Does Money Buy Higher Schooling? Evidence from Secondary School Track Choice in Germany

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Abstract. The German schooling system selects children into different secondary school tracks already at a very early stage in life. School track choice heavily influences choices and opportunities later in life. It has often been observed that secondary schooling achievements display a strong correlation with parental income. We use sibling fixed effects models and information on a natural experiment in order to analyze whether this correlation is due to a causal effect of income or due to unobservable factors that themselves might be correlated across generations. Our main findings suggest that income has no positive causal effect on school choice and that differences between high- and low-income households are driven by unobserved heterogeneity, e.g. differences in motivation or preferences.

JEL classification: D31, I21, J13.

Keywords: Child poverty, educational attainment, secondary schools, sibling differences, natural experiment.

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1. Introduction

According to inequality-related or relative concepts of poverty, child poverty rates increased considerably in Germany during the last couple of years (CORAK ET AL. (2005)). Public attention in child poverty was additionally boosted by the reforms of the social security system between 2003 and 2005 ('Hartz' reforms). Many commentators claimed that the only conceivable outcome of this set of reforms could be increased poverty. Among the detrimental consequences that could arise from an exacerbation of the income situation of children and their families are lower educational attainments. At first glance, these concerns are supported by the facts, since the association between income and educational attainment is well documented. While many studies analyzing this association focus on either test scores or highest school attainment (HAVEMAN and WOLFE (1995) and MAYER (2002) provide a general overview on empirical findings), this paper focuses on secondary school track choice, and aims at uncovering causal mechanisms.

Within the German educational system children are sorted to three different school tracks preparing for either academic or more technically oriented job profiles. This sorting takes place at a very early stage, generally after primary school when children are between 10 and 12 years old, and has long lasting effects on later labour market and earnings perspectives (DUSTMANN (2004)). Thus, school track choice is important because it is highly correlated with choices and opportunities later in life. Although sorting is supposed to be based on achievements during primary school and expected outcomes later on, it is also likely to be influenced by parental background. DUSTMANN (2004), for example, shows that track choice of children is highly correlated with educational attainment of the parents. BÜCHEL ET AL. (2001), JENKINS and SCHLUTER (2002), as well as SCHNEIDER (2004) show that children from poor households generally choose lower level tracks. Yet these studies leave open the question, whether choices differ due to heterogeneity in the level of ability of children from different families or whether these choices are causally affected by parental background and family income.

Why should we expect income to have any causal effect on school track choice? BECKER and TOMES (1979, 1986) argue that parents invest in children, e.g. in schooling, in order to maximize their own utility. Parental utility is affected by children's outcomes because parents receive part of children's income later on or because parents benefit from child well-being, i.e. they are altruistic. In this model, investment in children's education is optimal when the marginal rate of return to education equals the rate of return to other investments. In equilibrium, optimal investment in education is independent of parental income if parents have access to perfect capital markets. Thus, an effect from income to school choice exists, if capital markets are not perfect and parental budgets are constrained. Although there is generally no fee for secondary schooling in Germany, direct costs might still differ between school tracks. This might be due to costs associated with school attendance, e.g. transportation costs. In some, mostly rural areas, higher track schools are less numerous than lower track schools and thus transportation is more costly and time consuming. Also, parents might take into account expected costs for additional private lessons, if children do not succeed in higher track schools. A second reason for a causal impact of household income on school choice exists, if discount rates for future earnings or the level of altruism differs between households due to differences in the level of parental income. In this case, the opportunity cost of not working will differ for otherwise identical children. Since the number of years until completion of schooling differs between tracks and is shorter in lower ranked tracks, poor households might be more likely to send children to lower ranked tracks, which

basically prepare children for taking up apprenticeship or any other work at age 16, when compulsory school attendance ends.

Other reasons for income having a causal effect on school choice are that low income might cause emotional stress among parents (see MCLOYD (1990)). This in turn might lead to lower parenting quality, i.e. the parents are less supportive, consistent and involved, and thus have adverse effects on child attainments, e.g. during primary school where expectations on future success are formed. Consequently, teachers are more likely to recommend lower ranked tracks. Finally, in a few cases severe poverty can also lead to a reduction in food availability, e.g. lack of a daily breakfast, which in turn might lead to reduced child attainments in primary school, as well.

Apart from any causal effects, however, there are several other reasons why income and school choice are correlated. First of all, it is likely that parents with high income also have higher education, reflecting differences in ability that might be passed on to the child. In principle, the empirical analysis will be able to account for parental education and any other observable household characteristics. Yet, in addition there might be unobservable factors that are transmitted from parents to children, for example motivation or aspects of ability that are not reflected in parental education. Also, since higher schooling is generally associated with higher earnings later on, high-income parents might aspire that their children earn high incomes as well, i.e. parental preferences differ. Furthermore there might exist social relations and pressure from peer groups which influence parental decisions on children and make some parents more likely to choose higher-level tracks for their offspring than others. Or parental abilities to care for children differ, i.e. high income parents might simply be better parents.

Existing studies on parental income and school track choice in Germany generally support the hypothesis that income is positively associated with choosing higher tracks. BÜCHEL ET AL. (2001) find that children in the highest income quintile display significantly higher rates of attendance of the highest track, even when controlling for other parental background characteristics. Poor children, however, do not differ from children with intermediate income. SCHNEIDER (2004) finds that the coefficient of the income variable differs across the income distribution. For those with median income, increases in income are positively associated with attending the highest track, while increases in income seem to play no significant role for those at the higher and lower end of the income distribution. Finally, JENKINS and SCHLUTER (2002) show that higher income is positively correlated with attending higher tracks and that income during late childhood matters more than during early childhood. Their findings suggest that the association between income and track choice is linear.

