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Does having low family income during childhood affect which type of secondary school you go to? Evidence from the German Socio-Economic Panel

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Abstract

We examine the impact of family income during childhood on the type of secondary school that German children attend at age 14 – a good indicator of lifetime socioeconomic attainment. We also consider the relevance of the timing of low income spells during childhood, and potential non-linearities in the income effect. We find that income effects are substantively small, once other important background factors are controlled for, that early childhood income is more important than contemporaneous income, and that there are non-linear effects. Our results shed light on how far existing evidence, which mainly refers to the USA, is generalisable to other countries and socioeconomic structures.

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1. Introduction and motivation

Child poverty has become a major policy issue in a number of countries. The relationship between child outcomes, family income during childhood, and parental background has therefore come under increased scrutiny. In this paper we focus on the child outcome 'school type at age 14', and provide new evidence about the size of the income effect, controlling for other potential effects, using panel data for Germany. We also consider whether the timing of low income during childhood matters, and whether there are non-linearities in income effects. The results shed light on how far existing evidence – mainly for the USA (see *inter alia* Blau 1999; Duncan *et al.* (1997, 1998); Haveman and Wolfe, 1995) – is generalisable to other countries with other socio-economic institutions.

Existing literature suggests that the impact of childhood income on later outcomes is not clear cut – it depends on views about the nature of the intergenerational transmission mechanism. One line of argument suggests that income has a major role; a second suggests that it is not directly important. Let us consider these arguments in turn.

First, income may be important because it reduces credit constraint problems in the financing of a child's education. See e.g. the models of investment in human capital with credit constraints proposed by, *inter alia*, Acemoglou and Pischke (2001) or Shea (2000). An alternative rationale is provided by models that give income a direct role in the transmission mechanism linking parental income to child outcomes. Having more money might play several roles, ranging from increasing the ability to purchase goods that provide the child with a stimulating environment (such as books and educational toys), to being a measure of the stability of the parental environment. Poor children not only suffer from the lack of material goods but are often are exposed to higher levels of stress.

There is also evidence that the early childhood years are particularly important for longer term outcomes (see e.g. the survey by Currie, 2000). Put another way, lack of developmental progress in the early years may have cumulative consequences. Hence, if family income is relevant, it is also important to investigate the particular timing of low income during childhood. If income during childhood plays the principal role in practice, then the optimal policy for improving child outcomes is simple income redistribution, and targeted on the early childhood years: a poor child would, after the intervention, be similar to its non-poor peer in all relevant aspects.

A second and alternative story about the intergenerational mechanism focuses directly on parents in terms of their parenting skills, their ability and educational background rather

than on income *per se*. According to this perspective, financial resources play no special role over and above their association with parental background. What matters is the value that parents place on education and their active learning support – the quality of the home environment in short. If this transmission mechanism is the primary one, then the policy implications differ from if income had a direct role: direct income redistribution does not work, whereas resources directed at improving parenting skills and educational support do.

1.1 Secondary school pathways in Germany and their importance for later life outcomes

Our goal is to isolate the impact of childhood income on a major indicator of lifetime socioeconomic achievement in Germany, namely the type of school attended at age 14. (There is some diversity in the age at which children make the transition to secondary school – the average is after age 10 – but since virtually all transitions are made by age 14, we focus on outcomes at this age.) The German secondary school system has three separate strands. The *Gymnasium* leads to qualifications entitling entrance to university (after a total of 13 years of schooling). Pupils at *Hauptschule* leave school at age 16 and typically proceed onto a vocational training track (the German system of formal three or four year apprenticeship coupled with regular school attendance at special training colleges). In the *Realschule*, formal schooling also finishes at age 16, but this route provides more academically demanding schooling than Hauptschule. Typically pupils proceed to enter vocational training colleges, or move to a Gymnasium. German schools do not charge fees, being publicly funded and typically well-resourced. Private schools are rare, and, unlike in countries such as the UK, the best schools are in the public sector.

The type of secondary school that a child attends has long-term consequences for his or her socio-economic attainment. This point is illustrated in Table 1, which shows how earnings for prime-aged men in West Germany in 1994 varied with secondary school type. An income gradient is clearly visible and, for example, the premium for attending Gymnasium rather than Hauptschule is 47 percent on average. Since school choice and progress within the system is typically perceived to be meritocratic rather than depend on financial resources (ignoring the issue of opportunity costs), this system is a suitable testing ground to examine the role of parental financial resources in determining child outcomes.

