

**Paternal social class and sibling resemblance and difference in educational attainment in West Germany**

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## **Abstract**

We analyze sibling resemblance in educational attainment by father's social class in West Germany using data from the German Life History Study (GLHS). There are two contradicting hypotheses concerning the relationship between family class background and the degree of resemblance between siblings. The first (Becker and Tomes 1976; 1986) states that parents tend to invest more heavily in the schooling of academically more able children. Better-off parents are in a more favorable position to achieve this, as they can compensate the other siblings with investments in non-human capital, while worse-off parents need to balance between "optimal" investment in children's human capital and equal treatment between the siblings. As a result, siblings from better-off families tend to be less alike than those from disadvantaged backgrounds. In contrast to this hypothesis, Conley (2004) has argued that the resource constraints faced by disadvantaged families force them to favor some siblings at the expense of others. Using a six-class version of the Erikson-Goldthorpe schema, we find some support for the Becker-Tomes hypothesis. However, the patterns are clearly gendered: when we compare brother correlations to sister correlations by paternal class, we find that the Becker-Tomes hypothesis receives more support in the former than the latter case, where the results are clearly more mixed. We also find sharp differences in these correlations in some cases, particularly among the self-employed and skilled manual working class. We furthermore analyze the effects of demographic factors by class background, so that sibship size is negatively correlated with educational attainment in the lower classes but not in the higher ones, whereas birth order is positively related to educational attainment in the higher but not in the lower classes. We discuss the relevance of these findings for research on educational inequalities and for research using sibling resemblance models for analyzing the effects of family background on various outcomes.

## **Introduction**

There is a long and well-established sociological tradition in analyzing the effects of social background on educational attainment (e.g., Blau and Duncan 1967; Sewell and Hauser 1975; Shavit and Blossfeld 1993; Breen and Jonsson 1995; 2007). Given the crucial role educational attainment plays in the class and income attainment process in modern economies, the links between social origins and educational attainment cannot be underemphasized for an understanding of intergenerational social mobility (e.g., Blau and Duncan 1967; Sewell and Hauser 1975; Jencks 1979; Ishida, Müller and Ridge 1995; Breen 2004; Breen and Jonsson 2005). A common approach has been to examine the relationships between the class position (or educational attainment) of parents and the educational success of their children. These studies have documented how high class origins are everywhere associated with higher educational attainment levels, although the relationships are not stable across time or between countries.

Although these studies have been able to express important relationships between family background and educational achievement—the class background gradient in educational attainment—this approach is nevertheless limited in that family background obviously includes numerous factors that cannot be captured by measures of parental class. These include values and orientations shared by the family, genetic and social inheritance of skills and traits, and neighborhoods and schools that are shared by siblings from the same family. To capture this broader set of background factors, researchers have used sibling correlations (e.g. Jencks 1979; Hauser and Mossel 1985; De Graaf and Huinink 1992; Kuo and Hauser 1995; 1997; Björklund, Jäntti and Lindquist 2007; Conley and Glauber 2007). The idea behind their use is that if siblings are similar according education and other measures of socioeconomic attainment, this implies that the factors shared by the siblings exert a strong influence on their attainments. Thus, the stronger the sibling correlation, the stronger the effect of family background.

There has been quite some research on sibling resemblance, not only within numerous countries, but also across countries and across time (De Graaf and Huinink 1992; Toka and Dronkers 1996; Sieben and de Graaf 2001; Sieben, Huinink and de Graaf 2001; Björklund, Jäntti and Lindquist 2007; Conley and Glauber 2007). However, there has been hardly any research on sibling resemblance across social groups (for exceptions, Kuo and Hauser 1995; Conley and Glauber

2007). Do siblings from different backgrounds show similar levels of resemblance? In other words, are the effects of shared background characteristics similarly strong across social groups and social origins?

This question is not just of interest by itself, but also can shed light on social inequalities within (as opposed to between) families and on patterns of family decision making that influence the attainment levels of siblings. The effects of common factors shared by siblings may be stronger in some groups than others, for example because of different parenting styles, family, school or neighborhood experiences, or other factors. Alternatively, instead of investing similarly in the education of all siblings, families may invest differently in different children. Although in the latter case sibling correlations may be weak, this does not imply that the effects of families on children's education are also weak. As will be discussed in more detail in the next section of the paper, the extent to which families invest equally in their children or try to equalize their outcomes *vis a vis* favor some siblings at the expense of others may depend on the characteristics of the families and the resources that available to them. Thus, sibling resemblance in educational attainment may vary across social background.

In this paper, we analyze sibling resemblance in educational attainment by father's social class in West Germany using data from the German Life History Study (GLHS). Following the sociological tradition, we use father's social class as an omnibus measure of parental resources. Furthermore, this measure is readily available in our data. Germany has commonly been seen as a rather rigid society in terms of social mobility (Breen 2004), and the German system of early tracking in education has been linked to relatively strong effects of family background on educational attainment (Blossfeld 1993). Thus, it provides an interesting case for analyzing whether factors shared by siblings exert similar effects on the educational attainment levels across social classes.

We first analyze sibling resemblance according to paternal class among all siblings and separately between brothers and sisters, in order to examine any gender differences in the class-specific sibling resemblances. We also examine whether there have been any changes from an older to a younger cohort. We then estimate models with additional controls for demographic

and family compositional factors to see whether our results change. The coefficient estimates from these models are also used to shed light on the mechanisms, which affect educational attainment among siblings with different backgrounds. Before presenting the results, we first discuss the theoretical rationale of our study and present the methods and data used. Our last section concludes and provides a discussion of our results.

## **Theoretical background**

### *Family resources, parental social class, and sibling resemblance*

Why and how might parental social class influence the degree of similarity in the educational attainment of siblings? As a general framework, we can begin from the assumption and common observation that some siblings are more academically oriented and skilled than others. Parents may then either be neutral to these differences, enforce these differences by investing more in the academically stronger children, or aim to equalize the outcomes of these differences by investing more in the academically weaker children (e.g., Griliches 1979).

The traditional framework of sibling resemblance analysis emphasizes factors that are *shared* by the siblings. An implicit assumption in much research in this framework is that parents are neutral to the differences between their siblings. In other words, whatever differences there may be across time, space, or social groups in sibling correlations, these result from differences in the constraints family background poses on all siblings without recognition of ways in which some siblings may be constrained or enforced more than others. For instance, change in the sibling correlation across cohorts is generally interpreted as reflecting decreasing (shared) family background effects and increasing individualization and meritocracy (De Graaf and Huinink 1992; Kuo and Hauser 1995; Sieben and de Graaf 2001; Sieben, Huinink and de Graaf 2001). From this perspective, one could interpret class background differences in sibling resemblance through class differences in the ways in which siblings experience common factors when growing up. For example, children from disadvantaged backgrounds may share more similar neighborhood or school experiences whereas children from advantaged backgrounds may have access to more diverse environments. Another potential source of difference is the classic finding of class-based parenting styles (e.g. Kohn 1964). Middle-class parenting that lays more emphasis

on self-development and self-direction may produce less resemblance between siblings than more authoritarian parenting styles in the working class.

Another approach is to assume that classes differ in the extent to which they prefer, enforce, or constrain different children. However, assuming that class *X* parents prefer firstborns or boys more than class *Y* parents feel rather arbitrary. Why, then, might there be differences in the strategies toward their children across social classes?

Becker and Tomes (1976; 1986; also Becker 1991) argued that in general, parents need to balance between optimal investment in human capital (by investing in the academically best endowed children) and equal treatment of siblings. According to Becker and Tomes, better-off families have better resources for this and tend to invest more in their academically gifted children, while compensating other children by transferring non-human capital assets such as wealth to them. This will tend to increase sibling differences in educational attainment. Resource-constrained families, on the other hand, are in a more ambiguous situation as they may not be able to invest optimally in their gifted children. This would tend to lead to stronger resemblance between siblings from more disadvantaged backgrounds. In other words, the class status of parents and sibling similarities would be negatively correlated.

A different finding was made by Dalton Conley (2004; also Conley and Glauber 2007: 137; Conley, Glauber and Olasky 2004), whose results from qualitative research suggest that disadvantaged families tend to have higher sibling disparities because the more limited resources available to them do not permit investment in the education of all children, unlike the case in better-off families. Some siblings may also need to sacrifice their educational aspirations for others by, for example, working or by failing to benefit from extracurricular activities that are available for other siblings. Class background and sibling similarities in education would thus be positively correlated. This hypothesis plugs into familiar notions of some children from poor families of being constrained in their educational choices despite academic aspirations and skills while better-off families can secure high levels of education for even their academically less able children.