All existing studies for Germany have in common that they rely on regression-based methods controlling only for a modest set of family related and demographic characteristics. Consequently, the estimated effect of income might be spurious, due to omission of several other (often unobservable) factors that might be associated with differences in household income and track choice. This paper tries to identify the causal effect of income by applying sibling fixed effects models comparing track choices of siblings who were sorted to tracks under different financial circumstances. Furthermore, we use information on a natural experiment leading to exogenous variation in household incomes, i.e. we compare children choosing school tracks before and after the reform of the child benefit system in 1996. Our main findings suggest that income has no positive causal effect on school choice and that differences between high- and low-income households are predominantly driven by unobserved heterogeneity.

The remainder of the paper is organized as follows. In the next section we shortly provide information on the secondary schooling system in Germany. We also show that track choice has considerable influence on other outcomes later in life. In the ensuing section we present the data and our econometric models. Results are presented in section 4 and conclusions are provided in the last section.

2. Institutional Background

In Germany, secondary education is compulsory and generally provided free of charge. Traditionally, there are three school tracks which prepare children for different job profiles. *Hauptschule*, which is regarded as the lowest secondary school track, provides basic general education and some applied labour market skills; it mainly prepares for blue-collar work. *Realschule* provides a more extensive general education and applied skills relevant for white-collar work. Realschule is regarded as intermediate track. Finally, *Gymnasium* is regarded as highest track, because it provides in-depth general education preparing for academic careers. Children succeeding in Gymnasium obtain an upper secondary school degree (Abitur) which is the official university entrance level.[1]

Since education is regulated on the state level (Länder) there are some differences concerning this clear-cut division of tracks. In some Länder the lowest and the intermediate track are linked together more closely than in others. Furthermore, regulations differ on the timing of separation of children between tracks. In the majority of Länder children are sorted to secondary school tracks after fourth grade when children are about 10 years old. In other Länder, however, children are sorted after sixth grade when they are age 12. Track choice after primary school is influenced by a recommendation of teachers in primary school, mainly based on performance during primary school, and the final decision of the parents. In some Länder, parents can choose secondary school track quite freely without having to adhere to teacher recommendations, in others the child has to pass additional entrance tests if parents decide for higher level tracks than those recommended by teachers (KMK (2006)).

After initial sorting, changing from one track to the other is generally possible; however, the majority of children do not change tracks. Evidence for this is provided in SCHNEPF (2002) and in table 1, where we juxtapose school track attended at age 14 with highest schooling degree at age 21. For West German youths born between 1970 and 1984, we find that 67% of those attending the lowest school track at age 14 earn a degree from Hauptschule (secondary general school degree) as highest schooling degree, 61% of those attending Realschule hold an intermediate degree which is the degree obtained after finishing Realschule, and 66% of those attending Gymnasium manage to obtain upper secondary school degree, i.e. university entrance certificate. Some 21% of those attending Realschule at age 14 and a mere 5% of those attending Hauptschule manage to earn an upper secondary school degree or a commercial/technical school degree, which also provides access to university. Furthermore, approximately 10% of each track drop out of school without holding a degree or still attend school at age 21.

[1] Apart from these three school tracks there also exist comprehensive schools (Gesamtschulen). These are left out of the analysis, because there is no unambiguous ranking with the other tracks in terms of educational requirements and prestige of final degree. In our sample 7.5% of children in West Germany attend this type of school. Furthermore, there are commercial and technical high schools which impart advanced knowledge and award a degree, which provides restricted access to universities. Children attend commercial and technical high schools after finishing Hauptschule or Realschule. They are left out of the analysis because children do not attend these school types at age 14, which is the age we focus on.

DUSTMANN (2004) shows that different school-leaving certificates are followed by different post-secondary educational choices and translate into large wage differentials later in life. More specifically, for West German birth cohorts 1920 to 1956 he finds that the majority of men holding a general secondary degree went for blue-collar apprenticeship training afterwards, the majority of men with an intermediate degree went for white-collar apprenticeship training or attended a vocational school, and the majority of those with upper secondary degree attended university. For women results are similar. However, women with general secondary degree often favoured no further training or attending vocational school over blue-collar apprenticeship training. Analyzing entry wages of those entering the labour market between 1984 and 1990, DUSTMANN (2004) also shows that, controlling for age and cohort, individuals with an intermediate school degree earn 21-33% more than those with a general school degree (16-27% if further vocational training or university degree is additionally controlled for), and those with upper secondary school degree earn 54-73% more (30-37%). Taken together, these results suggest that school track choice is a vital decision taken quite early in life.

Table 1 – School track choice and highest school leaving certificate in West Germany

	Highest school leaving certificate at age 21						
School track at age 14	Upper secondary school deg.[1)]	Technical school degree[2)]	Intermediate secondary school deg.	Secondary general school deg.	Other degree	Dropout without degree	No degree yet
Gymnasium	66.22	4.25	13.05	1.40	0.00	11.50	3.58
Realschule	15.80	4.72	60.56	8.86	1.11	7.80	1.15
Hauptschule	1.39	3.94	18.72	67.23	0.50	8.23	0.00

Note: Table provides proportion of individuals (in %) holding a certain school degree at age 21 after having attended one of three school tracks at age 14. [1)] Upper secondary school degree (Abitur) is the official university entrance level. [2)] Degree from commercial or technical high school (Fachhochschulreife) is partly comparable to upper secondary school degree but provides only limited access to university.
Source: GSOEP, own calculations.

