Social and Genetic Influences on Education: Testing the Scarr-Rowe Hypothesis for Education in a Comparative Perspective

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Abstract

The Scarr-Rowe hypothesis claims that impoverished environmental settings suppress gene expression, while enriched social settings enhance the realization of genetic potential. We investigate whether the relative importance of genes for school grades and educational attainment varies by family socioeconomic status. We argue that welfare regimes can moderate socioeconomic differences in the effects of genes on education. We test this prediction using data from four advanced, industrialized societies which vary in their institutional settings. We use survey data for Germany (TwinLife) and the United States (Add Health) as well as register data for Norway and Sweden. Results based on ACE variance decomposition models provide evidence for the Scarr-Rowe hypothesis for Germany and to a lesser extent for Sweden. For the US, however, we find that genes are less important for education in high than in low status families. We conclude that both individual-level characteristics and macro-structural conditions shape individuals chances for gene expression.

Keywords: cross-national comparison; educational mobility; gene-environment interplay; socio-economic status; twins

Background

That genes and shared environments matter for individual differences in education is well-established (Branigan, Mccallum, and Freese 2013; Nielsen and Roos 2015; Nielsen 2016). However, whether the relative importance of these influences varies by socio-economic status is unclear. A prominent hypothesis in behavioral genetics is the so-called Scarr-Rowe hypothesis. This hypothesis states that the relative importance of genes is higher in socioeconomically advantaged compared to socioeconomically disadvantaged families (Bronfenbrenner and Ceci 1994; Rowe, Jacobson, and Van den Oord 1999; Scarr-Salapatek 1971). This is explained by different environmental influences children are exposed to. Advantaged families provide environmental conditions that match children's genetic dispositions, while environmental influences in disadvantaged families rather suppress the realization of genetic influences. What follows is that differences among individuals from advantaged backgrounds are stronger explained by differences in their genetic make-up whereas differences among individuals from disadvantaged background are stronger driven by shared environmental influences (ibid.)

To date empirical evidence for education based on sibling and twin data is scares. Most research has tested the Scarr-Rowe hypothesis for cognitive skills (i.e. IQ). Several studies found evidence for differential heritability using data on the United States (Turkheimer et al. 2003; Guo and Stearns 2002). Yet, this finding became challenged by a comparative meta-analysis based on twin studies for the United States, Australia, England, Germany, Sweden, and the Netherlands (Bates et al. 2016). The results show that differential heritability of IQ only exists in the United States. And a very recent study provides even conflicting evidence for the US context (Figlio et al. 2017). For educational attainment, a meta-analysis on ten countries confirmed the substantial influences of shared environmental and genetic influences (Branigan, Mccallum, and Freese 2013). This meta-analysis also finds variation in the relative importance of genetic and environmental influences by gender and changes over time. With regard to the Scarr-Rowe hypothesis, one recent study for Germany provides evidence for stronger genetic influences on educational attainment in advantaged families (Baier and Lang 2018).

In this study, we estimate variation in the relative importance of genetic and environmental influences for education by family socioeconomic status (SES) and across countries. We study four advanced, industrialized societies with different welfare regimes: Germany, Norway, Sweden and the United States. These countries represent different types of welfare regimes (Esping-Andersen 1990, 1999). We expect socioeconomic differences in the effects of genes on education to be stronger in countries with higher educational and income inequality and less generous welfare regimes. With respect to the four countries included in our study, we have the following expectations. In the United States, high ability-tracking in schools (i.e. within tracking), high income inequality, and the smaller welfare state lead to strong socio-economic differences in the influences of genes on education. The higher educational inequality in Germany due to the early selection in the German education system also leads to high socio-economic differences in the effects of genes on education. Contrary to that, the less stratified education systems, the lower levels of income inequality, and the more generous welfare regimes lead to smaller socioeconomic differences in the influences of genes on education in Norway and Sweden compared to Germany and the United States.

This study contributes to the literature in the following ways: Frist, we are the first to study whether the Scarr-Rowe hypotheses holds for education in a cross-national comparative perspective based on high-quality survey and register data. The comparative approach sheds light on the question whether macro-structural factors affect the relative importance of environmental and genetic influences underlying the intergenerational transmission of (dis-)advantage. Second, most research tested the Scarr-Rowe hypothesis using a measure of cognitive skills or intelligence. We extent this line of research and investigate educational achievement and educational attainment which are arguably more important outcomes to understand the long-term consequences of genetic and environmental influences on children’s life chances than cognitive skills. Third, the genetic sensitive design provides new insights to an understanding of the effect of family background on education.