These two hypotheses clearly contradict each other. While in the former case, better-off families can, for example, send their academically gifted children to expensive private schools and compensate for the less gifted children through transfers of non human capital, in the latter case better-off families can afford extra academic support for the less gifted children. There is of course no reason to assume that these mechanisms cannot work simultaneously; instead, what matters is which mechanism is the dominant one.

### *Social class, demographic factors and educational attainment*

Whether higher social background is positively or negatively correlated with sibling similarities in education is an empirical question. Observed sibling resemblance in educational attainment by parental social class can depend on demographic and other observed differences between social classes. In this discussion, we focus on two demographic factors, the number of siblings and birth order, that have gained a lot of attention in the literature. In the analyses, we also control for other factors (namely, sex and age of mother at birth of sibling). These factors may help explain some of the expected differences in sibling resemblance by class background. Furthermore, as argued below, their effects can vary across social classes. Such heterogeneous effects can also offer clues to the between- and within-family mechanisms that affect educational attainment of siblings.

Fertility differences according to social class have been well documented (e.g., Skirbekk 2008) and a general finding is that in modern societies, higher-status parents tend to have less children. Number of siblings is generally negatively correlated with lower test score performance and especially lower educational attainment (e.g., Blau and Duncan 1967; Kuo and Hauser 1997; Steelman et al. 2002), although there is no full agreement of the causal nature of this association, which also seems to vary across time and space (Rodgers et al. 2000; Steelman et al. 2002; Angrist et al. 2005; Maralani, forthcoming). More siblings mean potentially less resources (including time and attention) available to each child, which can have negative effects on educational attainment. Some resources are more affected than others (Downey 1995).

Moreover, this relationship can vary according to the overall resources available to families. When it comes to economic resources that boost educational achievement—such as direct

financing (e.g. tuition) and consumption on goods that provide intellectual stimulation (such as extracurricular courses and books)—parents can cut down on their own consumption to substitute for the increased needs due to an increase in the number of children (cf. Becker 1981; Downey 1995). We can expect that the marginal utility of own consumption is lower for better-off parents, and thus, an increase in the number of children has a smaller marginal effect on the resources available to each child in better-off families (Becker and Tomes 1976). Although parental attention is harder to buy, better-off parents may nevertheless be better able to compensate by “buying” attention through extra-curricular activities or simply by better affording a stay-home parent (or a nanny), an issue especially relevant given the traditionally high prevalence of housewives in West Germany and its positive association with (husband’s) social class (Blossfeld and Drobic 2001). Consequently, we would expect that the number of siblings has a stronger negative effect on educational attainment among children from lower class backgrounds. These differences may also account for some of the differences in sibling resemblance for children with different class backgrounds.

Birth order is another factor that has been found to influence children’s academic outcomes so that earlier-born children generally attain more education and also show advantages in cognitive and academic test scores (e.g., Steelman et al. 2002; Kalmijn and Kraaykamp 2005; Bjerkedal et al. 2007; Kristensen and Bjerkedal 2007). Several theories have been put forward to explain these patterns. Some theories stress family interactions and other favorable conditions for earlier-born children. Earlier born children may benefit from an extended time as the only child (without competition for attention) during the early formative years; moreover, they may benefit from a tutoring role they have in relation to their later-born siblings (Zajonc and Markus 1975). Again, other studies have challenged the birth order hypothesis on methodological grounds. Birth order can be confounded by family size, and some studies that have used within-family data of siblings from same families have claimed that the birth order effect on intelligence is a methodological artifact (Rodgers et al. 2000). However, other studies using similar data continue to find birth order effects. For example, Bjerkedal and associates (2007; see also Kristensen and Bjerkedal 2007) used data for Norwegian brothers who took IQ tests during their military service (around age 18) and found the common pattern of higher scores for earlier-born brothers. They found

support for the social interaction hypothesis, as later-born children with deceased elder siblings had IQ scores on par with earlier-born children without deceased elder siblings.

Why might birth order effects vary across social classes? Following the Becker-Tomes hypothesis, we may expect that if any birth order effects on academic aptitude were observable relatively early, better-off parents would be more likely to invest relatively more in the human capital of earlier-born children, thus enforcing any birth order effects in the higher classes. On the other hand, more resource-constrained families may not be able to invest enough in their able children, leading to underinvestment in the lower classes instead of overinvestment in the higher classes. Furthermore, if the higher classes put more emphasis on “developmental” parenting styles than the lower classes, we may see bigger differences in educational attainment of the more able children, even without explicit differences in investment according to aptitude. In each case, however, we would observe a similar pattern: a stronger birth order effect in the higher classes. In line with this expectation, Bjerkedal and associates found that birth order effects on measured intelligence of Norwegian conscripts were stronger among brothers from more advantaged family backgrounds (Bjerkedal et al. 2007). On the other hand, some earlier results suggest that birth-order effects may vary depending on the resources parents pass on to their children, so that firstborns receive more attention from their parents, whereas younger siblings are more likely to benefit from financial assistance in education (although the latter may be confounded by the parents of laterborns being older and thus financially better-off) (see Steelman et al. 2002: 256-7).

Summing up, we can make the following hypotheses. First, following the Becker-Tomes argument, we can expect that sibling resemblance in educational attainment is stronger among siblings from lower class backgrounds. Our second hypothesis contradicts this and argues—following Conley (2004)—that resemblance is stronger among siblings from higher class backgrounds. The theories behind both hypothesis argue that parents are not neutral in the decision making. However, it should be emphasized that—as discussed above—we may find patterns that are in line with either hypothesis even if parents do not enforce or equalize differences between their children. We made some suggestions of how this might lead to patterns in line with the Becker-Tomes hypothesis. However, since the theoretical or empirical

foundations for these expectations are less solid than in the two other hypotheses, we refrain from formulating any explicit hypotheses. We discuss these issues in the last section of the paper.

To shed more light to the mechanisms that may affect educational attainment among siblings with different backgrounds, we also expect that sibship size has a stronger negative association with educational attainment for children from lower class backgrounds whereas birth order has a stronger negative relationship with educational attainment among siblings from higher class backgrounds. These and other factors available in the data may also explain some of the expected differences in sibling resemblance by class background. As mentioned in the introduction—in addition to overall correlations between all siblings—we also examine whether these patterns have changed and are similar between brothers and sisters. Although we find remarkable differences, it is harder to explain them with the set of theoretical tools available to us. Thus, these results are mainly exploratory and await later theoretical explanations.

## **Models and estimation**

### *Sibling correlations in educational attainment*

We model sibling correlations in educational attainment by estimating the intraclass correlation coefficient using estimated family and individual level variance components from a two-level multilevel model (cf. Björklund, Jäntti and Lindquist 2007; Conley and Glauber 2007; Erola, Härkönen and Jäntti 2008). To fix ideas, an “empty” model of educational attainment of individual  $j$  in family  $i$  can be written as

$$y_{ij} = \mu + \varepsilon_{ij} \quad (1),$$

where  $\mu$  is the population mean and  $\varepsilon_{ij}$  is an individual specific component with variance  $\sigma_\varepsilon^2$ . This component shows the individual’s educational attainment relative to the population mean. This can be decomposed into a family specific component of permanent attainment ( $a_i$ ) that is common to all siblings in a family and an individual specific component of educational attainment  $b_{ij}$ :

$$\varepsilon_{ij} = a_i + b_{ij} \quad (2).$$

The former captures the family-specific deviations from the population mean whereas the latter denotes individual deviations from the average family attainment. Assuming that the components are independent, the variance,  $\sigma_\varepsilon^2$ , of the individual specific component in the population model is simply a sum of the variances of the common family component and the individual deviations from the family mean

$$\sigma_\varepsilon^2 = \sigma_a^2 + \sigma_b^2 \quad (3).$$

From this equation, we can calculate the intraclass correlation—here, the sibling correlation—in educational attainment with

$$\rho = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_b^2} \quad (4),$$

which equals the correlation between two randomly drawn pairs of siblings. This correlation is commonly interpreted as reflecting the influence family background, or more precisely, of factors that are shared by both siblings (including family resources, values, neighborhoods, schools, and genetic traits).

This interpretation rests on a central assumption, namely, that there is no relationship between the location of the family mean in the overall distribution (that is, the average educational attainment of the siblings) and the degree of sibling resemblance in educational attainment (cf. Conley and Glauber 2007: 140). This means that, for example, the degree of similarity between siblings from a family that has a high propensity of higher education is the same as the degree of similarity between siblings from a family with a low propensity of higher education. In our case, siblings from higher class backgrounds would have a similar degree of resemblance as siblings from lower class backgrounds. As discussed in the previous section of the paper, this is a strong argument and there are theoretical reasons to suspect that it does not hold.

