Like Brother, Like Sister? – The Importance of Family Background for Cognitive and Non-Cognitive Skills

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Very preliminary and incomplete – comments highly welcome!

Abstract

This paper estimates sibling correlations in cognitive skills and non-cognitive skills to evaluate the importance of family background in skill formation. Sibling correlations are a much broader measure of the impact of family background on children's outcomes than one-dimensional parent-child correlations, which are widely used in the intergenerational mobility literature. Our estimates are based on a large representative German dataset, which includes IQ test scores and measures of personality (locus of control, reciprocity, Big Five) for brothers and sisters. Using a Restricted Maximum Likelihood (REML) model we find substantial influences of family background on the skills of both brothers and sisters. Sibling correlations of personality traits range from 0.24 to 0.59, indicating that even for the lowest estimate, one fourth of the variance or inequality can be attributed to factors shared by siblings. With one exception, all calculated sibling correlations in cognitive skills are higher than 0.50, indicating that more than half of the inequality can be explained by family characteristics. Comparing these findings to the results in the intergenerational skill transmission literature suggests that intergenerational correlations are only able to capture parts of the influence of the family on children's cognitive and non-cognitive skills. This result is in line with findings in the literature on educational and income mobility.

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1 Introduction

The last decades witnessed an increasing number of studies that stressed the importance of cognitive and non-cognitive skills for both individual labor market outcomes and social outcomes.[1] Motivated by these results, a growing body of literature developed in the field of intergenerational mobility, which analyzed the transmission of cognitive and non-cognitive skills from parents to children. Studying the intergenerational skill transmission is interesting for two reasons. First, if there is a substantial intergenerational transmission of these skills, this could help to further understand the mechanisms behind the well-documented intergenerational transmission of economic outcomes, such as earnings or education (e.g. Solon 1999; Hertz et al., 2007). Second, interpreted in an equality of opportunity context, a strong intergenerational skill transmission would violate the normative goal of giving everyone the chance to achieve her potential.

However, especially for the interpretation as an indicator for equality of opportunities, a number of authors have recently stressed that estimating intergenerational correlations only reveals part of the picture (e.g. Björklund and Jäntti, 2012).[2] They suggest instead estimating sibling correlations, which are a broader measure of the impact of family background on children's outcomes than a one-dimensional parent-child correlation.

In this study, we investigate the importance of family background for cognitive and non-cognitive skills based on sibling correlations. Our estimates are based on data from the German Socio-Economic Panel Study (SOEP), which is a large representative household survey. The SOEP data contains test scores from two ultra-short IQ-tests, which we use as our measure of cognitive skills. Furthermore, the SOEP provides data on locus of control, reciprocity, and the Big Five personality traits (openness, conscientiousness, extraversion,

[1] See for example Heckman et al. (2006) and Heineck and Anger (2010). An extensive overview can be found in Almlund et al. (2011).
[2] Björklund and Jäntti (2012) call this the „tip of the iceberg".

agreeableness and neuroticism), which act as our measures of non-cognitive skills. Most of the existing studies on skill correlations within families use Scandinavian register data and are restricted to leadership traits and cognitive test scores from military enlistment tests, which are only available for males. The contribution of our paper is therefore to present findings from data that provide broader measures of personality and information on skills for both men and women. By comparing our sibling correlations to previous findings we investigate whether differences in the skill formation process can potentially explain cross-country differentials in sibling correlations of labor market outcomes (Schnitzlein, 2011).

Using a Restricted Maximum Likelihood (REML) model we find substantial influences of the family background on the skills of both brothers and sisters. Sibling correlations of the personality traits range from 0.24 to 0.59, indicating that even for the lowest estimate, one fourth of the variance or inequality can be attributed to factors shared by siblings. With one exception, all calculated sibling correlations in cognitive skills are higher than 0.50, indicating that more than half of the inequality can be explained by family characteristics. Comparing these findings to the results in the intergenerational skill transmission literature suggests that intergenerational correlations are only able to capture parts of the influence of the family on children's cognitive and non-cognitive skills. This result is in line with findings in the literature on educational and income mobility.

2 Previous Studies

The last decades witnessed an increasing number of studies that stressed the importance of cognitive and non-cognitive skills for both individual labor market outcomes and social outcomes (Heckman et al. 2006, Heineck and Anger 2010, Almlund et al. 2011). This finding resulted in a growing interest in the development of cognitive and non-cognitive skills and in

the role of family background in the skill formation process. A growing body of literature developed in the field of intergenerational mobility, which analyzed the transmission of skills from parents to children. Intergenerational transmission of cognitive skills has been analyzed for Scandinavia (Black et al. 2009; Björklund, Hederos Eriksson, and Jäntti. 2010; Grönquivst et al. 2011), for the US (Agee and Crocker 2002), for the UK (Brown et al. 2009), and for Germany (Anger and Heineck 2010; Anger 2012), showing intergenerational correlations of between 0.3 and 0.5 for adult children. In contrast, there is only scarce evidence on intergenerational transmission of personality traits in the economic literature. The transmission of non-cognitive skills from parents to children has been examined for the US (Mayer et al. 2002; Duncan et al. 2005), Sweden (Grönquivst et al. 2001) and Germany (Anger 2012).[3] However, intergenerational correlations cover only part of the influence of family background. For example, Björklund and Jäntti (2012) show in the context of income mobility that even "more than half of the family and community influences that siblings share are uncorrelated with parental income". Therefore, in order to cover more than the one-dimensional relationship between parents and their children's outcomes, sibling correlations should be estimated as a broader measure of the impact of family background on the formation of cognitive and non-cognitive skills. So, far there is only very scarce evidence on sibling correlations in skills. The correlation in brothers' IQ test scores and non-cognitive skills has been analyzed by Björklund and Jäntti (2012) based on Swedish register data, whereas Mazumder (2008) estimates sibling correlations in both cognitive and non-cognitive skills for the US.