Data and Methods

Data

We selected a sample of four advanced, industrialized societies: Germany, Norway, Sweden, and the United States. For Germany we use data of the German Twin Family Panel TwinLife (Diewald et al. 2017). TwinLife provides a population-register based sample of monozygotic and same-sex dizygotic pairs of twins and their families residing in Germany (Lang and Kottwitz 2017). For this study we use data of the first panel wave on young adult twins (age 21 to 25 at the time of the interviews). Twins were sampled based on administrative data of communal registration offices. For the United States we use the National Longitudinal Study of Adolescent to Adult Health (Add Health) which is a nationally representative panel study on adolescents in the US. The study was launched in the school year 1994/1995 and surveys 7 to 9 graders (Harris 2009). We use data from an oversample of siblings implemented in wave I. Information about respondents' siblings (i.e. twins, half-siblings or non-related siblings that live in the same household) was retrieved from school rosters. For Sweden we draw on Swedish multi-generational registers. Each individual has a unique identifier (personal identification number (PIN)) which allows connecting the individual records with administrative data (Statistics Sweden 2011). We do not yet have results on Norway but we will have these in late 2018/ early 2019.

In all countries we analyze cohorts born between 1975 and the early 1990s. In Germany and the United States the information on twins' zygositiy (i.e. whether twins are mono- or dizygotic) was determined by means of self-reported zyogsity, similarity-, and confusability reports. In Sweden the information on zygosity was not provided. Hence, information on date of birth and sex was used to infer twins' zygosity. Siblings that are born at the same date are twins; opposite-sex twin pairs are dizygotic. Same-sex twins, however, can be both, monozygotic as well as dizygotic. Following the approach used in other studies (e.g. Figlio et al. 2017) we assume that all same-sex twins in Swedish sample are monozygotic. To assess the validity of this assumption we conducted additional analyses for possible differential heritability based on ICCs and variance components (*results available upon request*) (Turkheimer and Horn 2012,).

Variables

Our dependent variables are *educational attainment* and *educational achievement*. We measure *educational achievement* with school grades. In the US and Sweden which have comprehensive schooling systems we use GPA. In the United States respondents are between 14 and 18 years when we measure GPA. In Sweden school grades are observed at the end of the 9th grade (i.e. at the end of comprehensive schooling) when students are around 16 years old. In Germany we use final grade of general schooling. In contrast to Sweden and the United States secondary schooling in Germany is highly stratified and secondary school tracks differ strongly in length and curriculum. Only the graduation from the highest secondary school type qualifies for tertiary education. To account for differences in grades between secondary schooling tracks we rescaled the final school grade for Germany. Since the highest secondary school track is the most demanding, we subtracted 1 grade if students graduated from the intermediate and 2 grades if students' graduated from the lowest school track.[1]

Educational attainment is measured in years of education. For all countries we used the categorical information about twins' educational degrees and transformed this information into a linear measure of years of education (using established coding schemes for each country). Hence, years of education do not necessarily refer to the actual time spend in the education system. In Sweden, educational attainments is measured at age 30, in the US around age 25 and in Germany respondents are between 22 and 25 years old. Given the age range under study in Germany most of the respondents are still in vocational or tertiary education during the time of the survey. To address the related uncertainty about the final degree attained we provide "upper bound" and "lower bound" estimations. For the upper bound estimations we assume that all twins enrolled will finish their current educational track, while for the lower bound estimations we assume that all twins enrolled will drop out of their current educational. For both scenarios we assume that they do not pick up a track changing their final attainment afterwards.

We measure *family socio-economic background* using parent's occupation using the dominance principle. We distinguish whether at least one parent has a professional position (group with high occupational status) or not (group with low occupational status). Information about the sample sizes for each country are displayed in Table A1 in the Appendix.

Methods

To analyze the relative importance of environmental and genetic influences for educational outcomes we use a Classical Twin Design (CTD) (e.g., Plomin 2008). The CTD is a well-established and widely used design in quantitative genetics to differentiate between those influences (ibid).