3. Data and Methods

In the empirical analysis, we use data from the *German Socio-Economic Panel* (GSOEP).[2] The GSOEP is a representative longitudinal study of private households in Germany (see HAISKEN-DENEW and FRICK (2003)) and spans the years 1984 to 2005. It collects information on households and individuals. Individual information is available for all household members older than 16 years of age. The information includes household socio-demographic composition, occupational biographies, employment, income and earnings, among others. For children, the household head provides some individual information, e.g. on school track attendance. Our analysis is mainly based on a West German sample using information from GSOEP samples A and B. This West German sample provides information on income also during early childhood. For comparison we additionally use a sample for reunified Germany which is based on GSOEP samples A to E. Income histories for this sample are much shorter, ranging back to 1992 at most.

[2] The data used in this paper were extracted using the Add-On package PanelWhiz v1.0 (Oct 2006) for Stata. PanelWhiz was written by Dr. John P. Haisken-DeNew (john@panelwhiz.eu). The following authors supplied PanelWhiz SOEP Plugins used to ensure longitudinal consistency, John P. Haisken-DeNew (12), Markus Hahn and John P. Haisken-DeNew (22). The PanelWhiz generated DO file to retrieve the SOEP data used here and any Panelwhiz Plugins are available upon request. Any data or computational errors in this paper are our own. HAISKEN-DENEW and HAHN (2006) describe PanelWhiz in detail.

Central to our analysis is the calculation of income. We define three different income measures in order to check the sensitivity of our results: net household income, equivalent household income, and an indicator for living in relative poverty. Net household income includes labour income and income from self-employment, asset income, income from private and public transfers, and pension income. From these we subtract tax payments and social security contributions. In essence, this refers to the total money income available to the household after taxes and social transfers, given in real terms (year 2000 euros). Our second measure accounts for economies of scale by using the square root of the number of household members as the equivalence scale. Finally, a child is defined as living in relative poverty if the household has less than 50% of the prevailing median equivalent income in the population. Apart from income we control for several other factors that might influence track choice, including the gender of the child, an indicator for firstborn children, the number of siblings living in the household when the child is age 14, mother's age and age squared, an indicator for children living in households with a foreign household head, indicators for the size of town, year dummies that are supposed to reflect trends in track choice over time, dummies for Länder that are supposed to reflect differences in regional school regulations, and a set of indicators for the education of the parents. We control for mother's and father's highest schooling degrees and their highest vocational degrees. There is also an indicator for whether mother's/father's educational information is missing, which is equal to one if the respective parent did not respond or if the parent is missing altogether (e.g. in single parent households). Summary statistics for these variables are provided in the appendix in the left half of table A.1.

In the case at hand, we analyze school attendance at age 14 and use information on children attending Hauptschule, Realschule, or Gymnasium. Children attending other schools are left out of the analysis. We focus on 14 year-old children for several reasons. First, not all children have switched to secondary school track at an earlier age, because of differences in the timing of sorting between Länder, possible repetition of classes during primary school, or delayed entry to primary school. Furthermore, since schooling is compulsory until age 16 at least, all children are still within the schooling system. Second, because this choice fosters comparability across studies; most existing studies on track choice focus on children aged 14. Finally, the number of observations in the GSOEP, where information on school track attendance is available, is smaller for children at younger ages.

Overall, there are 3,670 observations on 14 year-old children in the West German sample (4,876 in the sample using data for reunified Germany from 1992 on). For 2,959 (3,879) of these, we know whether they attend Hauptschule, Realschule, or Gymnasium. In the West German sample we lose one (453) observation, because information on the parents is missing, or sample weights are zero. Complete information on income at age 10 is available for 2,159 (2,115) observations, at age 7 to 10 for 1,620 (1,172) observations and at age 3 to 6 for 1,159 (542) observations. For each child GSOEP provides identification numbers of the mother and the spouse/partner of the mother. We use mother's identification number in order to identify siblings.

Several different types of econometric models might be applied to analyze track choice. All models have in common that the observable choice y of one of the discrete outcomes is based on an unobservable underlying latent variable y^* which represents the propensity to select the track of interest. A quite straightforward model is the ordered logit/probit model, which has been used, for example, by JENKINS and SCHLUTER (2002). Assume that the latent

variable of child *i* is influenced by parental and child characteristics x_i and an error term u_i, i.e., $y_i^* = x_i'\beta + u_i$. The child (or his parents) will choose outcome *k* if y_i^* exceeds a certain threshold μ_k but is smaller than the next higher threshold μ_{k+1}, i.e. the probability for choosing outcome *k* is $P(y_i = k) = F(\mu_{k+1} - x_i'\beta) - F(\mu_k - x_i'\beta)$, with $F(\cdot)$ representing the cumulative distribution function of the error term. In our analysis we will use the logistic distribution.

A related model is the generalized ordered logit model which relaxes the assumption put on β, namely to be independent of the actual outcome (see WILLIAMS (2006), who also provides an estimator for Stata). This so-called 'proportional odds/parallel lines' assumption is violated, if for example the effect of living in a large town (relative to the baseline, a small town) on attendance of highest track compared with the effect of living in a medium-sized town is not proportional to the two effects on attendance of lowest track. In the generalized ordered logit model the coefficients are choice-specific (β_k) and the probability for choosing outcome *k* is $P(y_i = k) = F(\mu_{k+1} - x_i'\beta_{k+1}) - F(\mu_k - x_i'\beta_k)$. The generalized ordered logit model can be approximated by splitting up the outcome into *K-1* binary outcomes $\tilde{y}_i^k$, indicating whether individual *i* has chosen outcome *k* or higher versus an outcome lower than *k*. The probability for choosing at least outcome *k* is $P(\tilde{y}_i^k = 1) = F(\mu_k - x_i'\beta_k) \quad \forall k = 2,...,K$. This strategy has been followed, for example, by BÜCHEL ET AL. (2001), who analyze attendance of Gymnasium (versus attendance of Realschule or Hauptschule). They, however, do not consider the second outcome, i.e. attendance of at least Realschule versus attending Hauptschule.