At the same time, there is a well-established literature on the intergenerational transmission of income and education and on the importance of family background for economic outcomes

[3] Although economic research on non-cognitive skill formation is rather scarce, intergenerational correlations have been analyzed by psychologists for decades (e.g. Loehlin 2005). However, the data sets used by most psychological studies are based on a small number of observations or lack representativeness.

(Black and Devereux 2011; Björklund and Jäntti 2009). As is evident from cross-national research, there are cross-country differences in the estimated explanatory power of family background (Björklund et al. 2002; Schnitzlein 2011). Hence, by estimating sibling correlations in cognitive and non-cognitive skills, we aim at answering the question whether cross-country differences in family influences on skill formation are potential determinants of these differentials.

3 Data and Descriptives

Our estimates are based on data from the German Socio-Economic Panel Study (SOEP), which is a representative household panel survey that started in 1984 (Wagner et al., 2007). The SOEP conducts annual personal interviews with all household members aged 18 and above, and provides rich information on socio-demographic characteristics, family background, and childhood environment on about 20,000 individuals in more than 11,000 families in the most recent wave. We use the years 2005, 2006, 2009, and 2010, as the key variables in our study, personality measures and cognitive ability test scores, are available in these years. However, the identification of adult siblings may be based on information from earlier years, at the time when they lived as children in their parents' household. The information on family relations between household members and the follow-up concept of the SOEP allows to observe these children over time and to identify them as siblings even when they are grown up and live in different households. This study considers two children to be siblings if they have the same social parents at age 17.[4] Our sample includes all individuals that are aged 18 and above and have successfully answered at least one of the personality items in one of the waves or participated in the cognitive ability test. Persons who were not of

[4] However, alternative definitions of siblings using information on common fathers will be used in the robustness section to show that the results do not hinge on this definition.

German nationality were excluded from the study, since individuals with a migration background may be disadvantaged as compared to native speakers due to inadequate language skills when taking the tests or when rating their personality.

Cognitive Skills

Information on cognitive skills was collected from adult respondents (aged 18 and above) in 2006 and comprises test scores from a word fluency test and a symbol correspondence test. Both are ultra-short tests and were especially developed for the SOEP, as fully fletched IQ tests cannot be implemented in a large-scale panel survey (Lang et al., 2007). Since the symbol correspondence test is carried out using a computer, these tests were only conducted with respondents with a computer assisted personal interview (CAPI) – about one third of all respondents. Both tests correspond to different modules of the Wechsler Adult Intelligence Scale (WAIS) and produce outcomes, which are relatively well correlated with test scores from more comprehensive and well-established intelligence tests.[5]

The symbol correspondence test is conceptually related to the mechanics of cognition or fluid intelligence and comprises general abilities. The test involved asking respondents to match as many numbers and symbols as possible within 90 seconds according to a given correspondence list which is permanently visible to the respondents on a screen. The word fluency test is conceptually related to the pragmatics of cognition or crystallized intelligence. It involves the fulfillment of specific tasks that improve with knowledge and skills acquired in the past. The word fluency test implemented in the SOEP was based on the animal-naming task (Lindenberger and Baltes, 1995): respondents name as many different animals as possible within 90 seconds. While verbal fluency is based on learning, speed of cognition is related to

[5] Lang et al. (2007) carry out reliability analyses and find test–retest coefficients of 0.7 for both the word fluency test and the symbol correspondence test.

an individual's innate abilities (Cattell, 1987). In addition, a measure of general intelligence is generated, by averaging the two types of ability test scores.[6] The overall sample of individuals with IQ measures, for whom at least one parent with valid information on IQ test scores can be identified, consists of 843 adult sons and daughters from 663 families.[7]

Non-Cognitive Skills

Measures of personality for adult respondents are available for 2005 (Dehne and Schupp, 2007), and were repeated in 2009 and 2010. The personality measures in 2005 include self-rated measures that were related to the Five Factor Model (McCrae and Costa, 1999) and comprise the five basic psychological dimensions – openness to experience, conscientiousness, extraversion, agreeableness, neuroticism (Big Five) – which are each measured with 3 items. In addition, self-rated measures of locus of control (10 items) and reciprocity (6 items) are included in 2005. Locus of control is the extent to which an individual believes that she controls the event that affects her. Psychologists differentiate between external locus of control, i.e. individuals believe that events are mainly the result of external effects, and internal locus of control, i.e. individuals believe that events are the results of their own action. Reciprocity measures the extent to which an individual is willing to respond to positive or negative behavior. One can distinguish positive reciprocity, i.e. the extent to which individuals respond positively to positive actions and negative reciprocity, i.e. the extent to which individuals respond negatively to negative behavior. All items related to the personality traits are answered on 7-point Likert-type scales (1 – "disagree completely" to

[6] This approach has also been used in the intergenerational mobility literature to account for measurement error (for example, Zimmerman, 1992). Using average test scores is expected to reduce the error-in-variable bias by diminishing the random component of measured test scores. Furthermore, average test scores could be interpreted as an extract of a general ability type, which captures both coding speed and verbal fluency.

[7] The severe reduction in sample size raises the issue of the representativeness of the data, as there might be selection problems with respect to intergenerational associations of interest. However, despite the restrictions on the sample, selection does not seem to be a major problem for the interpretation of the results (see Anger and Heineck, 2010).

7 – "agree completely"). The scores are summed up to create an index ranging from 1 to 7. In 2009, respondents were repeatedly asked to rate their personality according to the dimensions of the Five Factor Model. Self-ratings of locus of control and of reciprocity were repeated in 2010. For those individuals who provided information on their personality traits in two years, we calculate the average score.[8] The sample consists of 5,931 adult children with non-cognitive skill measures from 4,057 families who can be linked to their parents with valid information on personality traits.

Descriptive Statistics

Graph 1 to Graph 3 show the distribution of non-cognitive skills separately for men and women. Graph 4 presents the distribution of cognitive skills.

The following tables show the mean test scores and the number of observations for measures on personality traits (locus of control, reciprocity, Big Five), and for the measures on cognitive skills (crystallized, fluid, and general intelligence).

[to be completed]

[8] Personal traits have been shown to be relatively stable over the adult lifespan (Cobb-Clark and Schurer, 2012).