Thus, in our paper we analyze whether sibling resemblance in educational attainment is similar regardless of class background. We do this by estimating separate equations for different social classes. But before going to discuss the data and the class background measures used, we first present the empirical models used in the analyses.

Our basic model is the following two-level model

$$y_{ij} = \alpha + \beta age_{ij} + \psi birthyear_{ij} + \varphi X_{ij} + \theta_i + \epsilon_{ij} \quad (5),$$

where  $\alpha$  is the constant,  $\beta$ ,  $\psi$ , and  $\varphi$  are regression coefficients for year of birth, age of and a set of other regressors  $X$  the sibling  $j$  in family  $i$ ,  $\theta$  is the residual term for family  $i$ , and  $\epsilon$  is the residual term for sibling  $j$  in family  $i$ . We include year of birth and age in each model to account for educational expansion and the possibility that some younger siblings might be too young to have completed some level of education. In other models, we also include sex of the sibling, birth order, number of brothers and sisters, and age of the mother at birth of the sibling.

Hypotheses of the number of siblings were discussed above; we furthermore want to test whether the number of brothers and sisters have similar effects (see Steelman et al. 2002). The age of the mother at birth of the sibling is needed as a control for birth order effects, as mothers of younger siblings are older when they give birth, which has been shown to have a positive influence on educational attainment (Kalmijn and Kraaykamp 2005). Since class and mothers age at birth at different parities also covary, age of the mother can also reduce the family and individual variance components—and thus affect the sibling correlation—differently in different classes. Sibship size also needs to be controlled when estimating the effects of birth order, since the two are related in obvious ways. However, here we are not able to control for other between- and within family factors that may affect educational attainment and bias our estimates of sibship size and birth order (for a discussion of such effects in analyses of family composition on intelligence, see Rodgers et al. (2000)). Thus, our models are correlational; we seek to address these issues in future versions of the paper.

We analyze these models with two-level OLS models, fitted with aML 2.09 package (Lillard and Panis 2003). Given the nature of the German educational system—discussed below—ordered (probit or logit) models may be more appropriate. We tested the use of ordered probit models with differently categorized outcome variables (educational attainment) and received very similar estimates (for a comparison of sibling correlations with linear and ordered measures in West Germany, see Sieben, Huinink and de Graaf (2001)). However, ordered models are less powerful, and especially in the case of subsamples, aML at times failed to estimate proper standard errors. The linear models did not suffer from such problems. We also ran estimations which only included families with two or more siblings, in order to check whether the inclusion of singletons (and possible class differences in their frequency) which appear in the denominator but not the numerator bias our estimates. We did not find any change to the results.

The standard errors for the sibling correlations were calculated using the ML method, recommended for intraclass correlations with typical sibling data by Donner and Wells (1986: 405).

## **Data**

We use data from the German Life History Study (GLHS), a retrospective life course survey of German residents, collected through multiple samples of different birth cohorts (see e.g., Brücker and Mayer 1998; Mayer 2008). We use data for all the cohorts in the West German samples of the study. The oldest cohort was born in 1919 and the youngest in 1971. In these data, the respondents were also asked questions (including year of birth, sex, and educational attainment) about their sibling. We include data for all siblings with non-missing educational attainment records who were born between 1910 and 1975. These restrictions led to sample size reductions of approximately 5 percent. We further eliminated respondents who were born and schooled in the former German Democratic Republic or abroad, and those who were less than 15 years old at the time of interview. With these restrictions, our sample consists of 19,408 siblings (9,777 men and 9,631 women) from 7,212 families.

Our dependent variable is educational attainment. As is well known, the (West) German educational system is characterized by different education tracks to which students are selected

at a relatively early age. The basic features of the system were formed in the late nineteenth century and have remained very much the same since. The educational reforms of the 1960s and 1970s did not affect the basic features of the educational system, which can be summarized as follows (Blossfeld 1993: 52-53): 1) the coexistence of three types of secondary schools (lower secondary school (*Hauptschule*); middle school (*Mittelschule* or *Realschule*); and higher secondary school (*Gymnasium* or *Fachoberschule*), following four year of compulsory primary education, and 2) the continued importance of vocational education that is part enterprise based and part school based. Education in our cohorts was mainly publicly financed, although in the older (up to WWII) cohorts some fees were collected from students and their families.

*Figure 1*

Figure 1 provides another summary of the German educational system and demonstrates the tracked paths along which students can proceed along the educational career. These ages at which different levels and attended and the years spent in schooling (in the right-hand side) are illustrative of an “ideal” educational career. The figure clearly portrays the highly tracked nature of the educational system, where long-standing decisions are made early in the student’s life.

We use a ten-scale educational attainment variable that combines schooling and training. This is a modified version of the CASMIN scale. The lowest category (1) consists of siblings with only compulsory schooling, whereas the second group includes those with compulsory schooling and training (2). Siblings in the third group (3) have only lower secondary schooling, while the fourth group (4) is otherwise similar but also has vocational training. The fifth group (5) has middle school (*Realschule*) and the sixth group (6) combines middle level schooling and training. The seventh (7) and (8) eight categories consist of those with pre-university education with and without training, respectively, while the last two groups (9 and 10) have degrees from higher vocational training (*Fachhochschule*) and university, respectively.

*Table 1*

As a measure of class background, we use the class status of the biological father of the respondent, which is readily available in our data. As discussed in the introduction, we use class background as an omnibus measure of parental resources that can affect children's educational attainment. We use a six-class version of the Erikson-Goldthorpe (EGP) class schema (see Table 1) (e.g. Erikson and Goldthorpe 1992; Breen 2004). We chose a six-class version of the schema after theoretical considerations and empirical testing. We wanted to be able to differentiate between the different classes as far as possible without too many sacrifices on the number of cells in each class. We are able to separate between the upper and lower service classes (classes I and II). We also collapsed the non-farm self-employed (IVab) and farmer (IVc) classes into a single class. The sibling correlations and variance components were very similar in this class. We did not, however, combine the self-employed class with another category. The self-employed can pass their business to their children, thus they are able to compensate for lower investment in schooling for some siblings, as predicted by the Becker-Tomes hypothesis. As we will see in the course of the analysis, this separation also makes empirical sense. The EGP class schema does not allow a clear hierarchical interpretation. However, such an interpretation is commonly made. We use the EGP schema in a cautiously hierarchical manner. This is supported by findings that (controlling for year of birth) class background affects educational attainment in a hierarchical and more or less linear manner. The respondents were asked to report their father's occupation at the time they were 15 years old. The EGP classification was coded using the syntax provided by Uunk, Mach, and Mayer (2005) (see also Hillmert and Kröhnert (2000)).

## *Table 2*

Table 2 presents descriptive information on the data.

## **Results**

### *Sibling resemblance in educational attainment by gender and class background*

We begin with a description of sibling similarities in educational attainment overall and by class background. These provide basic estimates which also serve as benchmarks for the later analyses. They are based on models where we only control for age and year of birth. Table 3 shows estimates of the sibling correlations and the variance components first for all siblings (first

three columns), and then separately for brothers and sisters (columns 4-6 and 7-9, respectively). The overall sibling correlation in these estimates is 0.52, a result corresponding to estimates in other German studies (De Graaf and Huinink 1992; Sieben, Huinink and de Graaf 2001).

The figures show variation in sibling resemblance by class background, most notably in the relatively low correlations between siblings from an upper service class or higher routine non-manual background, where the correlations are 0.32 and 0.34, respectively as opposed to correlations around 0.42 among sibling from other class backgrounds. These estimates do not directly support either hypothesis, although they seem more in line with the Becker-Tomes one. In light of this hypothesis, the higher sibling correlation among children from the lower service class than those from the upper service and higher routine non-manual classes is somewhat intriguing. One should however keep in mind that the classes are not in an unambiguously hierarchical order. Overall, one could regard most of the sibling correlations *within* classes even surprisingly high. Obviously, they are smaller than the overall sibling correlation. However, factors that are shared by the siblings remain important even between families with the same class background. In other words, class is only one of the factors affecting educational attainment and there are important family and neighborhood factors that affect educational attainment even among children with the same class background.

### *Table 3*

Looking at the variance components, both the family and individual components are generally bigger in the higher classes. This is especially true for the individual component, which (with the exception of the difference between higher non-manual and the lower service class) grows nearly linearly from the lower to the upper classes. In most cases, this growth is offset by the growth in the family variance component. These results show that there is generally speaking more inequality in educational attainment among those born into higher classes, and particularly within families in these classes.