The most important strength of these redefined binary outcomes is that they are suitable for estimating sibling fixed effects models, namely the conditional fixed effects logit model. The main advantage of these models is that they allow to control for unobserved time invariant parental characteristics. A weakness of these models is that they can only identify the parameters using those observations, where the outcome variable differs between siblings. Fixed effects logit models have been used, for example, by FRANCESCONI ET AL. (2006), who analyze the effect of single parenthood on school track choice.

If one is not willing to accept the assumption that track choice is an inherently ordered outcome, one can alternatively use the multinomial logit model. This has been done by SCHNEIDER (2004). We however do not consider the multinomial logit, because we believe that there is an inherent order in track choice as required learning potential of the child, rewarded prestige and future earnings perspectives clearly increase from Hauptschule to Realschule and further to Gymnasium. Instead, we present results obtained by estimating the ordered logit model, the generalized ordered logit model and the conditional fixed effects model.

4. Results

Taking a first look at school track choices (table 2), we find that 39% of children of West German birth cohorts 1973 to 1991 attended the highest school track (Gymnasium) when they were age 14, 31% attended the intermediate track (Realschule) and 30% the lowest track (Hauptschule). Among children living in poor households at age 10, however, only 16% attended Gymnasium, while more than half attended Hauptschule. In the following we

analyze whether household income has a causal effect on track choice. First we present results of several ordered logit models controlling for a core set of observable individual and parental characteristics. Since any correlation between income and school track choice observed in these models might be due to either a causal effect of income on school choice or unobserved differences in child or household characteristics, which are both associated with differences in income and school choice, we then present results for our siblings sample. Track choice of siblings is analyzed using conditional fixed effects logit models. Finally, we use information on a natural experiment which took place in 1996, when child benefits were increased considerably. This latter analysis is based on comparing track choice before and after the increase in child benefits.

Table 2 – School track attendance at age 14 in West Germany

School track at age 14	Overall	Non-poor at age 10	Poor at age 10
Gymnasium	38.96	40.37	16.26
Realschule	31.03	31.28	27.06
Hauptschule	30.00	28.36	56.69

Note: Table provides weighted shares (in %) of West German children attending one of three secondary school tracks. The sample excludes those children who attend any other type of secondary school, e.g. comprehensive school. Poverty is defined as having less than 50% of contemporaneous West German median equivalent household income.

Ordered Logit Models

In the first part of this section we present results of several ordered logit models using all three income measures mentioned above. Table 3 presents results for a set of specifications using several poverty indicators. These indicators measure poverty at different points in time: (i) we use an indicator for having been poor at age 10, the year when the decision on track choice is generally taken, (ii) an indicator for ever having been poor while the child was 7 to 10 years old, i.e. during primary school, (iii) the number of years having been poor during primary school, (iv) an indicator for ever having been poor while the child was 3 to 6 years old, and (v) the number of years having been poor during this period. In table 3, we present the coefficients of the poverty indicators as well as the marginal effects of switching from a poor to a non-poor household on each of the probabilities to attend a specific track. This marginal effect is estimated for a reference child.[3]

As can be seen in table 3, all coefficients are negative and significant at the 5%-level or at least the 10%-level. This indicates that, even after controlling for a whole set of other parental background factors, poor children choose lower tracks significantly more often.[4] Compared to children who experienced poverty, the probability of choosing Gymnasium increases by an impressing 12 percentage points if a child has never experienced poverty during primary school, while the probabilities to choose one of the other tracks decrease by 6 percentage points each. Comparing the point estimates of the coefficients of all specifications, it seems

[3] Our reference child is a girl, who has one more sibling, but is the firstborn child, who is living in a non-foreigner household, in a small town in Baden-Württemberg, in the year 2005, who has a mother age 41 and has parents who both attended Realschule and completed an apprenticeship.

[4] The effects associated with the other control factors used in the equations are not shown in the tables and can be obtained upon request. In all specifications we find that schooling and vocational attainment of the parents show a strong correlation with children's track choice, with children of better educated parents attending higher tracks. This confirms findings of most previous studies. Furthermore we find that the number of siblings in the household has no influence on track choice, which is in line with findings of BAUER and GANG (2001). However, birth sequence seems to be important; firstborn children generally attend higher school tracks than their siblings. Also, girls are generally more likely to visit higher tracks than boys. These effects do hardly differ between the specifications, independent of which income measure or poverty indicator is used.

that poverty in early childhood might be more important, i.e. has a larger effect, than poverty in later childhood. Yet, the difference between the point estimates does not appear to be significant from a statistical perspective and, if we control for both, poverty during primary school and in the time before, we do not find that poverty during earlier times is more important (see table A.2).

Table 3 – Ordered logit results for different poverty indicators (West Germany)

	Poor at age 10		Ever poor age 7 to 10		Years poor age 7 to 10		Ever poor age 3 to 6		Years poor age 3 to 6	
	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error
Poverty indicator	*-0.504*	0.269	**-0.485**	0.237	*-0.225*	0.133	**-0.667**	0.267	**-0.458**	0.143
Observations	2159		1620		1620		1159		1159	
	Marginal effect		Marginal effect		Marginal effect		Marginal effect		Marginal effect	
P(Hauptschule)	-5.57		-6.28		-2.71		-7.57		-5.01	
P(Realschule)	-6.94		-5.75		-2.91		-8.91		-6.38	
P(Gymnasium)	12.52		12.03		5.62		16.48		11.39	

Note: Coefficients printed in *italics* indicate marginal significance (10%-level), and coefficients printed in **boldface** indicate statistical significance at 5%-level. The marginal effect is the effect of switching from poor to non-poor for a reference child (see footnote 3). Specifications include core set of control factors as described in section 3.