4 A Simple Statistical Model and Estimation Strategy

To provide an illustration of sibling correlations, we start with a simple statistical model as introduced by Solon et al. (1991) and Solon (1999). Let y_{ij} be a measure of cognitive or non-cognitive skills for child j of family i. The interaction of family background (including community effects) and individual effects can be characterized as decomposition into the sum of two orthogonal components, a family component α_i and an individual component μ_{ij}.

$$y_{ij} = \alpha_i + \mu_{ij} \tag{1}$$

The family component in this framework covers the combined effect of all factors that are shared by siblings from family i. The individual component covers all factors that are purely idiosyncratic to sibling j. As one child is only observed in one family, α_i and μ_{ij} are orthogonal to each other. So the variance of the observed measure σ_y^2 can be expressed as the sum of the variances of the family component α_i and the individual component μ_{ij}:

$$\sigma_y^2 = \sigma_\alpha^2 + \sigma_\mu^2 \,. \tag{2}$$

The correlation coefficient ρ of the cognitive or non-cognitive skill measure of two siblings j and j' equals the ratio of the variance of the family component σ_α^2 and the variance of the measure $\sigma_\alpha^2 + \sigma_\mu^2$:

$$\rho = corr\left(y_{ij}, y'_{ij}\right) = \frac{\sigma_\alpha^2}{\sigma_\alpha^2 + \sigma_\mu^2} \;\; with\, j \neq j'. \tag{3}$$

The intuitive interpretation of this ratio is that the correlation in cognitive and non-cognitive skills between two siblings (therefore sibling correlation) equals the proportion of the variance that can be attributed to factors shared by siblings, e.g. family factors or neighborhood factors.

As σ_α^2 and σ_μ^2 cannot be negative, ρ takes on values between 0 and 1. A correlation of 0 indicates that there is no influence from family and community factors and 1 indicates that there is no influence from the individual. The first case would describe a fully mobile society and the latter a fully deterministic one.

Solon (1999) shows that the relationship of the sibling correlation defined above and the often estimated intergenerational correlation is:

$$\rho = IGC^2 + other\ shared\ factors\ uncorrelated\ with\ cor.parental\ measure \quad (4)$$

The sibling correlation in cognitive and non-cognitive skills equals the square of the intergenerational correlation in skills plus the influence of all shared factors that are uncorrelated with the corresponding parental measure. As there are factors related to the family that are not shared by siblings, the sibling correlation is a lower bound of the true influence of family background.

The sibling correlations are estimated as the within-cluster correlation in the following linear multilevel model,

$$y_{ijt} = X_{ijt}\beta + \alpha_i + \mu_{ij} + \nu_{ijt} \quad (5)$$

with y_{ijt} being an annual observation of a specific outcome, X_{ijt} being a matrix of fixed year and age effects (including year dummies and polynomials of age) and the remaining three parts being the family (α_i), individual (μ_{ij}) and transitory components (ν_{ijt}).[9] The sum ($\alpha_i + \mu_{ij}$) represents the permanent part of the observed outcome. Following Mazumder (2008), we apply Restricted Maximum Likelihood (REML) to estimate this model and to calculate the variances of α_i and μ_{ij}. In the results section, we will report the variance components along with the sibling correlation. The standard error for the sibling correlation is

[9] Solon et al. (1991) showed that not controlling for transitory fluctuations leads to serious underestimation of sibling correlations. See Solon (1992) for a similar result for intergenerational correlations.

calculated using the delta method. For outcomes with only one observation in time, i.e. for cognitive skills, the model is estimated with only two levels.

5 Results

Tables 1-4 present our results. The first column in each of the tables contains the estimated brother correlation, the second column contains the sister correlation and the third column contains the sibling correlation including both, brothers and sisters.

Sibling Correlations in Non-Cognitive Skills

Table 1 shows the results for external and internal locus of control. All estimated sibling correlations are 0.50 or higher. That means that at least half of the variance or inequality can be attributed to factors shared by siblings. This indicates a strong effect of family background on both dimensions of locus of control. This is true for brothers and sisters.

Table 2 contains the results for reciprocity, again measured in two dimensions. Positive reciprocity measures the extent to which individuals are willing to respond positively to positive actions of other individuals. In contrast, negative reciprocity describes the extent of negative responses to negative actions. Again, we find very high sibling correlations indicating a strong effect of family background on both dimensions.

The results for the Big Five personality traits are presented in Table 3. The pattern here is not as clear as in Tables 1 and 2 but again, we find evidence for substantial influences of family background on the personality traits of children. The estimates range from 0.24 to 0.59, which means that even for the lowest estimate, one fourth of the variance can be explained by family background characteristics.

To summarize our main results from above, we find a strong influence of family and community background for all dimensions of locus of control and reciprocity. This is true for both brothers and sisters. The estimated correlations in Big Five personality traits reveal that at least one fourth of the variance is explained by factors shared by siblings.

[to be completed]

Sibling Correlations in Cognitive Skills

Finally, Table 4 contains the estimates for cognitive skills.[10] Again, we find a strong influence of family background on all dimensions of cognitive abilities. With one exception, all calculated sibling correlations are higher than 0.50, indicating that more than half of the inequality can be attributed to factors shared by siblings. Hence, family and community background explains at least 50 percent of the variation in IQ-test scores for both brothers and sisters.

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Cross-Country Comparisons

In the next step, we compare our results to sibling correlations for the US and Sweden to explore whether cross-country differentials in sibling correlations of labor market outcomes (Schnitzlein 2011) can potentially be explained by differences in the skill formation process. The sibling correlations for the US reported by Mazumder (2008) are 0.62, and identical for

[10] These results are very preliminary, due to the low number of observations. At the moment, there is only data available from two ultra-short IQ-tests carried out in the wave 2006. A replication of these tests is currently in the field as part of the 2012 wave. First results will be available in late October. This will clearly increase our number of observations for this measure.

brothers and sisters. Hence, the influence of family background on the formation of cognitive skills is slightly more important in the US than in Germany.[11] In contrast, the sibling correlations in non-cognitive skills for the US are clearly lower than in Germany. Mazumder (2008) uses the Rotter sclae for Locus of control and finds correlations of 0.11 for brothers, 0.07 for sisters, and 0.09 for all.