However, the results just discussed mask clear gender differences. In Table 3, columns 4 and 7 present brother and sister correlations, respectively, by class background. We can find several

interesting patterns. Firstly, sister correlations are higher than brother correlations across the board. A similar result was found by Conley and associates for the United States (Conley, Glauber and Olasky 2004). What is maybe more striking is how the difference between brother and sister correlations varies across classes. They are close (and the difference is not statistically significant) in the lower service class and the unskilled working class, but very different in the other classes. Take, for instance, the self-employed. The brother correlation is 0.33 whereas the sister correlation is 0.58. In light of the Becker-Tomes hypothesis, if the self-employed compensate educational differences among their children by passing on their business, they do so for sons, but not daughters. The difference is also remarkable in the skilled manual class (0.37 vs. 0.54). In both cases, the difference is statistically significant. In the upper service class and higher routine non-manual class, the difference is smaller (in the range of 0.1) and not statistically significant.

How do these results correspond to the hypotheses we made? With the exception of the lower service class, the brother correlations yield some support for the Becker-Tomes hypothesis. For example, the correlations are statistically significantly stronger among brothers from unskilled working class backgrounds than all other classes except the lower service class. The other differences are also in line with the hypothesis, although not statistically significant. The sister correlations do not show any such clear pattern. They are the highest in the self-employed class and statistically significantly different from correlations in all other classes than the skilled manual class (and even this is significant at the 0.1 level). The correlation between sisters from the skilled manual class is also higher than between sisters from the higher routine non-manual, upper service, and unskilled working classes. The results suggest that if the Becker-Tomes hypothesis holds, it does so for brothers whereas for sisters the classes are clearly more idiosyncratic. The often striking differences between brother and sister correlations are harder to explain from this point of view.

We also examine whether the sibling correlations have changed across cohorts. For this purpose, we split the data into two cohorts, those born between 1919 and 1945 and those born between 1946 and 1975. This split is admittedly rather arbitrary and crude and reflects the data restrictions (number of cases by class). These cohorts, however, correspond historically with two

major periods in recent German history, the Weimar Republic-Great Depression-Third Reich (including WWII) period and the period of the *Bundesrepublik*. To keep with this categorization, we excluded the oldest cohorts (born 1910-8). It is clear, however, that this simple categorization masks a great deal of heterogeneity in the life experiences of these cohorts. Nevertheless, this examination can help us examine some changes in sibling resemblance across time. In general, it is expected (and often found) that sibling correlations decrease from older to younger cohorts, reflecting a decrease in the importance of shared background factors (De Graaf and Huinink 1992; Kuo and Hauser 1995; Björklund, Jäntti and Lindquist 2007; Conley and Glauber 2007). To the extent that class inequality has decreased across cohorts, we could expect to find smaller differences in sibling resemblance across paternal class in the younger than the older cohort.

*Table 4*

The results are presented in Table 4. The overall correlations decrease for all siblings and for both brothers and sisters. Although sister correlations decrease somewhat more, they remain stronger than the brother correlations. Using the same data but finer cohort distinctions, Sieben, Huinink and de Graaf (2001) did not find any systematic trend for sibling correlations in education in West Germany, although a general decline in the class gradient in educational attainment has been observed elsewhere (Müller and Pollak 2004). Looking at the correlations by father's class, we see that for all siblings, the correlations decrease in a statistically significant way among those whose fathers were in the lower service class, higher routine non-manual class, or self-employed, while it *increases* for those whose father was an unskilled worker. Among brothers, we find a decrease for brothers with lower service class and self-employed fathers whereas for sisters, the correlations decrease for those with higher routine non-manual and self-employed fathers. The increases for brothers and sisters from the unskilled working class are not statistically significant.

Overall, the spread in the correlations according to paternal class for all siblings are smaller in the younger cohort: in this respect, class background seems to matter less. Regarding our hypothesis, the results for the younger cohort are somewhat in line with the Becker-Tomes hypothesis, whereas the older cohort shows a hump-shaped pattern. For brothers we see some

support for the Becker-Tomes hypothesis when looking at the four lowest classes in the older cohort (note also the implausibly low correlation among brothers from the higher service class in this cohort). In the younger cohort, the higher correlation in between brothers from with unskilled working class backgrounds is also in line with this hypothesis. Overall, the class differences appear smaller in the younger cohort. For sisters, the situation is different. For the older cohort, we find a hump-shape pattern while for the younger one, any patterns are harder to detect.

Although we found some support for smaller class background differences in overall sibling correlations and brother correlations in the younger cohort, as we expected, one might have also expected that the sibling correlations change in the same direction, regardless of class background. However, as we saw, this was not the case for correlations for siblings from the unskilled working class. Whereas the decreasing sibling correlations may reflect smaller family constraints or that parents in some classes invest increasingly in their more able children, the strengthening resemblance among siblings from the unskilled working class may reflect changes in other family effects. Following Conley's (2004) hypothesis, one could interpret this finding by suggesting that in the older cohort, families from the unskilled working class had to—possibly unwillingly—restrict the education of most of their children, whereas in the younger cohorts such measures were less necessary. This may also explain the hump-shaped pattern for all siblings and for sisters in the older cohort: in earlier times, disadvantaged families could not support the education of all children, whereas the highest classes could compensate, leading to bigger disparities in both ends of the class structure. For brothers, however, this was not the case. Although these explanations remain a possible, they cannot be proven with the results at hand.

#### *Effects of observed family composition factors and sibling resemblance*

In Table 5 we present the regression coefficients for models for all cohorts. In the first part, we present the estimates for all siblings. In addition to year of birth and age, we include age of mother at birth, sex of the sibling, birth order, and the number of brothers and sisters. As discussed above, this set of regressors is obviously small and in now means exhaustive, but it can still provide clues as to how family demographics affect differences within and between families. Interactions between birth order and number of siblings were not statistically significant. Neither

did we find important nonlinearities. We also estimated the same models separately for brothers and sisters and for the older and younger cohort. These results are presented in the appendix. We comment only on the relevant differences between these results and those in Table 5. We also tested replacing birth order with the birth order of brothers and sisters. This did not add to our results. Finally, our parameter estimates combine between- and within-family effects and are not free from bias due to heterogeneity. Thus they do not enable a causal interpretation.

#### *Table 5*

The first column in Table 5 presents the results for all siblings. All coefficients are statistically significant. Later cohorts attain unsurprisingly more education. Age of the mother at birth is positively related to educational attainment, a result in line with those by Kalmijn and Kraaykamp (2005), among others. Even after controlling for maternal age, birth order is negatively associated with educational attainment. We can also find a negative association between the number of brothers and sisters and educational attainment, in line with the resource competition hypothesis. After controlling for these covariates, the sibling correlation falls only slightly compared to that shown in Table 3. The variance components do not change remarkably either. This result remains also across the different classes, showing that the observed factors included in our regressions do not account for much of the individual or family variation in educational attainment or for the sibling correlation. Unobserved factors thus account for the majority of the sibling resemblances found.

Moving on to the results for the different paternal classes, we receive some support for our hypotheses of the different ways in which demographic factors interact with class background in producing educational attainment. The number of brothers and sisters is not associated with educational attainment in the three highest classes (service classes and higher routine non-manual class) whereas both are negatively related with educational attainment among children of the self-employed and the skilled manual class. Only the number of brothers is associated with educational attainment in the unskilled working class, although among brothers, both the number of sisters and of brothers matters. On the other hand, among sons of the self-employed, the number of sisters is negatively associated with educational attainment while the number of

brothers is not. Overall, these results support the hypothesis that siblings need to compete for resources only among the less well-off; in the better-off classes, parents can use their resources better to equalize opportunities between children even in bigger families.

With the exception of the self-employed class, birth order is negatively related to educational attainment in each class. We also found that among the self-employed, first-borns attain more education, whereas birth order among later children does not matter (not shown). The association between birth order and educational attainment is also stronger in the higher classes and the strongest in the upper service class. This result supports our hypothesis. However, the birth order associations (and the class interaction) appear only in the younger cohort (see Appendix), whereas in the older cohort the coefficient estimates are not significant (except in the unskilled class, but even in this class the effect is weak).

## **Discussion**

In this paper, we have analyzed sibling resemblance in educational attainment by class background, measured through a six-class version of the Erikson-Goldthorpe class schema. Using data from German Life History Study, we presented results for all siblings, separately for brothers and sisters, and also for two crude birth cohorts distinguished from the data (born 1919-45 and 1946-75). We also studied the coefficient estimates of two family composition variables (number of brothers and sisters and birth order) for extra hints of the mechanisms shaping sibling resemblance in different classes.