Results for equivalent income measured at different points in time are presented in table 4. Experimenting with several specifications using income and its square and income interacted with an indicator for above median income as explanatory variables, we find that income squared and the interaction term, respectively, are insignificant in all specifications.[5] Therefore we present results for linear specifications only. The marginal effects are provided for an increase of equivalent household income from 6,000 euros, which is close to the average annual equivalent household income of a poor household, to 7,200 euros, i.e. by 20%. The coefficient of the income variable is positive in all three specifications and larger for those income measures taken earlier during childhood. Increasing average income by 20% during primary school is associated with an increased attendance of Gymnasium of approximately 2 percentage points and a reduction in the attendance of Hauptschule of almost equal size. This marginal effect seems to be considerably smaller than the one observed for switching from poverty to non-poverty. However, in comparing these marginal effects, one has to take into account that the average equivalent income of a non-poor household is 2.8 times the income of a poor household, i.e. the switch from poor to non-poor is associated with nine times an income increase by 20%. Thus the marginal effects observed for both income measures are not too different from one another.

Since there are hardly any differences between the estimation results when using equivalent household income compared to using net household income instead, the latter are not discussed (for results see table A.3). In addition to these basic ordered logit models we also estimated generalized ordered logit models. Results from these models are very similar to those of the basic model and, hence, are not present either.[6] Tests for the hypothesis that β_k is the same for all tracks *k* are not rejected for most of the control factors, including the income measures. We find that only some of the Länder dummies, the indicator for firstborn child, and the indicator for mother with university degree are track-specific in some of the

[5] This is in line with JENKINS and SCHLUTER (2002), who report that the effect of income is linear instead of non-liner. However, findings by BÜCHEL ET AL. (2001) and SCHNEIDER (2004) are different on this specific aspect.
[6] Results are available from the authors upon request.

specifications. Overall, results for reunified Germany are quite similar to those for West Germany (see table A.4).

Table 4 – Ordered logit results for different measures of equivalent income (West Germany)

	Income at age 10		Average annual income at age 7 to 10		Average annual income at age 3 to 6	
	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error
Equivalent income[1)]	**0.051**	0.015	**0.079**	0.014	**0.102**	0.020
Observations	2159		1620		1159	
	Marginal effect		Marginal effect		Marginal effect	
P(Hauptschule)	-0.95		-1.88		-2.18	
P(Realschule)	-0.48		-0.08		-0.35	
P(Gymnasium)	1.43		1.96		2.53	

Note: Coefficients printed in *italics* indicate marginal significance (10%-level), and coefficients printed in **boldface** indicate statistical significance at 5%-level. The marginal effect is the effect of increasing equivalent income by 20% (from 6,000 to 7,200 euros) for a reference child (see footnote 3). Specifications include core set of control factors as described in section 3. [1)] Per thousand euros.

Taken together, we find that having more income or being non-poor is positively associated with higher school track choice and that results are very robust, i.e. are independent of the income measure or estimation method used. Whether these associations represent causal effects of income on track choice is analyzed in the next two parts of this section.

Sibling Fixed Effects Models

In the second part of this section we present results of sibling fixed effects models. Sibling fixed effects models assume that unobserved parental characteristics, such as motivation or ability, do not change over time and affect all siblings equally. In comparing the outcomes of siblings, these unobserved factors cancel out removing potential omitted variable bias of the estimated effects of the observed factors. In our specifications, these observed factors are mainly changes in household income and poverty status that took place between the track choice of one sibling and the track choice of another sibling. Furthermore we account for differences in gender, birth sequence, mother's age and size of town.

Sibling comparisons have been criticized because income often changes slowly; differences between siblings might therefore be small. In addition, measurement error in the income variables may lead to an attenuation bias. Table A.5 however provides evidence that in our sample income changes quite considerably. While only 9% of siblings experience different poverty states when they are age 10, the mean absolute difference in equivalent income is more than 4,000 euros (median 3,105 euros) and the mean absolute difference in net household income is 10,000 euros (median 7,117 euros). Furthermore, sibling samples have been criticized for being selective. At least, they only identify the effect of interest using those observations of households with at least two children where outcomes differ between siblings. Table A.1 juxtaposes means of our control factors in the siblings and the entire West German sample. The last column provides the differences between means in percent. We find that children in the siblings sample are somewhat less likely to attend Gymnasium and more likely to attend Realschule, their mothers and fathers generally hold lower schooling and vocational degrees than in the entire sample, and reside in medium-sized towns less often. Yet, this should not challenge our findings, if the assumption holds that the effect of income is equal for all children and independent of other household characteristics, an assumption, which generally is also imposed in those models used for analyzing outcomes in the entire sample.

Tables 5 and 6 present results for the sibling fixed effects models for specifications using poverty indicators and equivalent income. Results for net household income are reported in table A.6. All tables present results for two outcomes. The first outcome indicates whether the child attends Gymnasium (vs. Realschule or Hauptschule) and the second whether it attends at least Realschule (i.e. Gymnasium or Realschule vs. Hauptschule). We find that attendance of Gymnasium is not affected by income or poverty status on a significant level in any of the specifications. This indicates that the choice of highest track is independent of financial endowments of the household and that those findings presented in the first part of this section are probably biased due to unobservable factors that differ between rich and poor households. For attendance of at least Realschule, however, results are less clear. While we do not find any significant effects using the poverty indicators, we find negative effects if using equivalent income or net household income. These negative effects imply that siblings are more likely to choose the lowest track, i.e. Hauptschule, if household income is higher when they are age 10 or during primary school.[7] In our sample that uses observations for reunified Germany, none of the fixed effects estimates is significant (see table A.7).