Dizygotic (DZ) and monozygotic (MZ) twins are born and raised at the same time. MZ twins are additionally (at conception) genetically alike, while DZ twins share on average on average 50% of the 1% of all genes in which humans tend to vary. The CTD uses this information to decompose the total variance

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[1] In Germany graduation grades range from 1 (very good) to 4 (sufficient). Pupil failing to graduate are coded as 5 (insufficient).

of the outcome under study into additive, genetic influences (A), to shared environmental influences (C), and to unique environmental influences including the error term of the decomposition (E).

The identification of the ACE-components relies on additional assumptions: First, it is assumed that the characteristic under study is not affected by different environmental influences that MZ and DZ twins encounter (Equal environment assumption (EEA), Scarr and Carter-Saltzman 1979). If environmental influences are more similar for MZ twins compared to DZ twins, estimations of the relative importance of genetic influences are inflated since the higher similarity of MZ twins is not the result of genes but driven by a more similar treatment by their surroundings. To date empirical studies of the EEA and educational outcomes are missing. However, empirical studies show that more similar environments of MZ twins do not lead to an overestimation of the heritability of IQ (Derks et al. 2006). Second, it is assumed that there is no assortative mating between spouses. Assortative mating describes the phenomenon that mates are similar in regards to characterisitcs that affect the trait under study. If spouses mate randomly it can be assumed that dizygotic twins share about 50% of their DNA. However, assortative mating based on education is a well established phenomena across western societies (e.g., Blossfeld 2009). This increases the genetic similairty of spouses and accordingly the genetic similarity of DZs. Since the genetic similarity is then on average higher than 50%, related findings on shared environmental influences are likely to be upwardly biased. In our analysis we account for assortative mating as suggested by Loehlin, Harden, and Turkheimer (2009). Based on the information of parents education it is possible estimate the average corrrelation of DZ twins and to adjust the specification of the parameters accordingly (ibid.). Moreover, the CTD identifies *additive* genetic influences and thus, assumes that different genetic loki do not interact with each other. Finally, the CTD also assumes that environmental and genetic influences do neither interact nor correlate. The Scarr-Rowe hypothesis, however, proposes an interaction between genes and environmental conditions, and we test this assumption by investigating whether A, C and E components vary in high compared to low status families and between national contexts.

To examine the relative importance of genetic and environmental influences on educational outcomes we first estimate ACE variance decomposition models for each country and each outcome separately (base models). Additionally, we then account for assortative mating. The ACEmodels are estimated with a linear multilevel mixed-effects parameterization (Rabe-Hesketh, Skrondal, and Gjessing 2008). In a second step we estimate ACE models for subgroups defined by parents occupational status which is called non-parametric gene-environment interaction analysis (Guo and Wang 2002). We use the statistical software Stata (14.2) and the acelong.ado developed by Lang (2017).

Preliminary results

The results for the A, C and E components for grades and educational attainment are visualized in figures 1 (grades) and 2 (educational attainment). For further information on the estimation results see Table A2 and A3 in the appendix.

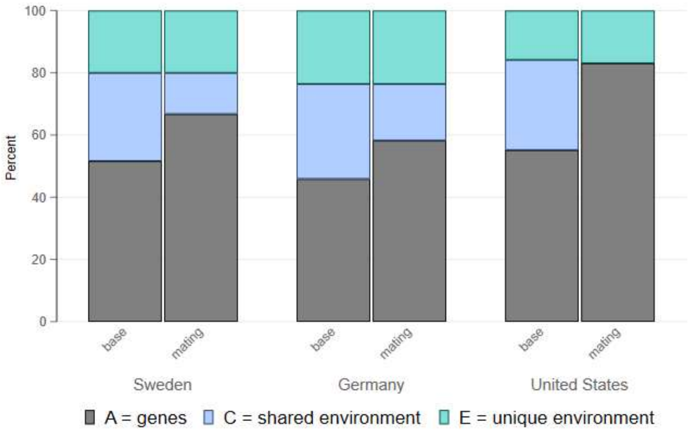

Figure 1. ACE-variance decompositions for twins' grades. *Sources*: Sweden: Swedish Registers; United States: National Longitudinal Study of Adolescent to Adult Health (Add Health); Germany: TwinLife wave 1.

Findings for the base model for grades show that genes matter most in the US (55%). In Sweden genetic influences account for about 52%, and in Germany for about 46% of the total variation in grades. The relative importance of shared environmental influences is fairly similar across countries i.e. approximately 30%. Unique environmental influences are least pronounced for the US (16%), followed by Sweden (20%) and Germany (24%). Thus, independent of country we find a substantial impact of both genetic and shared environmental influences on grades. However, assortative mating is an important aspect to consider since the relative importance of shared environmental influences decreases independent of country. In the US, shared environmental influences are even absent once assortative mating is accounted for.

