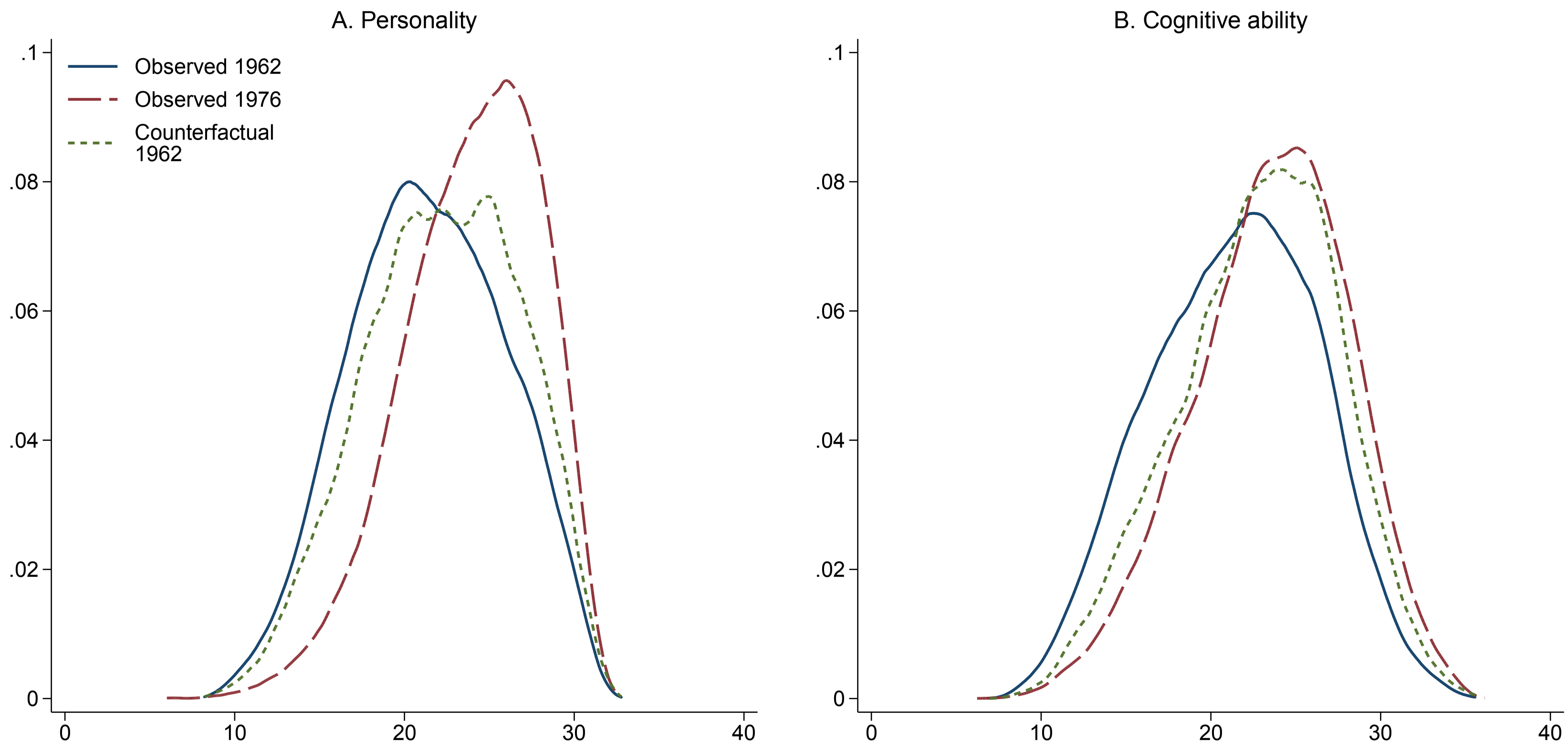

Figure S19: DFL decomposition of anchored test scores. Each figure shows the test score distribution of the 1962 birth cohort (solid line), the observed test score distribution of the 1976 birth cohort (dashed line), and the counterfactual distribution where we reweight the 1962 test score distribution to correspond to the 1976 distribution of background characteristics (dotted line). See section *Trends in background variables* for details.