Table 5 – Sibling fixed-effects results for different poverty indicators (West Germany)

	Poor at age 10		Ever poor age 7 to 10		Years poor age 7 to 10		Ever poor age 3 to 6		Years poor age 3 to 6	
	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error
	Attendance of Gymnasium (vs. Realschule or Hauptschule)									
Poverty indicator	0.590	0.636	-0.759	0.729	-0.653	0.495	-0.581	0.885	-0.197	0.525
Observations	322		233		233		160		160	
	Attendance of Gymnasium or Realschule (vs. Hauptschule)									
Poverty indicator	0.554	0.575	-0.135	0.468	-0.082	0.276	-0.541	0.621	0.092	0.419
Observations	377		268		268		152		152	

Note: Coefficients printed in *italics* indicate marginal significance (10%-level), and coefficients printed in **boldface** indicate statistical significance at 5%-level. Specifications also control for gender, birth sequence, mother's age and size of town.

Table 6 – Sibling fixed-effects results for different measures of equivalent income (West Germany)

	Income at age 10		Average annual income at age 7 to 10		Average annual income at age 3 to 6	
	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error
	Attendance of Gymnasium (vs. Realschule or Hauptschule)					
Equivalent income[1)]	0.002	0.032	-0.009	0.054	-0.038	0.052
Observations	322		233		160	
	Attendance of Gymnasium or Realschule (vs. Hauptschule)					
Equivalent income[1)]	**-0.072**	0.036	**-0.239**	0.093	0.006	0.064
Observations	377		268		152	

Note: Coefficients printed in *italics* indicate marginal significance (10%-level), and coefficients printed in **boldface** indicate statistical significance at 5%-level. Specifications also control for gender, birth sequence, mother's age and size of town. [1)] Per thousand euros.

Natural Experiment

In the third part of this section we use information on a natural experiment which took place in 1996, when child benefits were raised considerably. In Germany child benefits

[7] Concerning the other factors included in the fixed effects models, we find that only gender has a significant influence on track choice in most of the specifications. Girls generally choose higher school tracks.

(Kindergeld) have been paid since 1954. Parents receive a fixed amount of benefit each month for every child below age 18 and for children aged 19 to 27 if these children remain in school or receive vocational or university education. During the first half of the 1990s monthly child benefits were 70 DM[8] for the first child, 130 DM for the second, 220 DM for the third and 240 DM for each additional child. In 1996, child benefits were increased considerably due to an intervention of the federal constitutional court. The court had decided in September 1992 that child benefits were too low. In 1996, child benefits were raised to 200 DM for the first and the second child, 300 DM for the third and 350 DM for each additional child. Hence, the increase in benefits was more than 180% for the first child, leading to an additional annual amount of 1,560 DM (800 euros) for a family with one child. For the second and any further child the increases were somewhat lower (54% and less) but still sizable. This change in child benefit regulations led to a permanent increase in household income by a considerable amount. Especially for low income households, the increase was quite high in comparison to annual income. Furthermore, this change or at least the size of the increase was unanticipated by most households, because the German parliament did not decide on the changes before September 1995. We consider this change a natural experiment and analyze whether track choice differs between children who made their choice before and after the reform of the child benefit regulations.

Table 7 presents results for several specifications using different control and treatment groups. In the first column we compare children leaving primary school in 1995 (control group) with those leaving in 1996 (treatment group), in the second column we use those leaving in 1994 or 1995 as control and those leaving in 1996 or 1997 as treated. The remaining comparisons gradually extend the control and treatment groups by one cohort each. If we do not control for child and household characteristics, the effect of the reform is insignificant for all comparisons (upper part of table 7). If we additionally account for our core set of control factors, the results are somewhat striking (lower part of table 7). The closer treatment and control groups are, in terms of time, the larger is the effect. With every additional cohort included in the comparison, the effect becomes smaller.[9] Generally, the effect of higher benefits on track choice is positive, i.e. children are more likely to choose higher tracks after the reform. However, the effect is significant only in two specifications, when primary school leaving cohorts 1994-1997 and 1993-1998 are compared, and approaches zero if more distant cohorts are included. The picture is quite similar if we do not only focus on children in West Germany but on all children living in reunified Germany. Table A.8 in the appendix shows that the point estimate of the effect is larger for closer cohorts and even becomes negative if more distant cohorts are included. In these comparisons for reunified Germany, however, none of the effects is significantly different from zero. Results not displayed in the tables show that the findings for West Germany are entirely driven by track choices of children in households with above median income. For all comparisons, the effect of the reform is insignificant for children in households with below medium income, whereas it is significantly positive in the first three comparisons of the West German sample for children in households with above medium income.

We take this as evidence that the reform, and thus the additional income, had no effect on school track choice, at least not over a prolonged period and especially not for individuals at the lower end of the income distribution. At best, there is an effect in the first two to three years after the reform for high income households, which might indicate that people were still surprised and did not fully integrate the extra amount of income into their spending and

[8] The official exchange rate for the conversion of DM to Euro fixed in 1998 is 1.956 DM/Euro.

[9] Results are qualitatively identical, if we hold constant the control group (cohorts 1994 and 1995) and only extend the treatment group by including additional cohorts.

consumption behaviour. Instead, it might have been used for long-term investments in their children. After this initial surprise, however, track choice behaviour became very similar to how it was before the reform. Given that the relative increase in household income experienced by households with above median income was much lower than for households with below median income, it is quite plausible, however, that changes in school track choice of high income households might be driven by other reasons than the increase in child benefits, e.g. changes in preferences for higher school tracks.