<Table 1 near here>

1.2 The raw association between childhood income and secondary school type

We report in Table 2 a cross-tabulation of children's school type at age 14 and contemporaneous household income in order to provide a quantitative benchmark for our investigation (the data will be described in more detail below). This appears to lend weight to the first view concerning income and child outcomes outlined in the Introduction. The table shows a strong income gradient by school type. Only 15 percent of children attending Gymnasium come from the poorest fourth of the income distribution, whereas 46 percent come from the richest fourth. This 31 percent differential is substantial. Similarly, of all children in the poorest fourth of incomes, only 20 percent attend Gymnasium, whereas 60 percent of all children in the richest fourth do.

<Table 2 near here>

Does the strong income gradient revealed by these correlations persist once parental background and their educational inputs are controlled for? We shall argue that the answer to this question ranges from 'only a little' to a resounding 'no'. Our estimates indicate that: the conditional income effect is about 0–8 percent depending on income and the model estimated, i.e. substantially less the 31 percent reported in Table 2 (where other factors were not controlled for). Moreover, the income effect depends on the income level in a non-linear way: we find that the income effect for children with below average income is non-existent. Only among children with higher childhood incomes do we observe a positive income effect; one that may be compensating for a relative lack of parental educational qualifications. The timing of periods of low income during childhood also matters – it is only income in early childhood (and not contemporaneous income) which plays a role in the determination of school type at age 14.

In the rest of this section we briefly place our study within the context of earlier work. Then in Section 2 we discuss the nature of our econometric model. Section 3 contains a description of the German Socio-Economic Panel data. In Section 4 we present our estimation results and use them to compare the relative importance of childhood income and parental background for the choice of school type. Section 5 concludes.

1.3 The international context

Our results for Germany contribute to a growing body of existing evidence about the relationship between child outcomes, parental income and parental background. We treat our

school type variable as an ordered categorical outcome, whereas most authors using US data have studied non-categorical child outcomes such as 'years of completed schooling' or cognitive scores: see *inter alia* Haveman and Wolfe (1995), Duncan *et al.* (1997), Duncan *et al.* (1998), or Blau (1999). Duncan *et al.* (1998) also study the outcome 'high school graduation'. They find, as we do, that income affects child outcomes non-linearly, and that early income is relatively more important than contemporaneous income. Some authors have studied other child outcomes. Currie and Coles (1993) and Levine and Zimmerman (2000) analysed the effect of the incidence of maternal welfare receipt on child birth weight and cognitive scores. By contrast, Cameron and Heckman (2000) examined on the probability of attending college. Consistent with our results, these studies all suggest that the income effect is substantially diminished once parental background has been controlled for. And the magnitude of the income effect varies through childhood, typically found to greater during early childhood years rather than, say, adolescence. Finally, income effects on outcomes such as physical health are typically lower than those for socioeconomic achievement measures.

There have been a small number of studies of the family background and child outcome relationship for countries other than the USA. For example Ermisch and Francesconi (2000) analysed educational attainment in the UK, measured in terms of the probability of attaining A-levels (the university entrance qualification). Their reduced form equation excluded income, and hence their results do not permit a cross-national comparison of income effects. Büchel *et al.* (2001) considered child outcomes in Germany as measured by 'school type at age 14' (as we do). Much of their analysis, however, was confined to documenting facets of the high raw correlation between income and school choice (as illustrated by our Table 2).

2. The Econometric Model

We seek to estimate a reduced form model of a parent's 'demand function' for a specific child outcome. Our interest is in the conditional income effect, i.e. the association between income and outcomes, controlling for the impact of other relevant factors. Consequently, as in any textbook demand function, the explanatory variables in the regression model should not include any variables that are subject to the choice of the parent or the child. If they are included, then one cannot undertake conduct comparative static exercises such as the study of income effects (a point re-iterated by Blau, 1999). In these cases, based on assumption about the sequential timing of the decision, computing the income effect on the child outcome

would also require taking into account the indirect effect via a first stage regression of these decision variables on the income, background and demographic covariates.