Furthermore, we compare our results to the sibling correlations reported in Björklund and Jäntti (2012) for Sweden. They find brother correlations of 0.47 for cognitive skills and of 0.32 for non-cognitive skills, which are very similar to our sibling correlations.

[to be completed]

Comparison to Sibling Correlations in Economic Outcomes

Next, we compare our results to findings in the literature on economic outcomes to contrast the importance of factors shared by siblings in the context of skill formation to the role of family background for education and income. The results reported above for the sibling correlations in skills compare to sibling correlations in education of 0.5 for sons and 0.45 for daughters, and of 0.43 for sons and 0.39 for daughters when compared to sibling correlations in earnings.

[to be completed]

Comparison to Intergenerational Correlations in Skills

[11] However, it may be problematic to directly compare these results to Mazumder (2008), since he uses a different measure of cognitive skills (AFQT test scores).

Finally, we compare the sibling correlations in cognitive and non-cognitive skills to intergenerational correlations reported in the literature to find out whether previous models of intergenerational skill transmission indeed underestimate the influence of family background on skill formation. Therefore, we draw on the intergenerational correlations reported in Anger (2012) who uses the same dataset and outcomes as we do. The coefficients are displayed in Table 5 for non-cognitive skills and in Table 6 for cognitive skills respectively. If we compare our results with the results from Anger (2012) it is apparent that, for all analyzed outcomes, the estimated sibling correlations are considerably higher than the corresponding adjusted R-squared measures in the intergenerational transmission regressions. This finding suggests that intergenerational correlations are in fact only able to capture parts of the influence of the family on children's cognitive and non-cognitive skills. This result is in line with findings in the literature on educational and income mobility.

[to be completed]

6 Robustness Checks

[to be completed]

7 Conclusion

In this study, we investigate the importance of family background for cognitive and non-cognitive skills based on sibling correlations in order to provide a broader measure of the role of family background in the process of skill formation than the previously used

intergenerational transmission estimates. Our estimates are based on data from the German Socio-Economic Panel Study (SOEP), which is a large representative household survey and provides measures of cognitive skills from two ultra-short IQ-tests, and self-rated measures of locus of control, reciprocity, and the Big Five personality traits (openness, conscientiousness, extraversion, agreeableness and neuroticism).

Previous analyses on Sweden and the US are restricted in as much as they are based only on males (Björklund and Jäntti 2012) or use only locus of control out of many personality traits (Mazumder 2008). Hence, this study contributes to the literature by providing evidence on sibling correlations in broader measures of personality for both men and women.

Using a Restricted Maximum Likelihood (REML) model we show that family background is important for cognitive and non-cognitive skills for both men and women. Sibling correlations of the personality traits range from 0.24 to 0.59, indicating that even for the lowest estimate, one fourth of the variance or inequality can be attributed to factors shared by siblings. With one exception, all calculated sibling correlations in cognitive skills are higher than 0.50, indicating that more than half of the inequality can be explained by family characteristics. Comparing these findings to the results in the intergenerational skill transmission literature suggests that sibling correlations are indeed able to provide a more complete picture of the family influence on children's cognitive and non-cognitive skills. This result is in line with findings in the literature on educational and income mobility.

Comparing our results to previous findings for the US and Sweden provides no evidence that the differential in sibling correlations in economic outcomes can be explained by differences in the formation of cognitive skills. The evidence from cross-country comparisons with respect to sibling correlations in non-cognitive skills is less clear.

[to be completed]

References

Almlund, Mathilde, Duckworth, Angela L., Heckman, James J., and Tim *Kautz (*2011): Personality Psychology and Economics, in: E. Hanushek, S. Machin, and L. Woessman (eds.), *Handbook of the Economics of Education*, Elsevier, Amsterdam, 1-181.

Anger, Silke (2012): Intergenerational Transmission of Cognitive and Noncognitive Skills, in: John Ermisch, Markus Jäntti, and Timothy Smeeding (eds.), *From Parents to Children: The Intergenerational Transmission of Advantage*, Russell Sage Foundation, New York, pp. 393 – 421.

Anger, Silke, and Heineck, Guido (2010a): Do Smart Parents Raise Smart Children? The Intergenerational Transmission of Cognitive Abilities, *Journal of Population Economics*, 23(3), 1105-1132.

Anger, Silke, and Heineck, Guido (2010b): Cognitive abilities and earnings - first evidence for Germany, *Applied Economics Letters*, 17(7), 699-702.

Agee, Mark D., and Crocker, Thomas D. (2002): Parents' discount rate and the intergenerational transmission of cognitive skills, *Economica*, 69, 143-154.

Björklund, Anders and Jäntti, Markus (2012): How Important is Family Background for Labour-Economic Outcomes? Labour Economics, 2012, 19, 465-474.

Björklund, Anders M., and Jäntti, Markus (2009): Intergenerational Income Mobility and the Role of Family Background, in *Oxford Handbook of Economic Inequality*, ed. by Salverda, W., Nolan, B., and Smeeding, T. M.: Oxford University Press, 491-521.

Björklund, Anders, Hederos Eriksson, Karin, and Jäntti, Markus (2010): IQ and Family Background: Are Associations Strong or Weak?, *The B.E. Journal of Economic Analysis & Policy*, Berkeley Electronic Press, 10(1), Article 2.

Björklund, A., L. Lindahl, and M. Lindquist (2010): What More Than Parental Income, Education and Occupation? An Exploration of What Swedish Siblings Get From Their Parents‖, *The B.E. Journal of Economic Analysis & Policy*, 10 (1), Article 102.

Björklund, Anders, Jäntti, Markus, and Solon, Gary (2007): Nature and Nurture in the Intergenerational Transmission of Socioeconomic Status: Evidence from Swedish

Children and Their Biological and Rearing Parents, The B.E. Journal of Economic Analysis & Policy, 7.