Table 7 – Ordered logit results for natural experiment (West Germany)

	1995 vs. 1996		1994-1995 vs. 1996-1997		1993-1995 vs. 1996-1998		1992-1995 vs. 1996-1999		1991-1995 vs. 1996-2000		1990-1995 vs. 1996-2001	
	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error
	Specifications without other control factors											
After reform	0.149	0.421	0.090	0.296	0.174	0.225	0.135	0.197	0.147	0.169	0.183	0.153
	Specifications with further control factors[1)]											
After reform	0.649	0.528	**0.568**	0.289	**0.458**	0.229	0.161	0.203	0.047	0.180	0.005	0.157
Observations	203		410		641		849		1095		1339	

Note: Coefficients printed in *italics* indicate marginal significance (10%-level), and coefficients printed in **boldface** indicate statistical significance at 5%-level. [1)] Specifications include core set of control factors as described in section 3.

5. Conclusions

The German schooling system selects children into different secondary school tracks generally directly after leaving primary school. Since approximately two thirds of the children do not change school tracks after age 14 and the final schooling degree is highly correlated with subsequent choices regarding the occupational or academic career and other labour market outcomes like wages, school track choice is a vital decision taken quite early in life. Earlier studies have shown that track choice is highly correlated with household income. Children from less wealthy households generally choose lower tracks. Our analysis shows that this association remains significant, even if we control for further information on parental background. However, these associations might be due either to a causal effect of income on school choice or to differences in child or household characteristics which both are associated with differences in income and school choice.

In order to identify the causal effect we compare outcomes of siblings which experienced different income situations when switching to secondary school. These sibling comparisons suggest that income has no causal effect on choosing the highest track (Gymnasium). For lower tracks, there is even some indication of income having a negative effect, i.e. sibling raised during more affluent times are more likely to choose the lowest track (Hauptschule) than to choose the intermediate track (Realschule). In addition to these sibling differences we use information on a natural experiment that took place in 1996, when child benefits increased considerably. Comparing children who switched from primary to secondary school before and after the reform, we find that the reform had no effect on school track choice, at least not over a prolonged period. Overall, these findings suggest that income has no positive causal effect on school choice and that differences between high- and low-income households are predominantly driven by unobserved heterogeneity, e.g. differences in ability, motivation or preferences. At least, this holds for differences in family income experienced when the child was aged 3 to 10 years. Due to small sample size, we are not able to extend our analysis

to account for income differences experienced during the first or second year after birth. Thus, we are not yet able to rule out that income has an impact on track choice or, more broadly, on cognitive skills during these early years (for empirical evidence on sensitive periods for certain investments, see CUNHA ET AL. (2005)).

For policy makers these results imply that they should not focus on financial transfers to families with children that are in need. Instead, more promising interventions might be those that focus on compensating differences in motivation and parenting quality. Experimental studies show that additional classroom sessions, teacher visits at home, and other supportive interventions have a powerful influence on the development of cognitive and social skills (for a summary on findings from different disciplines see KNUDSEN ET AL. (2006)). These interventions should start already early in life and might help to improve the level of intergenerational mobility, i.e. to lower the degree of transmission of income, poverty or wealth from parents to children.

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Appendix – Additional Tables

Table A.1 – Descriptive statistics for West German sample

Variable	Mean		Difference between samples (in %)
	Entire sample	Siblings sample	
Information on the child			
Attends Gymnasium	0.3896	0.3069	-21.24
…Realschule	0.3103	0.3954	27.42
…Hauptschule	0.3000	0.2977	-0.78
Girl	0.4988	0.5009	0.42
Firstborn child	0.4765	0.3119	-34.55
Information on the household			
Number of siblings	1.99	2.37	19.05
Foreign household	0.1533	0.1638	6.91
Size of town small (<20,000 inhabitants)	0.4499	0.5127	13.97
…medium (20,000-100,000 inhabitants)	0.2969	0.2136	-28.06
…large (>100,000 inhabitants)	0.2532	0.2736	8.09
Information on the mother			
Mother's age	41.45	41.32	-0.32
Mother holds no school degree	0.0504	0.0563	11.76
…general secondary degree	0.4191	0.4136	-1.31
…intermediate degree	0.2786	0.3419	22.70
…upper secondary degree or technical school degree	0.1558	0.0902	-42.13
…missing	0.0961	0.0980	2.02
Mother holds no vocational degree	0.2659	0.2717	2.19
…completed an apprenticeship	0.5948	0.6431	8.12
…holds university degree	0.1098	0.0739	-32.63
…missing	0.0295	0.0113	-61.89
Information on the father			
Father holds no school degree	0.0306	0.0271	-11.52
…general secondary degree	0.3649	0.3983	9.16
…intermediate degree	0.1471	0.1795	22.02
…upper secondary degree or technical school degree	0.1939	0.1451	-25.18
...missing	0.2635	0.2500	-5.10
Father holds no vocational degree	0.1237	0.1344	8.66
…completed an apprenticeship	0.5257	0.6185	17.66
…holds university degree	0.1853	0.1148	-38.08
…missing	0.1653	0.1323	-19.94
# Observations	2159	582	

Note: Based on West German sample for those children where information is available on poverty status at age 10.