Underpinning the empirical model is the concept of a child outcome production function that relates output and inputs, such as income and the quantity and quality of parental involvement in the child's education. According to this interpretation, higher income finances more readily quantifiable inputs such as books and educational toys, but also increases factors providing a more conducive learning environment, such as more space and less stress, and thus a greater readiness to learn. We do not attempt to distinguish between these interpretations – that would require a structural model – instead we remain agnostic and let the data 'speak for themselves'.

Secondary school type is a categorical variable. Moreover, school type is naturally ordered from lowest (Hauptschule) to highest (Gymnasium): the ordering is associated with a progressively more challenging academic education and increasingly better career prospects. Let the school type at age 14 of child j in family i be denoted by x_{ji}. The covariates included in the regression are variables summarising the demographic structure of the family, Z_{ji}, income covariates Y_{ji}, and parental educational qualifications E_i. Suppose that there is a latent index describing school type on some underlying continuum

$$x_{ji}^* = x_{ji} + e_{ji} \tag{1}$$

where the observable index is

$$x_{ji} = \beta_1' Z_{ji} + \beta_2' Y_{ji} + \beta_3' E_i \,. \tag{2}$$

Assuming that the disturbance term (e_{ji}) has a logistic distribution, we estimate the following probabilities:

$$\begin{aligned} \Pr(\text{school type = Hauptschule}) &= \Lambda(-x_{ji}) \\ \Pr(\text{school type = Realschule}) &= \Lambda(\kappa_1 - x_{ji}) \\ \Pr(\text{school type = Gymnasium}) &= 1 - \Lambda(\kappa_2 - x_{ji}) \end{aligned} \tag{3}$$

where the ancillary parameters satisfy $1 < \kappa_1 < \kappa_2$ and $\Lambda(.)$ denotes the cumulative logistic distribution function. Hence we estimate an ordered logit model.

The income effect (derived from estimates of β_2) may be biased upwards by the presence of an unobserved family specific or child effect, α_{ji}, such as ability, so that the true latent index is given by $x_{ji}^* = \alpha_{ji} + x_{ji} + e_{ji}$. The commonly-used estimation strategy of using variations in outcomes amongst siblings to difference out any family-specific effect ($\alpha_{ji} = \alpha_i$) is not feasible in our case because the sample size and sibling variation are too small. Instead,

we also estimated a random effects model.[1] It turned out, however, that we could not reject the hypothesis that that the variance of the Normally distributed random effect was not statistically significantly different from zero.[2] The results from this model are therefore not reported here. Another type of heterogeneity operates if income effects differ for poor and rich children. We investigate this potential non-linearity in income using a spline specification.

In order to facilitate the interpretation of the estimates of the model's β parameters and the 'income effect' in particular, we have computed marginal effects for each of the covariates.[3]

3. The Data

We base our analysis on the German Socio-Economic Panel (GSOEP), using data from the first wave in 1984 through to the 1997 interview wave.[4] The measure of income used is household net (post-tax post-benefit) income, assumed to be shared equally amongst household members – but not equivalised, as we wish to examine the effects of differences in money income. Differences in household composition are controlled for directly using various covariates.

Our unit of analysis is the child. We divided childhood into three stages, roughly corresponding to key developmental and schooling stages: the 'early years' (when aged 0–5 years), the 'middle years' (ages 6–10), and the 'contemporaneous years' (age 11+). For each child, we have averaged household income during these periods. We use measures of income from each of the three stages of childhood in our analysis because since we wish to study the importance of the timing of periods of low income. Table 3 shows that family income at

[1] The presence of child or family specific effects poses substantial problems for categorical dependent variable models. As Arellano and Honoré (2000) observe: 'Since little is know about how to deal with fixed effects other than the ones discussed above, it is often appealing to make assumptions on the distribution of the individual effects' (p.70).

[2] Fixed effects are more general since the fixed effect (such as ability) can be correlated with income. In this case, and given the likely positive correlation between the two, our estimates of the income coefficient need to be interpreted as upper bounds. This does not cause major problems since the estimated income effects are small, so the true effect would be even smaller.