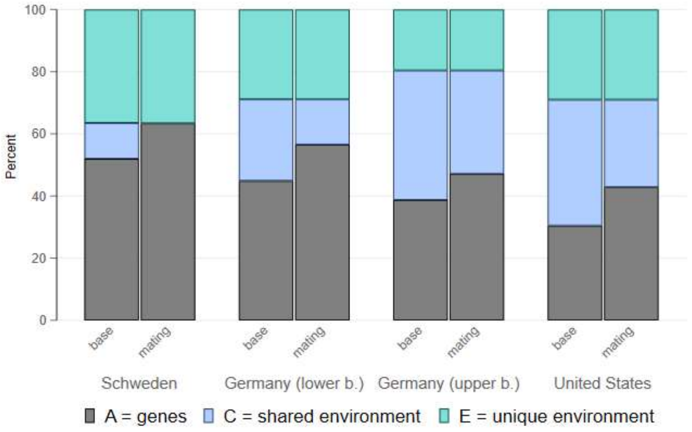

Figure 2. ACE-variance decompositions for twins' education. *Sources*: Sweden: Swedish Registers; United States: National Longitudinal Study of Adolescent to Adult Health (Add Health); Germany: TwinLife wave 1.

For educational attainment the base results show that Sweden diverts from Germany and from the US: In Sweden genes are most important (52%) while shared environmental influences are least pronounced (12%). In Germany genes account for about 45% in the lower bound scenario and for about 39% in the upper bound scenario, while shared environmental influences account for about 26% in the lower and for 42% in the upper bound scenario. In the US genes account only for about a third of the total variation, and shared environmental influences approximately 41%. In line with the findings for grades we find that the assumption of random mating biases the results upwardly in each country. In Sweden the shared environmental influences are even absent once assortative mating is accounted for.

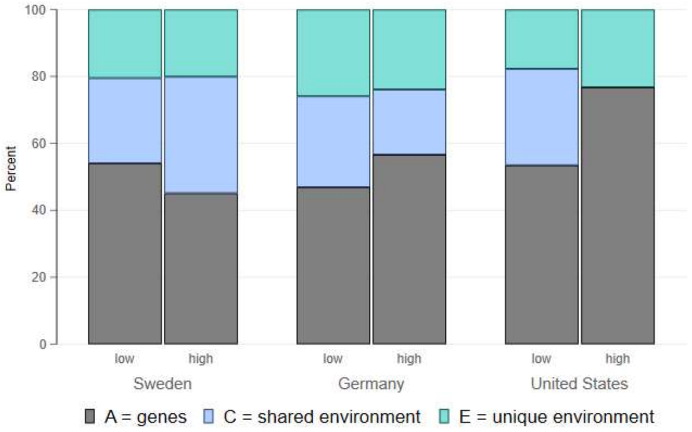

Figure 3. ACE- variance decompositions for twins' grades by parents occupation. *Sources:* Sweden: Swedish Registers; United States: National Longitudinal Study of Adolescent to Adult Health (Add Health); Germany: TwinLife wave1.

Now we test the Scarr-Rowe hypothesis and start with the findings for grades. Figure 3 shows how the overall results for A,C and E components for grades change when we estimate these models for subgroups differentiated by parents occupational status (low vs. high). Further information on the estimation results are displayed in Table A4 in the Appendix.

In line with our theorectical exspectation we find a more prononced Scarr-Rowe interaction in the United States and Germany. In Germany shared environmental influences account for about 27% of the total variation in grades in low status families, while shared environmental influences account for only about a fith of the varation in high status families. Here, shared environmental influences are not even statisticially significant. Relatedly, the relative importance of genetic influences is higher in high status families (57% compared to 47% in low status families). This interaction is even more pronounced in the United States: While shared environmental influences account for roughly a third of the variation in low status families, shared environmental influences are almost absent in high status families. Genetic influences account for 55% of the total variation in grades in high status families, and for about 45% in low status families. In Sweden by contrast, the results tend in the opposite direction. Here, the relative importance of shared environmental influences is higher for high status families (about 35%) compared to low status families (25%). Genetic influences are higher for low status families (45%) compared to high status families (54%). Thus, regarding grades we identify the expected cross-country variation. For Germany and the United States wefind results supporting the Scarr-Rowe hypothesis but not for Sweden.