In the theoretical background, we discussed different frameworks under which one may expect class differences in sibling resemblance. In one framework, parents are neutral to sibling differences in academic abilities and aspirations. Class differences may emerge in sibling resemblance may occur if families in different classes are differently exposed to shared family and neighborhood factors, different parenting styles that reward abilities differently, or for other reasons. Secondly, we discussed the Becker-Tomes hypothesis predicting that better-off parents tend to invest more heavily in the human capital of more academically oriented and able children and compensate other siblings through non-human capital transfers. More disadvantaged parents, on the other hand, need to balance between optimal investment in their children's human capital

and equal treatment between siblings. As a result, we would expect to find more sibling disparities among the higher than the lower classes. A third approach (Conley 2004) states the opposite: that one would expect more resemblance among children with higher class backgrounds. This is because advantaged families are better able to support their less endowed children, whereas those from lower classes often need to “put their bets on one horse”.

The results do not show any straightforward support for any hypothesis, although they generally are more in line with the Becker-Tomes predictions. However, this hypothesis gets the most consistent support for brothers. For sisters, we do not find any patterns that would clearly support either hypothesis. These gender differences are among the most striking results of our analysis. They show that sister correlations are stronger across the board, and especially strong in some classes, such as the self-employed and the skilled manual working class. We did not offer any clear explanation to these findings. It is clear that any model of differences in sibling resemblance in educational attainment across social classes must take these gender patterns into account. We also found some changes across the two cohorts identified. Overall, and for most classes, sibling correlations decreased, suggesting that the effects of shared background factors have decreased. However, the correlation increased among siblings with unskilled working class fathers. We offered a possible explanation in the lines of Conley’s (2004) argument, emphasizing how unskilled working class parents in earlier times may not have had resources to invest equally in their children’s education. Furthermore, we found a hump-shaped pattern for sibling and sister correlations in the earlier cohort. This may mean that in earlier times, disadvantaged parents were restricted in their investments in the education of all children, whereas more privileged parents could use strategies in the lines of the Becker-Tomes hypothesis. We leave these explanations for future research.

We also made hypotheses of how the association between the number of siblings, birth order and educational attainment may vary across class backgrounds. In line with our expectations, we found that the number of siblings is negatively correlated with educational attainment in the lower but not the higher classes. This we interpret as suggesting that in the higher classes, parents can better adjust their investment to larger families than parents with limited resources. We also found that birth order has a stronger negative association with educational attainment in

the higher than in the lower classes, albeit only in the later cohort. If any birth order effects on ability were observed at early ages, parents may either enforce or compensate for these effects. In line with the Becker-Tomes hypothesis, we expected the former, a prediction that was also supported by the data.

In the theoretical section to the paper, we discussed possibilities that sibling resemblance may differ across class backgrounds even without active enforcement or compensatory strategies by the parents. For example, if parents from the higher classes use parenting styles that encourage self-development and working class parents stress parental authority, we may find similar patterns as predicted by the Becker-Tomes hypothesis. Such differences in parenting style may also transform any birth order effects on academic ability into birth order effects in educational attainment. On the other hand, “class experiences” can be heterogeneous in the sense that the effects of factors shared by siblings are stronger in some classes than others. Such a prediction would be in line with the “conventional” approach to sibling resemblance. Due to a lack of solid theoretical foundations, we did not make any explicit hypotheses of these mechanisms. Nevertheless, we must entertain the possibility of their existence.

It is clear that factors—especially those having to do with parent’s strategies—that produce differences between siblings’ socioeconomic outcomes demand much more theoretical and empirical attention than they have thus far received. To the extent to which sibling disparities become dominant in explaining overall inequalities, this task becomes ever more pressing. In this paper, we have presented differences in sibling similarities in educational attainment across class backgrounds, but many of these differences—especially those having to do with gender—escape our theoretical arsenal. Empirical estimation of the ways in which parents may enforce or equalize differences between their siblings also need development. Often identification of such patterns is cumbersome, to say the least (cf. Conley, Glauber, and Olasky 2004). In future versions of this paper, we wish to build on our analyses by extending the number of background factors used in the models. These include factors shared by the siblings as well and others, such as the spacing of births. We will also explore whether the class differences in birth order effects hold in a within-family setting.

Methodologically, our results call into question a central assumption in research that uses sibling resemblance as a tool for estimating the “global” effect of family background. As discussed in the methodology section of the paper, such estimation depends on the assumption that the variance components do not covary (see Conley and Glauber 2007: 140). According to our results, this assumption should not be always taken for granted.

## References

Angrist, Joshua D., Lavy, Victor and Analia Schlosser (2005) New Evidence on the Causal Link Between the Quantity and Quality of Children. NBER Working Paper No. 11835. National Bureau of Economic Research, Cambridge (MA).

Becker, Gary S. (1991) *A Treatise on the Family*. Enlarged Edition. Harvard University Press, Cambridge.

Becker, Gary S. and Tomes, Nigel (1976) Child Endowments and the Quantity and Quality of Children. *Journal of Political Economy* 84(2): S143-S162.

Becker, Gary S. and Tomes, Nigel (1986) Human Capital and the Rise and Fall of Families. *Journal of Labor Economics* 4(3): S1-S39.

Bjerkedal, Tor, Kristensen, Petter, Skjeret, Tor A., and Breivik, John I. (2007) Intelligence Test Scores and Birth Order Among Young Norwegian Men (Conscripts) Analyzed Within and Between Families. *Intelligence* 35: 503-514.

Björklund, Anders, Jäntti, Markus and Lindquist, Matthew J. (2007) Family Background and Income during the Rise of the Welfare State: Brother Correlations in Income for Swedish Men Born 1932-1968. IZA Discussion Paper No. 3000. IZA, Bonn.

Blau, Peter M. and Duncan, Otis Dudley (1967) *The American Occupational Structure*. John Wiley and Sons, New York.

Blossfeld, Hans-Peter (1993) Changes in Educational Opportunities in the Federal Republic of Germany. A Longitudinal Study of Cohorts Born in 1916 to 1965. Shavit, Yossi and Blossfeld, Hans-Peter (eds.) *Persistent Inequality. Changing Educational Attainment in Thirteen Countries*. Westview Press, Boulder.

Blossfeld, Hans-Peter and Drobnic, Sonja (2001) *Careers of Couples in Contemporary Societies*. Oxford University Press, Oxford.

Breen, Richard (2004) *Social Mobility in Europe*. Oxford University Press, Oxford.

Breen, Richard and Jonsson, Jan O. (2007) Explaining Change in Social Fluidity: Educational Equalization and Educational Expansion in Twentieth-Century Sweden. *American Journal of Sociology* 112(6): 1775-1810.

Brückner, Erika, and Karl Ulrich Mayer (1998) Collecting Life History Data: Experiences from the German Life History Study, pp. 152-181 in Janet Z. Giele and Glen H. Elder Jr. (eds.): *Methods of Life Course Research*. Sage Publications London.

Conley, Dalton (2004) *The Pecking Order. Which Siblings Succeed and Why?* Pantheon Books, New York.

Conley, Dalton and Glauber, Rebecca (2007) Family Background, Race, and Labor Market Inequality. *The ANNALS of the American Academy of Political and Social Science* 609(1): 134-152.

Conley, Dalton and Glauber, Rebecca, and Olasky, Sheera (2004) Sibling Similarity and Difference in Socioeconomic Status. Institute for Research on Poverty. Discussion Paper no. 1291-04. University of Wisconsin, Madison.

De Graaf, Paul M. and Huinink, Johannes J. (1992) Trends in Measured and Unmeasured Effects of Family Background on Educational Attainment and Occupational Status in the Federal Republic of Germany. *Social Science Research* 21(1): 84-112.

Donner, Allan and Wells, George (1986) A Comparison of Confidence Interval Methods for the Intraclass Correlation Coefficient. *Biometrics* 42(2): 401-412.

Downey, Douglas B. (1995) When Bigger is Not Better: Family Size, Parental Resources, and Children's Educational Performance. *American Sociological Review* 60(5): 746-761.

Erikson, Robert and Goldthorpe, John H. (1992) *The Constant Flux: A Study of Class Mobility in Industrial Societies*. Clarendon Press, Oxford.

Erola, Jani, Härkönen, Juho and Jääntti, Markus (2008) Trends in Brother Correlations in Class and Incomes in Finland. A Comparison of Cohorts Born in 1932-62. Paper presented at the RC28 Spring Meeting in Florence, 15-17 May 2008.