Black, Sandra E., Devereux, Paul J. (2010): Recent Developments in Intergenerational Mobility, *IZA Discussion Paper No. 4866*.

Black, Sandra E., Devereux, Paul J., and Salvanes, Kjell G. (2009): Like father, like son? A note on the intergenerational transmission of IQ scores, *Economics Letters*, 105, 138-140.

Blanden, Jo, Gregg, Paul, and Macmillan, Lindsey (2007): Accounting for intergenerational income persistence: Noncognitive skills, ability and education, *Economic Journal*, 117, C43-C60.

Bowles, Samuel, and Gintis, Herbert (2002): The Inheritance of Inequality, Journal of Economic Perspectives, 16, 3-30.

Brown, Sarah, McIntosh, Steven, and Taylor, Karl B. (2009): Following in your parents' footsteps? Empirical Analysis of Matched Parent-Offspring Test Scores, *IZA Discussion Paper No. 3986.*

Cameron, Stephen V., and Heckman, James J. (1993): Nonequivalence of high school equivalents. *Journal of Labor Economics* 11(1): 1-47.

Case, Anne, and Katz, Lawrence F. (1991): The Company You Keep: The Effects of Family and Neighborhood on Disadvantaged Youth, *NBER Working Paper 3705*.

Cattell, Raymond. B. (1987): Intelligence: Its structure, growth, and action. Elsevier Science, New York.

Cobb-Clark, D.A.; Schurer S. (2012): The stability of Big-Five personality traits, *Economics Letters*, 115 (1): 11-15.

Costa Jr., Paul T., and McCrae, Robert R. (1994): Set like plaster: evidence for the stability of adult personality. In: Heatherton, Todd F., and Weinberger, Joel L. (Eds.): Can Personality Change? In: *American Psychological Association*, Washington, DC, 21–40.

Couch, Kenneth A., and Dunn, Thomas A. (1997): Intergenerational correlations in labor market status: A comparison of the United States and Germany*, Journal of Human Resources*, 32(1): 210-232.

Cunha, Flavio, and Heckman, James J. (2007): The Technology of Skill Formation, *American Economic Review*, 97, 31-47.

Dehne, Max, and Schupp, Jürgen (2007): *Persönlichkeitsmerkmale im Sozio-oekonomischen Panel (SOEP) - Konzept, Umsetzung und empirische Eigenschaften*, DIW Research Notes 26, German Institute for Economic Research (DIW Berlin), Berlin.

Duncan, Greg, Kalil, Ariel, Mayer, Susan E., Tepper, Robin, and Payne, Monique R. (2005): The Apple Does not Fall Far from the Tree, in: Bowles, Samuel, Gintis, Herbert, and Osborne Groves, Melissa (Eds): Unequal Chances: Family Background and Economic Success, Russell Sage Foundation, Princeton University Press.

Grönqvist, Erik, Öckert, Björn, and Vlachos, Jonas (2010): The Intergenerational Transmission of Cognitive and Non-Cognitive Abilities, CEPR Discussion Paper No. 7908.

Heckman, James J., and Rubinstein, Yona (2001): The Importance of Noncognitive Skills: Lessons from the GED Testing Program, AER Papers and Proceedings, 91(2), 145-149.

Heckman, James J., Stixrud, Jora, and Urzua, Sergio (2006): The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior, Journal of Labor Economics, 24 (3), 411-482.

Heckman, James J., and Vytlacil, Edward (2001): Identifying the role of cognitive ability in explaining the level of and change in the return to schooling. *Review of Economics and Statistics*, 83, 1-12.

Heineck, Guido, and Anger, Silke (2010): The Returns to Cognitive Abilities and Personality Traits in Germany, *Labour Economics*, 17 (3), 535–546

Hertz, Tom, Jayasundera, Tamara, Piraino, Patrizio, Selcuk, Sibel, Smith, Nicole, and Verashchagina, Alina (2007): The Inheritance of Educational Inequality: International Comparisons and Fifty-Year Trends, *The B.E. Journal of Economic Analysis & Policy*, 7, Art. 10.

Lang, Frieder R., Weiss, David, Stocker, Andreas, and Rosenbladt, Bernhard von (2007): Assessing Cognitive Capacities in Computer-Assisted Survey Research: Two Ultra-Short tests of Intellectual Ability in the German Socio-Economic Panel, *Schmollers Jahrbuch (Proceedings of the 7th International Socio-Economic Panel User Conference (SOEP2006),* ed. by Ferrer-i-Carbonell, Ada, Grabka, Markus M., and Kroh, Martin), 127, 183-191.

Lindenberger U., Baltes B. (1995): Kognitive Leistungsfähigkeit im Alter: Erste Ergebnisse aus der Berliner Altersstudie, *Zeitschrift für Psychologie*, 203(4): 283–317.

Loehlin, John C. (2005): Resemblance in Personality and Attitudes between Parents and Their Children: Genetic and Environmental Contributions. Princeton University Press, Princeton.

Mayer, Susan E., Duncan, Greg, and Kalil, Ariel (2004): Like mother, like daughter? SES and the intergenerational correlation of traits, behaviors and attitudes, Working Paper No. 0415 (Harris school of Public policy studies, University of Chicago).

Mazumder, B. (2008): Sibling Similarities and Economic Inequality in the US, *Journal of Population Economics*, 21 (3), 685–701.

McCrae, Robert R., and Costa Jr., Paul T. (1999): A Five-Factor Theory of Personality. In: Pervin, Lawrence A., and John, Oliver P. (Eds): Handbook of Personality: Theory and Research. Guilford: New York, 139-153.

Mood, Carina, Jonsson, Jan O., and Bihagen, Erik (2011): Socioeconomic persistence across generations: The Role of Cognitive and non-cognitive processes, Russell Sage Foundation.

Mulligan, Casey B. (1999): Galton vs. human capital approaches to inheritance, *Journal of Political Economy*, 107(6), 184-224.