Table A.2 – Ordered logit results for income measured in two periods (West Germany)

	Ever poor		Years poor		Average equivalent income[1)]		Average net household income[1)]	
	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error
At age 7 to 10	**-0.777**	0.304	**-0.364**	0.167	**0.063**	0.028	**0.029**	0.012
At age 3 to 6	*-0.533*	0.274	**-0.342**	0.156	0.049	0.032	0.019	0.013
Observations	1059		1059		1059		1059	

Note: Coefficients printed in *italics* indicate marginal significance (10%-level), and coefficients printed in **boldface** indicate statistical significance at 5%-level. Specifications include core set of control factors as described in section 3 and two income measures taken during primary school and while the child was 3 to 6 years old. [1)] Per thousand euros.

Table A.3 – Ordered logit results for different measures of net household income (West Germany)

	Income at age 10		Average annual income at age 7 to 10		Average annual income at age 3 to 6	
	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error
Net household income[1)]	**0.022**	0.006	**0.033**	0.006	**0.043**	0.008
Observations	2159		1620		1159	
	Marginal effect		Marginal effect		Marginal effect	
P(Hauptschule)	-0.79		-1.46		-1.66	
P(Realschule)	-0.50		-0.30		-0.63	
P(Gymnasium)	1.29		1.75		2.28	

Note: Coefficients printed in *italics* indicate marginal significance (10%-level), and coefficients printed in **boldface** indicate statistical significance at 5%-level. The marginal effect is the effect of increasing net household income by 20% (from 12,000 to 14,400 euros) for a reference child (see footnote 3). Specifications include core set of control factors as described in section 3. [1)] Per thousand euros.

Table A.4 – Ordered logit results for different measures of income (reunified Germany)

	Poor at age 10		Ever poor age 7 to 10		Years poor age 7 to 10		Equivalent income at age 10[1)]		Average equiv. annual income at age 7 to 10[1)]	
	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error
Income measure	0.122	0.322	-0.454	0.299	*-0.291*	0.154	**0.044**	0.014	**0.081**	0.019
Observations	2115		1172		1172		2115		1172	
	Marginal effect		Marginal effect		Marginal effect		Marginal effect		Marginal effect	
P(Hauptschule)	0.96		-2.55		-1.54		-0.68		-0.96	
P(Realschule)	2.05		-8.18		-5.26		-0.58		-1.42	
P(Gymnasium)	-3.01		10.73		6.79		1.26		2.38	

Note: Coefficients printed in *italics* indicate marginal significance (10%-level), and coefficients printed in **boldface** indicate statistical significance at 5%-level. The marginal effect is the effect of switching from poor to non-poor or for increasing equivalent income from 6,000 to 7,200 euros for a reference child (see footnote 2). Specifications include core set of control factors as described in section 3. [1)] Per thousand euros.

Table A.5 – Descriptive statistics on income differences between siblings at age 10 (West Germany)

	Average absolute difference between siblings	
	Mean difference	Std. error
Poor at age 10	0.0851	0.2796
Equivalent income at age 10	4374.76	5018.61
Net household income at age 10	9997.64	11210.74
# siblings	582	
# households	235	

Note: Based on West German sample for those siblings with information on poverty status at age 10, which differ in school track choice.

Table A.6 – Sibling fixed-effects results for different measures of net household income (West Germany)

	Income at age 10		Average annual income at age 7 to 10		Average annual income at age 3 to 6	
	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error
	Attendance of Gymnasium (vs. Realschule or Hauptschule)					
Net household income[1)]	-0.002	0.014	-0.010	0.023	-0.014	0.025
Observations	322		233		160	
	Attendance of Gymnasium or Realschule (vs. Hauptschule)					
Net household income[1)]	**-0.038**	0.016	**-0.103**	0.039	0.008	0.031
Observations	377		268		152	

Note: Coefficients printed in *italics* indicate marginal significance (10%-level), and coefficients printed in **boldface** indicate statistical significance at 5%-level. Specifications also control for gender, birth sequence, mother's age and size of town. [1)] Per thousand euros.

Table A.7 – Sibling fixed-effects results for different measures of income (reunified Germany)

	Poor at age 10		Ever poor age 7 to 10		Years poor age 7 to 10		Equivalent income at age 10[1)]		Average equiv. annual income at age 7 to 10[1)]	
	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error
	Attendance of Gymnasium (vs. Realschule or Hauptschule)									
Income measure	-0.755	1.259	-15.651	3317.905	0.286	1.629	-0.042	0.055	-0.178	0.137
Observations	246		111		111		246		111	
	Attendance of Gymnasium or Realschule (vs. Hauptschule)									
Poverty indicator	-0.671	1.244	1.059	1.103	0.631	0.775	-0.078	0.052	-0.059	0.111
Observations	234		117		117		234		117	

Note: Coefficients printed in *italics* indicate marginal significance (10%-level), and coefficients printed in **boldface** indicate statistical significance at 5%-level. Specifications also control for gender, birth sequence, mother's age and size of town. [1)] Per thousand euros.

Table A.8 – Ordered logit results for natural experiment (reunified Germany)

	1995 vs. 1996		1994-1995 vs. 1996-1997		1993-1995 vs. 1996-1998		1992-1995 vs. 1996-1999		1991-1995 vs. 1996-2000		1990-1995 vs. 1996-2001	
	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error
	Specifications without other control factors											
After reform	0.134	0.308	-0.114	0.201	-0.024	0.152	-0.031	0.131	0.030	0.113	0.077	0.103
	Specifications with further control factors[1)]											
After reform	0.400	0.300	0.043	0.194	0.022	0.153	-0.104	0.132	-0.068	0.119	-0.027	0.107
Observations	416		952		1488		1991		2523		3019	

Note: Table presents results for several treatment and control groups leaving primary school in different years. Coefficients printed in *italics* indicate marginal significance (10%-level), and coefficients printed in **boldface** indicate statistical significance at 5%-level. [1)] Specifications include core set of control factors as described in section 3.