Griliches, Ziv (1979) Sibling Models and Data in Economics. Beginnings of a Survey. *Journal of Political Economy* 87(5): S37-S64.

Hillmert, Steffen and Kröhnert, Steffen (1992) EGP-Klassifikation auf der Basis von Angaben zu Beruf (ISCO 68) und beruflicher Stellung. Technischer Arbeitsbericht 6/2000. Max-Planck-Institut für Bildungsforschung, Berlin.

Ishida, Hiroshi, Müller, Walter, and Ridge, John M. (1995) Class Origin, Class Destination, and Education: A Cross-national Study of Industrial Nations. *American Journal of Sociology* 101: 145-93.

Jencks, Christopher (1979) *Who Gets Ahead? The Determinants of Economic Success in America*. Basic Books, New York.

Kalmijn, Matthijs and Kraaykamp, Gerbert (2005) Late or Later? A Sibling Analysis of the Effect of Maternal Age on Children's Schooling. *Social Science Research* 34: 634-650.

Kohn, Melvin L. (1964) Social Class and Parent-Child Relationships: An Interpretation. *American Journal of Sociology* 68(4): 471-480.

Kristensen, Petter and Bjerkedal, Tor (2007) Explaining the Relation Between Birth Order and Intelligence. *Science* 316: 1717.

Kuo, Hsiang-Hui Daphne and Hauser, Robert M. (1997) How Does Size of Sibship Matter? Family Configuration and Family Effects on Educational Attainment. *Social Science Research* 26(1): 69-94.

Lillard, Lee A. and Panis, Constantijn W.A. (2003) *aML Multilevel Multiprocess Statistical Software. Version 2*. EconWare, Los Angeles, California.

Maralani, Vida (forthcoming) The Changing Relationship Between Family Size and Educational Attainment over the Course of Socioeconomic Development: Evidence From Indonesia. *Demography*.

Mayer, Karl Ulrich (2008) Retrospective Longitudinal Research: The German Life History Study, In S. Menard (ed.), *Handbook of Longitudinal Research: Design, Measurement and Analysis*. Elsevier, San Diego, pp. 85-106.

Müller, Walter and Pollak, Reinhard (2004) Social Mobility in West Germany: The Long Arms of History Discovered? In Breen, Richard (2004) *Social Mobility in Europe*. Oxford University Press, Oxford, pp. 77-113.

Rodgers, Joseph Lee, Cleveland, H. Harrington, van de Oord, Edwin, and Rowe, David C. (2000) Resolving the Debate Over Birth Order, Family Size, and Intelligence. *American Psychologist* 55(6): 599-612.

Sewell, William H. and Hauser, Robert M. (1975) *Education, Occupation, and Earnings. Achievement in the Early Career*. Academic Press, New York.

Sieben, Inge and de Graaf, Paul M. (2001) Testing the Modernization Hypothesis and the Socialist Ideology Hypothesis: A Comparative Sibling Analysis of Educational Attainment and Occupational Status. *British Journal of Sociology* 52(3): 441-467.

Sieben, Inge, Huinink, Johannes, and de Graaf, Paul M. (2001) Family Background and Sibling Resemblance in Educational Attainment. Trends in the Former FRG, the Former GDR, and the Netherlands. *European Sociological Review* 17(4): 401-430.

Skirbekk, Vegard (2008) Fertility Trends by Social Status. *Demographic Research* 18: 145-180.

Steelman, Lala Carr, Powell, Brian, Werum, Regina and Carter, Scott (2002) Reconsidering the Effects of Sibling Configuration: Recent Advances and Challenges. *Annual Review of Sociology* 28: 243-269.

Toka, Gabor and Dronkers, Jaap (1996) Sibling Resemblance in Educational Attainment, Occupational Prestige, and Wealth in Hungary during the Communist Regime. *European Sociological Review* 12(3): 251-269.

Uunk, Wilfred, Mach, Bogdan W. and Mayer, Karl Ulrich (2005) Job Mobility in the Former East and West Germany: The Effects of State Socialism and Job Composition. *European Sociological Review* 21(4): 393-408.

Zajonc, R.B. and Markus, Gregory B. (1975) Birth Order and Intellectual Development. *Psychological Review* 82(1): 74-88.

## Tables

**Table 1.** EGP class categories and category groupings used for father's class

EGP class	Description	Name
I	Higher-grade professionals, administrators, and officials; managers in large industrial establishments; large proprietors	Upper service class
II	Lower-grade professionals, administrators, and officials; higher-grade technicians; managers in small industrial establishments; supervisors of non-manual employees	Lower service class
IIIa	Routine non-manual employees, higher grade (administration and commerce)	Higher routine non-manual
IVabc	Small proprietors, artisans, etc. with and without employees; farmers	Self-employed
V & VI	Lower-grade technicians; supervisors of manual workers; skilled manual workers	Skilled manual workers
VIIab & IIIb	Semi- and unskilled manual workers; agricultural and other workers in primary production; routine non-manual employed, lower grade (sales and services)	Unskilled workers

**Table 2.** Descriptive statistics (percentages and means)

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<i>Educational attainment</i>	
Max compulsory schooling	2.9 %
+ training	2.5 %
Lower secondary schooling	17.5 %
+ training	38.4 %
Middle school	2.4 %
+ training	18.7 %
Pre-university education	1.3 %
+training	4.2 %
Fachhochschule	4.2 %
University	8.0 %
<i>Father's class</i>	
Upper service class	7.5 %
Lower service class	8.1 %
Higher routine non-manual	7.6 %
Self-employed	22.7 %
Skilled manual workers	31.2 %
Unskilled workers	22.9 %
<i>Covariates</i>	
Year of birth	1946.0
Age	42.6
Men	50.4 %
Women	49.6 %
Age mother at birth	28.5
Number of brothers	1.6
Number of sisters	1.6
Birth order	2.6
N families	7212
N individuals	19408

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*Source:* German Life History Study

**Table 3.** Sibling correlations and variance components by paternal class: all siblings, brothers only, and sisters only. Standard errors in parentheses.

	All siblings			Brothers			Sisters		
	Sibling correlation	Variance components		Sibling correlation	Variance components		Sibling correlation	Variance components	
		Family	Individual		Family	Individual		Family	Individual
Higher service	<b>0.324</b> <b>(0.035)</b>	1.700 (0.224)	3.549 (0.142)	<b>0.309</b> <b>(0.065)</b>	1.631 (0.325)	3.644 (0.269)	<b>0.415</b> <b>(0.053)</b>	2.108 (0.373)	2.969 (0.174)
Lower service	<b>0.438</b> <b>(0.029)</b>	2.256 (0.286)	2.897 (0.104)	<b>0.461</b> <b>(0.046)</b>	2.716 (0.538)	3.179 (0.206)	<b>0.484</b> <b>(0.044)</b>	2.137 (0.309)	2.277 (0.121)
Higher routine non-manual	<b>0.338</b> <b>(0.033)</b>	1.659 (0.224)	3.247 (0.132)	<b>0.299</b> <b>(0.057)</b>	1.662 (0.421)	3.901 (0.299)	<b>0.390</b> <b>(0.052)</b>	1.638 (0.267)	2.560 (0.244)
Self-employed	<b>0.427</b> <b>(0.017)</b>	1.727 (0.103)	2.316 (0.034)	<b>0.329</b> <b>(0.029)</b>	1.454 (0.141)	2.972 (0.087)	<b>0.585</b> <b>(0.021)</b>	2.045 (0.124)	1.452 (0.032)
Skilled manual	<b>0.419</b> <b>(0.015)</b>	1.334 (0.061)	1.850 (0.027)	<b>0.370</b> <b>(0.025)</b>	1.329 (0.098)	2.268 (0.058)	<b>0.545</b> <b>(0.020)</b>	1.426 (0.068)	1.192 (0.029)
Unskilled	<b>0.428</b> <b>(0.017)</b>	1.105 (0.054)	1.479 (0.022)	<b>0.445</b> <b>(0.025)</b>	1.284 (0.089)	1.603 (0.041)	<b>0.480</b> <b>(0.025)</b>	1.022 (0.056)	1.107 (0.026)
All	<b>0.524</b> <b>(0.007)</b>	2.387 (0.066)	2.170 (0.018)	<b>0.488</b> <b>(0.012)</b>	2.430 (0.099)	2.550 (0.035)	<b>0.616</b> <b>(0.010)</b>	2.455 (0.070)	1.528 (0.017)

**Table 4.** Sibling correlations by paternal class for all siblings, brothers only and sisters only in two cohorts: 1919-46 (Weimar-Third Reich) and 1946-75 (Bundesrepublik). Standard errors in parentheses, with significance levels for differences.