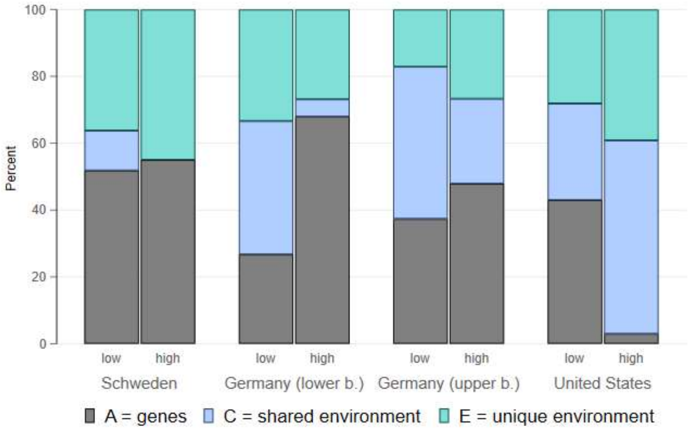

Figure 4. ACE- variance decompositions for twins' education by parents' occupation. *Sources*: Sweden: Swedish Registers; United States: National Longitudinal Study of Adolescent to Adult Health (Add Health); Germany: TwinLife wave1.

For education (see Figure 4 and Table A5 in the Appendix) we find support for the Scarr-Rowe hypothesis in Germany and to a lesser extent in Sweden. In Germany in both scenarios the relative importance of genetic influences is higher in high status families (68% in the lower bound, and 48% in the upper bound) compared to low status families (27%, 37% respectively), while shared environmental influences are less important in high status families (5%, 25% respectively) compared to low status families (40%, 46% respectively). In Sweden there is less clear evidence for the Scarr-Rowe hypothesis since the relative importance of genes is fairly similar in low (about 52%) and status families (55%), however, shared environmental influences matter only in low status families (12%) and are absent for high status families. In the US, by contrast, we find evidence for a gene-environmental interaction contrary to the prediction of the Scarr-Rowe hypothesis: genetic influences account for 43% of the total variation in education in low status families and only about 3% in high status families. Shared environmental influences explain roughly a third of the variation in low educated families and are almost twice as high in high status families (i.e. 58%).The results indicate that educational attainment in the United States is much more dependent on shared environmental influences compared to the other countries we analyzed. In the United States genetic influences on educational attainment are not even significant in high status families.

Conclusion and Discussion

In this study, we extended previous research on the Scarr-Rowe hypothesis in two ways. We applied, first, a cross-national perspective and, second, examined educational outcomes instead of intelligence. We argued that welfare regimes provide an important environmental condition that shapes individuals chances for genetic expression. We hypothesized that the Scarr-Rowe hypothesis is less pronounced in Sweden and Norway than in Germany and the United States due to the more equal education system, the low level of income inequality, and the more generous welfare regulations in the Nordic social democratic welfare regimes (Esping-Andersen 1990, 1999). Our findings so far are in line with this expectation with respect to educational achievement (indicated by school grades) but not regarding educational attainment (indicated by years of schooling).

For the overall (non-stratified samples) we found that the A, C, and E components for grades are rather similar across countries if assortative mating is not controlled for. Both, shared environmental influences and genetic influences explained a substantial part of the total variation in school grades. Once corrected for assortative mating shared environmental influences became absent in the US. For educational attainment we found in the models where we correct for assortative mating that Germany and the US are more similar compared to Sweden. In Sweden, genetic influences were most and shared environmental influences least pronounced. Thus, our results show that genetic influences on education and school grades operate differently, and it seems that features of education systems can shape the extent to which genes matter for education. Our results also highlight that assortative mating biases the results on the importance of shared environmental influences on educational outcomes in all countries. Hence, further research based on twin or sibling data needs to correct for assortative mating to gain reliable results.

In Germany we found evidence for a Scarr-Rowe interaction for both school grades and educational attainment. Genes are more important in high status families, while shared environmental influences are more important in low status families. Since twins from low status families have, on average, lower schools grades and a lower educational attainment our results suggest that shared environmental influences in low status families are not beneficial for twins' educational outcomes.