Osborne Groves, Melissa (2005): How important is your personality? Labor market returns to personality for women in the US and UK, *Journal of Economic Psychology*, 26, 827-841.

Schnitzlein, Daniel (2011): How important is the family? Evidence From Sibling Correlations in Permanent Earnings in the US, Germany, and Denmark. SOEPpapers on Multidisciplinary Panel Data Research, 365, German Institute for Economic Research.

Solon, Gary (1999): Intergenerational mobility in the labor market. In Ashenfelter, Orley C., and Card, David. *Handbook of Labor Economics*, Volume 3, Amsterdam: Elsevier Science, 1761-1800.

Solon, Gary (1992): Intergenerational income mobility in the United States, *The American Economic Review*, 82(3): 393-408.

Solon, G., Corcoran, M., Gordon, R., Laren, D. (1991): A longitudinal Analysis of Sibling Correlations in Economic Status, *The Journal of Human Resources*, 26 (3), 509–534.

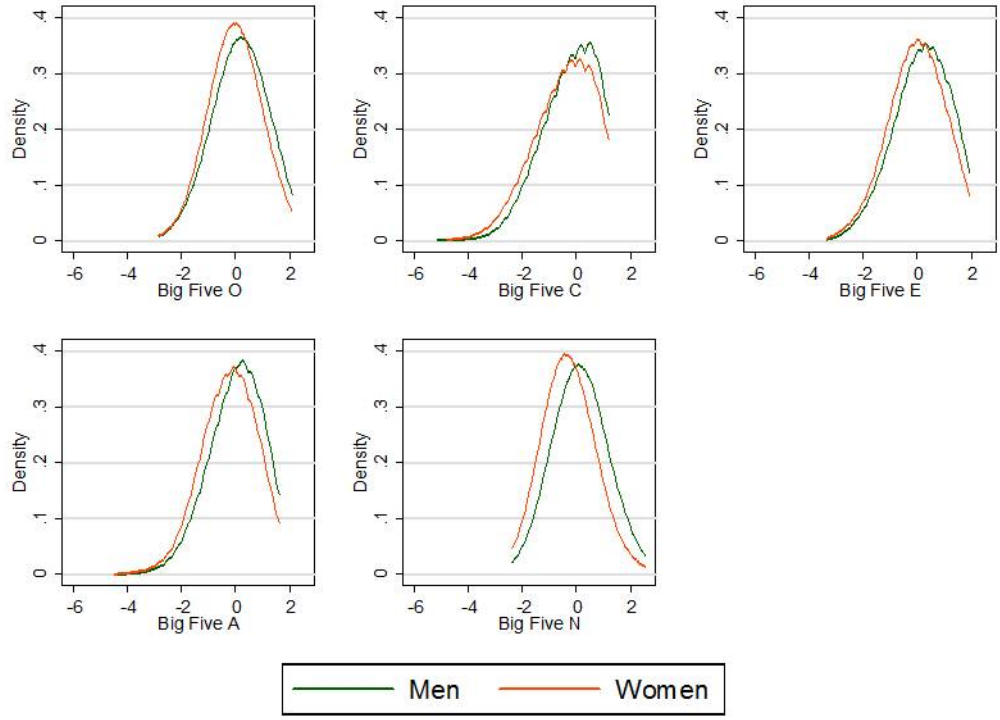
Srivastava, Sanjay, John, Oliver P., Gosling, Samuel D., and Potter, Jeff (2003): Development of personality in early and middle adulthood: set like plaster or persistent change? *Journal of Personality and Social Psychology*, 85 (5), 1041–1053.

Wagner, Gert G., Frick, Joachim R., and Schupp, Jürgen (2007): The German Socio-Economic Panel Study (SOEP). Scope, Evolution and Enhancements, Schmollers Jahrbuch : *Journal of Applied Social Science Studies / Zeitschrift für Wirtschafts- und Sozialwissenschaften*, 127, 139-169.

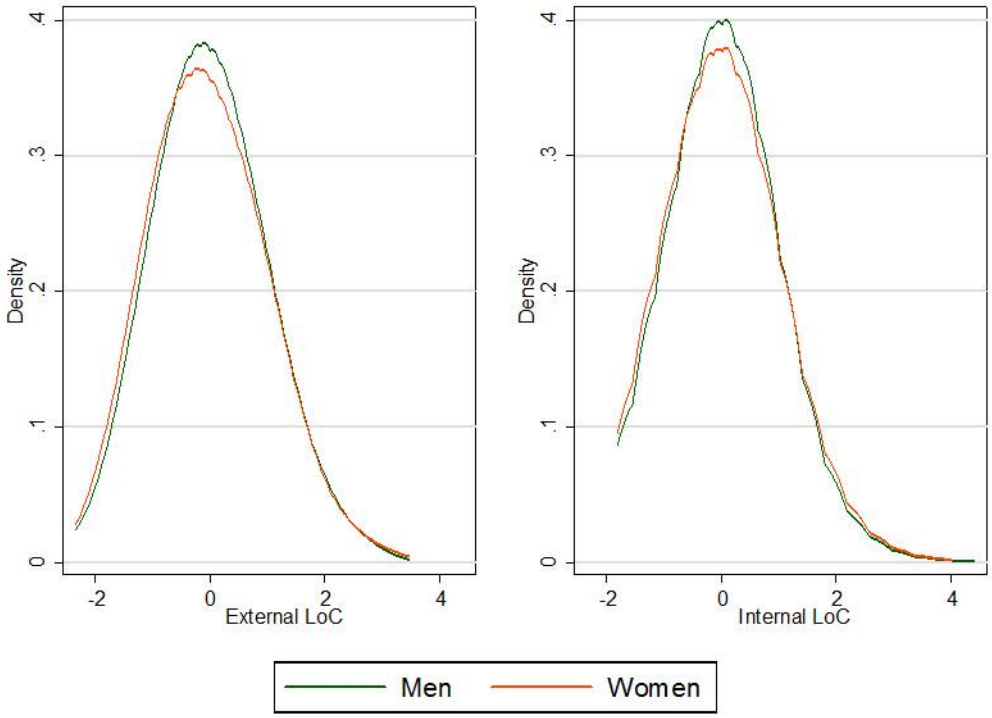
Zimmerman, D.J. (1992): Regression Toward Mediocrity in Economic Stature, *American Economic Review*, 82(3): 409–429.