	All siblings			Brothers			Sisters		
	1919-45	1946-75	Difference	1919-45	1946-75	Difference	1919-45	1946-75	Difference
Higher service	0.280 (0.064)	0.361 (0.037)	<b>0.075</b> <b>(0.074)</b>	0.027 (0.161)	0.365 (0.072)	<b>0.338</b> <b>(0.176)</b>	0.440 (0.089)	0.477 (0.062)	<b>0.037</b> <b>(0.109)</b>
Lower service	0.554 (0.040)	0.386 (0.035)	<b>-0.168**</b> <b>(0.053)</b>	0.605 (0.067)	0.400 (0.063)	<b>-0.205*</b> <b>(0.092)</b>	0.543 (0.067)	0.448 (0.061)	<b>-0.096</b> <b>(0.090)</b>
Higher non-manual	0.450 (0.049)	0.295 (0.039)	<b>-0.155*</b> <b>(0.062)</b>	0.294 (0.096)	0.311 (0.065)	<b>0.017</b> <b>(0.116)</b>	0.619 (0.073)	0.313 (0.072)	<b>-0.306**</b> <b>(0.103)</b>
Self-employed	0.500 (0.019)	0.356 (0.024)	<b>-0.144**</b> <b>(0.031)</b>	0.397 (0.037)	0.260 (0.045)	<b>-0.137*</b> <b>(0.058)</b>	0.649 (0.028)	0.474 (0.041)	<b>-0.174**</b> <b>(0.050)</b>
Skilled manual	0.383 (0.021)	0.424 (0.017)	<b>0.040</b> <b>(0.027)</b>	0.396 (0.037)	0.330 (0.034)	<b>-0.066</b> <b>(0.050)</b>	0.529 (0.032)	0.551 (0.027)	<b>0.022</b> <b>(0.041)</b>
Unskilled	0.364 (0.023)	0.431 (0.020)	<b>0.067*</b> <b>(0.031)</b>	0.429 (0.039)	0.450 (0.032)	<b>0.020</b> <b>(0.050)</b>	0.401 (0.038)	0.446 (0.035)	<b>0.045</b> <b>(0.052)</b>
All	0.570 (0.010)	0.455 (0.009)	<b>-0.071**</b> <b>(0.024)</b>	0.526 (0.018)	0.455 (0.015)	<b>-0.071**</b> <b>(0.024)</b>	0.665 (0.015)	0.577 (0.015)	<b>-0.088**</b> <b>(0.021)</b>

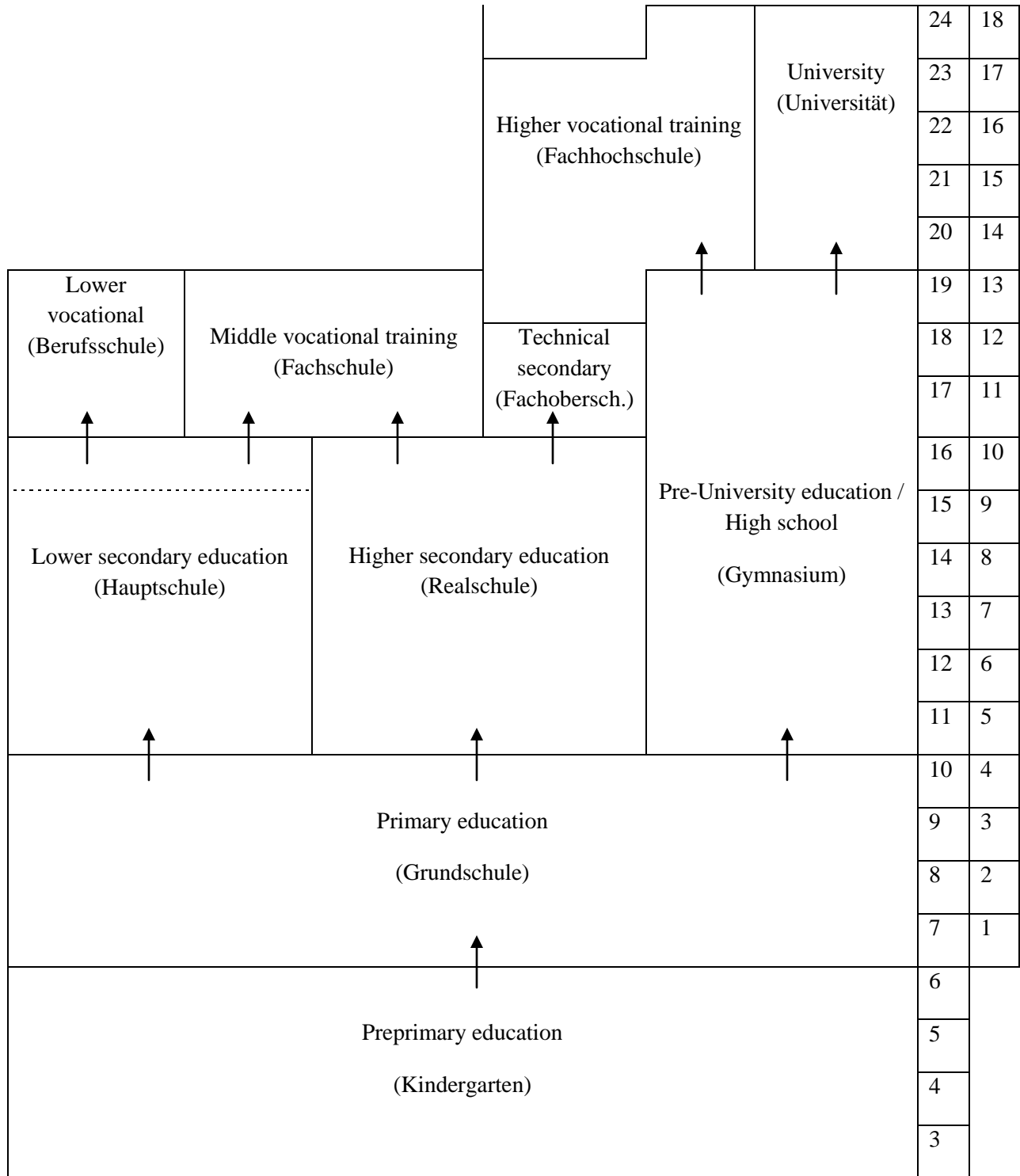
Significance levels for differences: \*  $p < 0.05$ ; \*\*  $p < 0.01$

**Table 5.** Two-level OLS regressions of educational attainment

	All	Higher service	Lower service	Higher non-manual	Self-employed	Skilled manual	Unskilled
<i>Coefficient estimates</i>							
Year of birth	0.082** (0.004)	0.015 (0.122)	0.081** (0.013)	0.038** (0.011)	0.082** (0.007)	0.078** (0.005)	0.074** (0.006)
Age	0.058** (0.004)	-0.189 (0.015)	0.064** (0.016)	0.010 (0.014)	0.054** (0.008)	0.060** (0.007)	0.053** (0.007)
Sex	-0.321** (0.029)	-0.557** (0.118)	-0.344** (0.106)	-0.284* (0.112)	-0.359** (0.058)	-0.343** (0.044)	-0.293** (0.048)
Age mother at birth	0.034** (0.004)	0.041** (0.015)	0.059** (0.015)	0.058** (0.013)	0.000 (0.008)	0.024** (0.005)	0.022** (0.005)
Number of brothers	-0.157** (0.019)	0.066 (0.078)	-0.012 (0.068)	-0.077 (0.071)	-0.085* (0.033)	-0.151** (0.027)	-0.099** (0.029)
Number of sisters	-0.128** (0.019)	0.107 (0.072)	0.002 (0.070)	-0.105 (0.068)	-0.141** (0.036)	-0.142** (0.026)	-0.052 (-0.029)
Birth order	-0.142** (0.013)	-0.347** (0.071)	-0.248** (0.055)	-0.286** (0.051)	-0.047 (0.028)	-0.087** (0.022)	-0.096** (0.019)
Constant	-156.822** (7.252)	-21.898 (24.487)	-154.780** (26.724)	-70.086** (22.484)	-157.285** (14.255)	-149.455** (10.344)	-143.445** (11.531)
<i>Variance components</i>							
Family	2.205 (0.060)	1.418 (0.227)	2.120 (0.286)	1.442 (0.207)	1.641 (0.097)	1.188 (0.056)	1.042 (0.052)
Individual	2.126 (0.018)	3.441 (0.144)	2.856 (0.103)	3.211 (0.132)	2.277 (0.033)	1.817 (0.027)	1.440 (0.019)
Sib. correlation	0.509 (0.007)	0.292 (0.036)	0.426 (0.029)	0.310 (0.034)	0.419 (0.017)	0.395 (0.015)	0.420 (0.017)