In the US an interaction in line with the Scarr-Rowe hypothesis was only found for school grades. For educational attainment, however, we found an interaction which points in the opposite direction. Genetic influences on educational attainment were almost absent in high status families while shared environmental influences explained the largest part of the total variation of education. For Sweden, evidence for the Scarr-Rowe interaction was comparatively weak. We found for school grades a similar pattern that we found in the US in regards to education, since the relative importance of shared environmental influences was higher in high- than in low-SES families. For educational attainment we found that shared environmental influences are absent in high status families while the relative importance of genes did not vary between high and low status families.

Our study demonstrates that the impact of shared environmental influences on education varies across countries. In the United States shared environmental influences on education and in Sweden shared environmental influences on grades are accompanied with better educational outcomes while in Germany shared environmental influences seem to have rather detrimental impact on educational outcomes.

Our findings highlight that not only the proximate family environment but also the institutional arrangements are an important environmental condition that needs to be considered to understand gene-environment interplay. Moreover, we found an interaction contrary to the Scarr-Rowe hypothesis for educational attainment in the United States. These finding is particularly striking since it points out that it is rather family background that shapes individual chances for educational attainment and to a much lesser extent individual's academic performance. One explanation might be rooted in the social selectivity of tertiary education with high levels of tuition fees in the United States. Further research is needed to understand which mechanisms explain cross-national variation in the impact of shared environmental influences, net of genetic influences, on education.

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Appendix

Table: A1 Sample sizes

	Sweden	Germany	United States
School grades			
Birth cohorts	1982-1991	1990-1993	1976-1980
Age	16	22-25[b)]	14-18
N_{pairs}	13,237	840	858
Educational attainment			
Birth cohorts	1975-1982	1990-1993	1976-1980
Age	30	22-25	25
N_{pairs}	8,089	840	1,233

[b)] Retrospective information on the final grade of general education provided by 22-25 year old twins *Sources*: Sweden: Swedish Registers; United States: National Longitudinal Study of Adolescent to Adult Health (Add Health); Germany: TwinLife wave 1.

Table A2: ACE-variance decompositions for twin twins grades

	Sweden			Germany			United States		
	b/var	c.s.e	z-value	b/var	c.s.e	z-value	b/var	c.s.e	z-value
Grades									
Base									
Constant	216.70	0.66	327.72	3.13	0.04	79.76	2.58	0.03	74.06
Total var.	3409.10	73.25	46.54	1.56	0.07	23.49	0.72	0.04	17.79
Variance in %									
A	51.56	4.21	12.26	45.87	8.73	5.25	55.17	9.75	5.66
C	28.34	4.19	6.77	30.49	7.90	3.86	29.01	9.30	3.12
E	20.01	0.92	21.84	23.64	2.53	9.33	15.82	2.92	5.42
N_{Pairs}	13,237			840			858		
Assortative mating									
Constant	216.70	0.66	327.72	3.13	0.04	79.76	2.58	0.03	74.06
Total var.	3409.10	73.25	46.54	1.56	0.07	23.49	0.72	0.04	17.79
Variance in %									
A	66.76	5.11	13.07	58.19	11.08	5.25	83.00	6.55	12.66
C	13.23	4.98	2.66	18.17	9.98	1.82	0.00	0.00	0.00
E	20.01	0.91	21.92	23.64	2.53	9.34	17.00	2.94	5.79
N_{Pairs}	13,237			840			858		

Sources: Sweden: Swedish Registers; United States: National Longitudinal Study of Adolescent to Adult Health (Add Health); Germany: TwinLife wave 1.

Table A3: ACE-variance decompositions for twins educational attainment (in years)

	Sweden			**Germany**						**United States**		
				Lower bound			Upper bound					
	b/var	c.s.e	z-value	b/var	c.s.e	z-value	b/var	c.s.e	z-value	b/var	c.s.e	z-value
Educational attainment												
Base												
contstant	13.73	0.03	443.60	13.09	0.07	187.68	14.67	0.09	156.88	13.87	0.08	167.65
Total var.	5.09	0.07	74.86	5.10	0.25	20.74	8.58	0.25	33.85	5.55	0.24	23.23
Variance in %												
A	51.97	6.01	8.65	44.86	8.97	5.00	38.74	66.98	5.55	30.46	13.93	2.19
C	11.65	5.56	2.08	26.22	8.09	3.24	41.65	6.66	6.26	40.54	11.13	3.64
E	36.48	1.37	26.56	28.92	2.85	10.15	19.61	1.93	10.18	29.01	5.04	5.75
N_{Pairs}	8,089			840			840			1,233		
Assortative mating												
contstant	13.73	0.03	443.60	13.09	0.07	187.68	14,67	0.09	156.88	13.87	0.08	167.65
Total var.	5.09	0.07	74.86	5.10	0.25	20.74	8,58	0.25	33.85	5.55	0.24	23.22
Variance in %												
A	63.38	1.68	37.59	56.57	11.30	5.01	47,17	8.51	5.55	42.82	19.71	2.17
C	0.00	0.00	0.00	14.51	10.13	1.43	33,22	8.03	4.14	28.17	16.51	1.71
E	36.61	1.33	27.68	28.92	2.85	10.16	19,61	1.92	10.19	29.01	5.07	5.73
N_{Pairs}	8,089			840			840			1,233		