[3] The marginal effects are calculated as $\partial[\text{Prob}(\text{school type} = i)]/\partial X_j$ for each continuous regressor X_j and for each dummy variable are calculated as the difference Prob(school type = i| dummy = 1) – Prob(school type = i| dummy = 0). In both cases all other covariates are evaluated at their sample mean. Note that the marginal effects sum to zero across school types. The marginal effects of dummy variables such as the parental educational categories are, of course, reported relative to the reference category. However, the marginal effects of switching between different educational categories are easily quantified since these marginal effects are transitive.

[4] See http://www.diw-berlin.de/soep/soepe.htm and Burkhauser *et al.* (2001) for details.

different childhood stages is correlated but not perfectly so – a reflection of the fact that income mobility in Germany is relatively high.[5]

<Table 3 near here>

In order to maximise sample size, we selected the sample according to the rule that a child must have at least one income observation in each of the three childhood stages. This yielded a sample of 520 children. About one half (51 percent) of these were present in the panel for 14 years. A further 24 percent were present 13 years, and 19 percent were present 12 years. Some 3 percent were present for 11 years and 2 percent for 10 years.

The third key explanatory variable in the ordered logit regressions is the highest educational qualification attained by the child's mother and father. For each, we defined five categories, in ascending order of value: no qualification, Hauptschule or Realschule (grouped to increase cell size), more advanced school leaving qualifications such as graduation from Gymnasium, apprenticeship, and finally university degree (or equivalent). Table 4 shows the proportion of children whose parents fall into the various categories.

<Table 4 near here>

Table 5 reports the sample means of the covariates used in our regressions.

<Table 5 near here>

4. Estimation

4.1 The models defined

We distinguish several models in order to examine potentially different facets of the transmission mechanism. The dependent variable is 'school type at age 14'. All models include regressors for income, parental background, and household demographics. The income variables are defined for each of the three childhood stages (early, middle, and contemporaneous). The parental background variables are defined in terms of the highest educational qualification attained by the parents, naturally ordered from 'none' to 'university degree'. General family controls include variables such as the age of the parents at the birth of the child, the number of children in the family when the child is aged 14, and a dummy

[5] Similar correlations are reported by Duncan *et al.* (1998) for the USA. For detailed studies of income mobility in the USA and Germany, see e.g. Burkhauser *et al.* (1998) and Schluter and Trede (2001).

variable summarising whether the child belongs to a guest-worker family. These covariates are common to all models.[6]

We also investigate the role of maternal labour supply.[7] Since labour supply also depends on income, computing the income effect on the child outcome also requires taking into account the indirect effect via a first stage regression of this variate on income, background and demographic covariates. Family breakdowns are major shocks in a child's life. We therefore investigate three avenues. Model 1 focuses on the timing of the shock, and also looks at the event of the mother finding another partner. Rather than focusing on the shock variable, Model 2 includes a variable measuring the duration of lone parenthood. Model 3 includes an indicator variable of whether the child ever lived in a lone parent household.

After dropping the insignificant labour supply and family breakdown variables, we then proceed to address the issue arising from the correlation between family income and parental educational attainment (Model 4). The appearance of both covariates in the child outcome equation, as in Models 1–3, reduces the background effect. On the other hand, income should appear in the outcome equation in its own right, since it is an input in the production of the child outcome. We have therefore estimated a standard first-stage equation to predict household income, the residuals of which were then used as regressors in the second-stage outcome equation. Note that the income coefficient will remain unchanged by this procedure, whilst the background coefficient will in the presence of a positive correlation will rise. This is our Model 4. All following models use the residuals from the first-stage regression.

Models 1–4 are based on income contributing linearly to the child outcome index of equation (2). However, this may be an excessively strong simplification in that the effect of changes in income may differ for children in low income families compared to children in rich families. In order to investigate this possibility, Model 5 allows for non-linear effects using splines. In view of our finding of heterogeneity in the income dimension, we also consider heterogeneity more generally by estimating the regressions separately for different income groups.

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[6] We also incorporated interaction terms which turned out to be insignificant and had therefore been excluded from our reported regressions.

[7] Blau (1999) has argued that parental wage rates are also legitimate regressors in models of this kind since they reflect the opportunity cost of parents' time, relevant to choices about how much time to devote to their child's education. As it happens, the coefficient estimates on parental wage rate variables were not statistically significant when these variables were included as regressors, and therefore we have not reported the estimates of these models.