\* p &lt; 0.05; \*\* p &lt; 0.01

**Figures**



**Figure 1.** Educational system in (West) Germany (Sieben, Huinink, and de Graaf 2001: 404).

**Appendix: Coefficient estimates for brother correlations, sister correlations, and earlier and later cohorts.**

**Brothers**

	All	Higher service	Lower service	Higher non-manual	Self-employed	Skilled manual	Unskilled
<i>Coefficient estimates</i>							
Year of birth	0.069** (0.005)	0.001 (0.016)	0.070** (0.018)	0.031* (0.015)	0.069** (0.009)	0.066** (0.007)	0.062** (0.007)
Age	0.051** (0.005)	-0.016 (0.020)	0.061** (0.021)	0.012 (0.200)	0.044** (0.011)	0.055** (0.009)	0.047** (0.009)
Age mother at birth	0.037** (0.005)	0.026 (0.021)	0.084** (0.022)	0.081** (0.200)	0.009 (0.011)	0.022* (0.008)	0.020* (0.008)
Number of brothers	-0.128** (0.026)	0.081 (0.112)	-0.027 (0.102)	-0.013 (0.093)	0.007 (0.047)	-0.152** (0.038)	-0.115** (0.042)
Number of sisters	-0.150** (0.024)	0.138 (0.099)	0.025 (0.102)	-0.122 (0.095)	-0.163** (0.046)	-0.139** (0.034)	-0.085* (0.038)
Birth order	-0.161** (0.021)	-0.328** (0.108)	-0.338** (0.087)	-0.417** (0.091)	-0.044 (0.043)	-0.106** (0.036)	-0.095** (0.030)
Constant	-131.715** (9.047)	6.209 (32.283)	-134.436** (25.939)	-57.082 (30.282)	-132.386** (17.740)	-126.557** (13.446)	-120.234** (14.454)
<i>Variance components</i>							
Family	2.208 (0.091)	1.598 (0.325)	2.541 (0.507)	1.404 (0.395)	1.378 (0.135)	1.141 (0.089)	1.173 (0.087)
Individual	2.554 (0.035)	3.610 (0.271)	3.136 (0.204)	3.795 (0.291)	2.972 (0.087)	2.283 (0.058)	1.603 (0.041)
Sib. correlation	0.464 (0.012)	0.307 (0.065)	0.448 (0.047)	0.270 (0.059)	0.317 (0.030)	0.333 (0.026)	0.423 (0.026)

### Sisters

	All	Higher service	Lower service	Higher non-manual	Self-employed	Skilled manual	Unskilled
<i>Coefficient estimates</i>							
Year of birth	0.093** (0.004)	0.025 (0.016)	0.089** (0.016)	0.047** (0.013)	0.095** (0.008)	0.086** (0.006)	0.085** (0.007)
Age	0.064** (0.005)	-0.022 (0.019)	0.066** (0.019)	0.013 (0.016)	0.062** (0.010)	0.063** (0.008)	0.059** (0.008)
Age mother at birth	0.036** (0.005)	0.054** (0.020)	0.050* (0.019)	0.038* (0.017)	-0.007 (0.010)	0.028** (0.006)	0.025** (0.007)
Number of brothers	-0.167** (0.022)	0.050 (0.098)	0.029 (0.082)	-0.099 (0.093)	-0.147** (0.040)	-0.151** (0.031)	-0.080** (0.031)
Number of sisters	-0.113** (0.023)	0.059 (0.099)	0.011 (0.076)	-0.125 (0.095)	-0.129** (0.047)	-0.121** (0.034)	-0.022 (0.034)
Birth order	-0.123** (0.017)	-0.371** (0.095)	-0.201* (0.075)	-0.202* (0.075)	-0.034 (0.033)	-0.066** (0.024)	-0.081** (0.026)
Constant	-180.306** (8.525)	-41.575 (31.269)	-171.212** (31.574)	-87.737** (26.955)	-183.185** (17.004)	-167.535** (12.247)	-164.542** (13.271)
<i>Variance components</i>							
Family	2.271 (0.067)	2.005 (0.361)	2.042 (0.302)	1.452 (0.258)	1.918 (0.117)	1.316 (0.066)	0.984 (0.055)
Individual	1.523 (0.017)	2.921 (0.172)	2.292 (0.127)	2.56 (0.168)	1.450 (0.031)	1.188 (0.031)	1.100 (0.025)
Sib. correlation	0.598 (0.010)	0.407 (0.057)	0.471 (0.045)	0.362 (0.052)	0.570 (0.021)	0.525 (0.020)	0.472 (0.024)

**Earlier cohort (1919-45)**

	All	Higher service	Lower service	Higher non-manual	Self-employed	Skilled manual	Unskilled
<i>Coefficient estimates</i>							
Year of birth	0.117** (0.014)	0.102 (0.071)	0.073 (0.067)	-0.102 (0.077)	0.148** (0.030)	0.058* (0.023)	0.086** (0.023)
Age	0.098** (0.012)	0.036 (0.057)	0.089 (0.056)	-0.095 (0.064)	0.119** (0.025)	0.059** (0.019)	0.076** (0.019)
Age mother at birth	0.018** (0.005)	0.004 (0.030)	0.017 (0.028)	0.058 (0.027)	-0.005 (0.010)	0.021* (0.008)	0.020** (0.007)
Number of brothers	-0.122** (0.025)	-0.039 (0.180)	0.109 (0.129)	-0.114 (0.130)	-0.075 (0.042)	-0.118** (0.035)	-0.081* (0.032)
Number of sisters	-0.109** (0.025)	0.111 (0.144)	-0.048 (0.102)	-0.302* (0.138)	-0.134** (0.045)	-0.096** (0.034)	0.012 (0.032)
Birth order	-0.071 (0.018)	-0.097 (0.134)	-0.078 (0.087)	-0.118 (0.105)	-0.021 (0.036)	-0.038 (0.031)	-0.065* (0.024)
Constant	-226.254** (28.470)	-191.781 (139.75)	-140.791 (131.946)	205.864 (152.128)	-286.490** (59.813)	-110.777* (46.143)	-168.035** (45.170)
<i>Variance components</i>							
Family	2.039	1.745	2.680	1.734	1.603	0.808	0.542
Individual	1.555	3.948	2.232	2.566	1.648	1.360	0.874
Sib. correlation	0.567	0.307	0.546	0.403	0.493	0.373	0.383

**Later cohort (1946-75)**

	All	Higher service	Lower service	Higher non-manual	Self-employed	Skilled manual	Unskilled
<i>Coefficient estimates</i>							
Year of birth	0.062** (0.005)	0.013 (0.014)	0.050** (0.015)	0.029* (0.013)	0.053** (0.010)	0.065** (0.007)	0.053** (0.008)
Age	0.036** (0.008)	0.023 (0.023)	0.022 (0.027)	-0.004 (0.024)	0.018 (0.017)	0.033** (0.011)	0.024 (0.013)
Age mother at birth	0.047** (0.005)	0.063** (0.019)	0.087** (0.019)	0.053** (0.015)	0.005 (0.013)	0.025** (0.008)	0.025** (0.009)
Number of brothers	-0.178** (0.028)	0.030 (0.088)	-0.064 (0.091)	-0.018 (0.088)	-0.089 (0.062)	-0.185** (0.040)	-0.107** (0.046)
Number of sisters	-0.168** (0.027)	0.065 (0.088)	-0.000 (0.090)	-0.083 (0.083)	-0.130* (0.063)	-0.189** (0.039)	-0.135** (0.046)
Birth order	-0.232** (0.022)	-0.439** (0.093)	-0.414** (0.083)	-0.354** (0.091)	-0.144* (0.057)	-0.137** (0.035)	-0.148** (0.039)
Constant	-118.463** (9.029)	-20.834 (27.275)	-93.832** (29.574)	-51.703* (25.860)	-98.960** (19.974)	-124.130** (13.538)	-100.382** (16.705)
<i>Variance components</i>							
Family	2.238	1.669	1.687	1.289	1.659	1.360	1.290
Individual	2.592	3.010	3.143	3.516	3.204	2.193	1.893
Sib. correlation	0.463	0.357	0.349	0.268	0.341	0.383	0.405