Sources: Sweden: Swedish Registers; United States: National Longitudinal Study of Adolescent to Adult Health (Add Health); Germany: TwinLife wave 1

Table A4: ACE-variance decompositions for twins grades by parents occupation

	Sweden			**Germany**			**United States**		
	b/var	c.s.e	z-value	b/var	c.s.e	z-value	b/var	c.s.e	z-value
Grades									
low occupational status									
Constant	213.88	0.69	308.74	3.47	0.06	57.26	2.52	0.04	62.20
Total variance	3410.13	76.13	44.80	1.74	0.10	18.11	0.75	0.05	16.08
Variance in %									
A	54.08	4.59	11.79	46.94	13.59	3.45	53.48	12.47	4.29
C	25.44	4.50	5.65	27.13	12.53	2.17	28.84	10.82	2.67
E	20.48	0.98	20.96	25.92	3.56	7.28	17.69	4.36	4.06
N_{Pairs}	12,006			417			620		
high occupational status									
Mean	244.54	1.88	130.25	2.80	0.05	55.14	2,85	0.05	53.26
Total variance	2551.13	238.70	10.69	1.20	0.08	3.81	0.51	0.04	11.40
Variance in %									
A	45.12	11.32	3.99	56.65	14.88	3.81	76.76	12.50	6.14
C	34.80	13.99	3.99	19.44	12.78	1.52	0.00		
E	20.08	3.19	6.30	23.91	4.54	5.27	23.24	8.11	2.87
N_{Pairs}	1,231			423			210		

Sources: Sweden: Registers; United States: National Longitudinal Study of Adolescent to Adult Health (Add Health); Germany: TwinLife wave 1

Table A5: ACE-variance decompositions for twins educational attainment by parents occupation

	Sweden			**Germany**						**United States**		
				lower bound			**upper bound**					
	b/var	c.s.e	z-value	b/var	c.s.e	z-value	b/var	c.s.e	z-value	b/var	c.s.e	z-value
Educational attainment												
low occupational status												
Constant	13.61	0.03	410.39	12.59	0.10	123.70	13.84	0.14	98.73	13.63	0.09	152.86
Total Variance	5.07	0.07	71.28	4.95	0.36	13.78	8.89	0.38	23.24	5.04	0.27	18.57
Variance in %												
A	51.87	6.46	8.02	26.71	14.48	1.84	37.37	10.88	3.43	42.97	19.37	2.22
C	11.93	5.98	2.00	39.90	13.36	2.99	45.49	10.60	4.29	28.91	15.98	1.81
E	36.21	1.47	24.60	33.39	4.62	7.23	17.14	2.55	6.73	28.12	6.07	4.63
N_{Pairs}	7,039			417			417			898		
low occupational status												
Mean	14.53	0.08	186.63	13.58	0.10	139.75	15.48	0.12	126.65	14.67	0.17	88.65
Total Variance	4.50	0.19	22.76	4.76	0.31	15.23	6.93	0.35	19.62	6.21	0.42	14.80
Variance in %												
A	55.06	5.18	10.63	67.93	13.81	***4.92***	47.93	12.90	3.72	2.98	32.75	0.09
C	0.00	0.00	0.00	5.19	11.84	0.44	25.39	12.00	2.12	57.86	22.25	2.60
E	44.94	4.31	10.42	26.88	4.29	6.28	26.68	3.74	7.13	39.16	14.84	2.64
N_{Pairs}	1,050			423			423			300		

Sources: Sweden: Swedish Registers; United States: National Longitudinal Study of Adolescent to Adult Health (Add Health); Germany: TwinLife wave 1.