4.2 Estimation results

The estimates of the ordered logit model are reported in Table 6.[8] Before interpreting the coefficients in terms of the marginal effects on child outcomes, we focus first on the coefficients directly. The income coefficients exhibit the same pattern across Models 1–3. The coefficients for early childhood income are approximately twice as large as for middle and contemporaneous income, suggesting that the timing of low income periods is crucial. However, the latter two coefficients are not statistically significant. The other models therefore focus only on early childhood income. Duncan *et al.* (1998) reported similar results for the USA concerning the importance of the timing of income receipt for the case where the child outcome variables were 'years of education' and 'high school completion'.

The parental background covariates have large and statistically significant associations. The relative magnitude of income and parental background effect will be discussed extensively in Section 4.4 below.

The general household demographic variables are not statistically significant, with the exception of the number of children in the family at age 14. Maternal labour supply, incorporated in Models 1–3, does not play a role in determining the child outcome except during child ages 6–10. None of the family breakdown variables – whether summarised in terms of incidence or duration – is statistically significant at conventional levels. Interestingly, these variables were also not significant in a leading US study of child outcomes (Duncan *et al.*, 1998).

In the light of this initial results we dropped the statistically insignificant income, family breakdown, and maternal labour supply covariates from Model 4 onwards. Recall that these models include a adjusted measure of income (the residuals from a first-stage income regression), rather than income itself. As expected, using the residuals strengthens the parental background effects.

We interpret the coefficient estimates of Model 4 in terms of marginal effects, reported in Table 7, confining our attention to the probability of the child attending Gymnasium. (We discuss the magnitude of the income effects in Section 4.4.) Parental background plays the most obvious role in determining secondary school type. The higher the parental educational qualifications, the greater is the chance of the child attending

[8] We also estimated a binary logit model that focused exclusively on whether the child attends Gymnasium or not (i.e. collapsing categories used in the ordered logit model). The estimates imply similar marginal effects of income on outcome, and so are not reported here.

Gymnasium. For instance, compared to the child with a father with no qualifications, the child of a father with a university degree has a 60 percent higher chance of attending Gymnasium. Since the marginal effects are transitive, we can also compare other educational categories. Unsurprisingly, the parental education effect is reduced when the reference category increases in educational attainment, but it remains substantial: there is a 40 percent difference in the outcome probability between children with fathers having passed apprenticeships and the ones having university degrees. Similar comments apply to the effect of maternal educational background. These calculations focus only on one parent in isolation. However, the impact of both parents having low educational attainment will be even more substantial; this is particularly since many parents in the low income group have poor or no educational qualifications.

The variables that control for demographic background have marginal effects that are of the expected signs but they are not statistically significant, with the exception of the number of children present when the child was aged 14. The more children there are, the smaller is the probability of attending Gymnasium.

<Table 6 near here>

<Table 7 near here>

4.3 Non-linear income effects and heterogeneity

Models 1–4 are based on the assumption that the transmission mechanism linking child outcomes, income and parental background is the same for every child, irrespective of whether the child is rich or poor. We relax this assumption by allowing income to have a non-linear effect in equation (2). Model 5 characterises this potential non-linearity using by fitting a spline function with knot points located at income deciles. Table 8 reports the coefficient estimates as well as the marginal effects of statistically significant covariates on the probability of the child attending Gymnasium.

Table 8 suggests that income effects are non-linear. The income coefficients for lower incomes are not significantly different from zero. More precisely, there are significant income effects only for children in the 5^{th}, 6^{th} and the 9^{th} income decile groups. As it happens, the last group contains an above average proportion of children whose fathers had had an apprenticeship. This suggests that the income effect for this group reflects compensation for the parental educational shortfall (relative to university degrees).[9] Hence, it is not surprising

[9] The strong parental background effect might also be loosely interpreted as a 'social class' effect. The specific

that for this group the marginal effect on the probability of Gymnasium attendance exceeds the estimated linear income effect of Model 4 by a factor of six. The marginal effects of the parental background covariates are similar to those of Table 7, however.

Heterogeneity might also play a role beyond the income non-linearity. In order to investigate this possibility, we split the sample and ran separate regressions for income groups below and above the mean (Model 6). The results are reported in Table 8.