Graphs and Tables

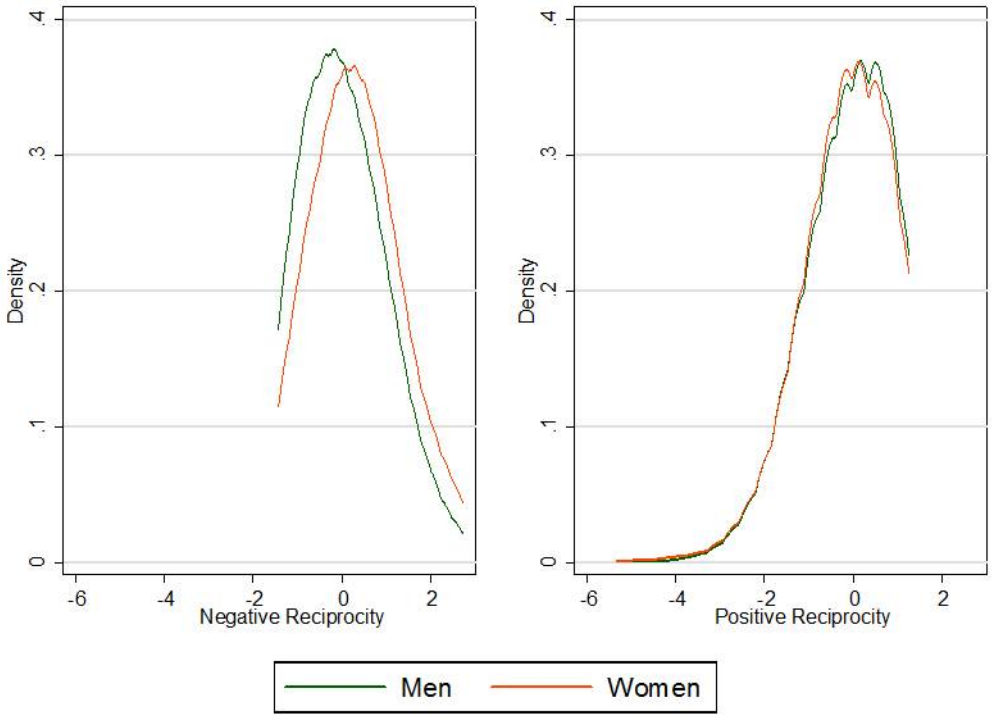
Graph 1: Distribution of Big Five Personality Traits



Graph 2: Distribution of Locus of Control



Graph 3: Distribution of Reciprocity



Graph 4: Distribution of Cognitive Skills

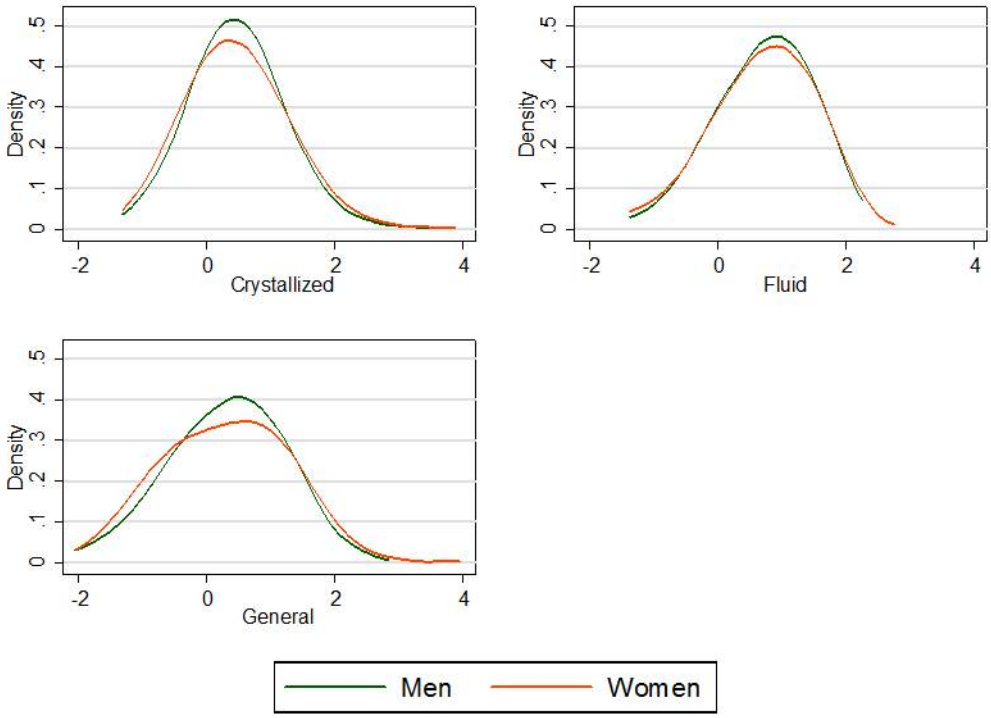


Table 1: Sibling Correlations in Non-Cognitive Skills (Locus of Control)

Locus of control	Brothers		Sisters		All	
External	**0.525**	[0.405 ; 0.645]	**0.527**	[0.376 ; 0.679]	**0.515**	[0.441 ; 0.588]
	(0.061)		(0.077)		(0.038)	
Observations	4,571		4,206		8,777	
Individuals	3,143		2,855		5,998	
Families	2,551		2,355		4,111	
Internal	**0.663**	[0.502 ; 0.825]	**0.500**	[0.287 ; 0.713]	**0.536**	[0.437 ; 0.634]
	(0.082)		(0.109)		(0.050)	
Observations	4,633		4,252		8,885	
Individuals	3,167		2,875		6,042	
Families	2,571		2,371		4,135	

Note: Presented are sibling correlations for external and internal locus of control. The mixed effects models are estimated via REML. Standard errors of the sibling correlations (presented in parentheses) are calculated via the delta method. 95 percent confidence interval is given in brackets. All estimations control for fixed aged profiles (age and age squared) as well as fixed year effects. The estimation model that includes all siblings additionally contains a gender dummy and interactions of the gender dummy and the polynomials of age.

Source: SOEPv28 (2005-2011).

Table 2: Sibling Correlations in Non-Cognitive Skills (Reciprocity)

Reciprocity	Brothers	Sisters	All
Positive	**0.647** [0.458 ; 0.835]	**0.428** [0.241 ; 0.616]	**0.500** [0.395 ; 0.605]
	(0.096)	(0.096)	(0.054)
Observations	4,642	4,264	8,906
Individuals	3,173	2,880	6,053
Families	2,576	2,373	4,144
Negative	**0.535** [0.414 ; 0.656]	**0.681** [0.537 ; 0.825]	**0.508** [0.434 ; 0.583]
	(0.062)	(0.074)	(0.038)
Observations	4,628	4,249	8,877
Individuals	3,170	2,879	6,049
Families	2,573	2,370	4,139

Note: Presented are sibling correlations for positive and negative reciprocity. The mixed effects models are estimated via REML. Standard errors of the sibling correlations (presented in parentheses) are calculated via the delta method. 95 percent confidence interval is given in brackets. All estimations control for fixed aged profiles (age and age squared) as well as fixed year effects. The estimation model that includes all siblings additionally contains a gender dummy and interactions of the gender dummy and the polynomials of age.

Source: SOEPv28 (2005-2011).

Table 3: Sibling Correlations in Non-Cognitive Skills (Big Five)

Big Five	Brothers		Sisters		All	
Openess	**0.359**	[0.248 ; 0.470]	**0.366**	[0.245 ; 0.486]	**0.353**	[0.292 ; 0.415]
	(0.057)		(0.062)		(0.031)	
Observations	4,754		4,378		9,132	
Individuals	3,105		2,826		5,931	
Families	2,519		2,329		4,057	
Conscientiousness	**0.590**	[0.473 ; 0.707]	**0.307**	[0.172 ; 0.442]	**0.406**	[0.338 ; 0.474]
	(0.060)		(0.069)		(0.035)	
Observations	4,756		4,378		9,134	
Individuals	3,109		2,822		5,931	
Families	2,524		2,324		4,060	
Extraversion	**0.263**	[0.147 ; 0.379]	**0.258**	[0.142 ; 0.375]	**0.242**	[0.179 ; 0.304]
	(0.059)		(0.060)		(0.032)	
Observations	4,765		4,377		9,142	
Individuals	3,113		2,827		5,940	
Families	2,527		2,330		4,063	
Agreeableness	**0.511**	[0.362 ; 0.659]	**0.334**	[0.189 ; 0.480]	**0.375**	[0.306 ; 0.444]
	(0.076)		(0.074)		(0.035)	
Observations	4,767		4,382		9,149	
Individuals	3,115		2,826		5,941	
Families	2,529		2,331		4,069	
Neuroticism	**0.337**	[0.206 ; 0.469]	**0.479**	[0.349 ; 0.610]	**0.348**	[0.276 ; 0.420]
	(0.067)		(0.067)		(0.037)	
Observations	4,768		4,389		9,157	
Individuals	3,112		2,827		5,939	
Families	2,525		2,331		4,063	

Note: Presented are sibling correlations for Big Five personality traits. The mixed effects model is estimated via REML. Standard errors of the sibling correlations (presented in parentheses) are calculated via the delta method. 95 percent confidence interval is given in brackets. All estimations control for fixed aged profiles (age and age squared) as well as fixed year effects. The estimation model that includes all siblings additionally contains a gender dummy and interactions of the gender dummy and the polynomials of age.

Source: SOEPv28 (2005-2011).

Table 4: Sibling Correlations in cognitive skills (PRELIMINARY)

Cognitive Skills	Brothers	Sisters	All
Crystallized intelligence	**0.551** [0.394 ; 0.707]	**0.530** [0.299 ; 0.760]	**0.516** [0.410 ; 0.622]
	(0.080)	(0.118)	(0.054)
Observations	446	396	842
Families	386	350	663
Fluid intelligence	**0.479** [0.308 ; 0.650]	**0.619** [0.470 ; 0.768]	**0.517** [0.420 ; 0.613]
	(0.087)	(0.076)	(0.049)
Observations	446	396	842
Families	386	350	663
General intelligence	**0.545** [0.387 ; 0.703]	**0.691** [0.558 ; 0.824]	**0.543** [0.446 ; 0.639]
	(0.081)	(0.068)	(0.049)
Observations	446	396	842
Families	386	350	663

Note: Presented are sibling correlations for cognitive skills. The mixed effects models are estimated via REML. Standard errors of the sibling correlations (presented in parentheses) are calculated via the delta method. 95 percent confidence interval is given in brackets. All estimations control for fixed aged profiles (age and age squared) as well as fixed year effects. The estimation model that includes all siblings additionally contains a gender dummy and interactions of the gender dummy and the polynomials of age.

Source: SOEPv28 (2005-2011).

Table 5: Intergenerational Correlations in non-cognitive skills (Anger 2012)

	Ext. LoC	Int. LoC	B5 O	B5 C	B5 E	B5 A	B5 N
Sib. Cor.	0,52	0,54	0,35	0,41	0,24	0,38	0,35
Adj. R2	0,07	0,11	0,08	0,07	0,04	0,07	0,02

Note: Adj. R2 are taken from Anger (2012). In all cases the numbers refer to IGC specifications including both sons and daughters.

Table 6: Intergenerational Correlations in cognitive skills (Anger 2012)

	Crystallized	Fluid	General
Sib. Cor.	0,52	0,52	0,53
Adj. R2	0,25	0,24	0,28

Note: Adj. R2 are taken from Anger (2012). In all cases the numbers refer to IGC specifications including both sons and daughters.