As expected from the results of Model 5, the income effect below the mean is zero whereas above it, it is positive but reduced. However, the parental background covariates now also exhibit a different pattern. For incomes above the mean, the paternal background effects are in effect zero, whereas the maternal background effects play the clearest role. We also note that the fit of the model has substantially improved compared to the preceding ones.

For children with below-average early childhood incomes, the importance of the parental effects is reversed: maternal effects are zero and paternal background covariates are significant. The marginal effect of the father with university degrees is substantially higher than the corresponding marginal effect in the homogeneity model reported in Table 7, while the other paternal marginal effects remain roughly unchanged.

<Table 8 near here>

4.4 The magnitude of the conditional income effect

We now discuss the magnitude of the income effects, having now controlled for parental educational background. For the sake of brevity, we focus only on the predicted probabilities of the child attending Gymnasium.[10] As a benchmark for judging the magnitude of income effects, recall that the unconditional effect, reported in Table 2, was 31 percent when moving from the 25th to the 75th percentile of the income distribution. We provide two rich comparisons. First we examine the change in the probability of attending Gymnasium were early childhood income reduced or increased by one standard deviation from mean income. As it turns out, the income change generated is substantial, as a one standard deviation income change leads to an income outside the 25th percentile to 75th percentile range. We therefore also look at income changes that place the child at 25th and 75th percentiles of the income distribution.

income effect then offers the interpretation of well-off parents with no university degrees to permit their children to move up into this 'social class'.

[10] We compute income effects by setting all covariates other than income at their sample means.

The results are reported in Table 9. If early childhood income is set at its sample mean value, then the predicted probability of attending Gymnasium is 0.31. We consider first the implications of the linear income model (Model 4). Changing early childhood income up and down by one standard deviation from the mean results in a difference in the outcome probability of 15 percentage points (39 percent minus 24 percent). Comparing children with incomes at the 25th and 75th income deciles halves the difference in the outcome probability: the implied income effect is 8 percentage points (34 percent minus 26 percent). Controlling for parental educational background in the linear income Model 4 yields an income effect of 8 percent which lies substantially below the benchmark value of 31 percent for the unconditional correlations as reported in Table 2. The magnitude of the conditional income effect is reduced further once we take into account income non-linearities and heterogeneity. In particular, all regressions reported in Table 8 suggest that the income effect on the probability of the child attending Gymnasium for children with below average income is zero. A positive income effect is only observed for high incomes. This implies that a redistribution of income sufficient to move the child from the 25th percentile to the 75th percentile would have no effect on the probability of the child attending Gymnasium.

<Table 9 near here>

5. Conclusion

Does childhood income affect the type of secondary school that German children attend? There is clearly a large raw association between income and school type, but that does not take into account other factors. We have found that, once this is done, income effects are generally small and, moreover, it is only family income during early childhood income that matters. In addition the income effect for children with below average income was estimated to be zero once non-linear income effects were allowed for. The large unconditional income effect is therefore a misleading estimate of the impact of childhood income. These findings have implications for the design of policies aimed at widening access to Gymnasiums for children on low incomes, since they suggest that merely redistributing resources will have little effect.

In contrast to the small income effects, parental educational background has a substantial association with secondary school type: children whose fathers had university degrees rather than no formal qualifications were 60 percent more likely to attend Gymnasium. The premium relative to fathers with apprenticeships was a substantial 40

percent. Heterogeneity also appears to affect the transmission mechanism. Our regressions suggest that for children with above average income, the educational background of the mother is more important than that of the father. For children with below average income, the parental roles are reversed. This is consistent with our observation that children in the upper income group are more likely to have parents who both have higher educational qualifications.

These results for Germany are consistent with a growing body of evidence, mainly based on US data. This consistency suggests that, despite cross-national institutional differences in education, welfare provision, and the precise educational outcome studied, the transmission mechanisms linking parental background, family income during the period of early childhood, and the child's educational outcomes are similar. That is, income effects are substantively small, once other important background factors are controlled for, and early childhood income is more important than contemporaneous income. One difference between Germany and the US relates to non-linearities in the income effect. Duncan *et al.* (1998) found that the income effect was larger for children on very low incomes than for children on higher incomes (the threshold was set at $20,000). By contrast, we find that the income effect is zero for all but a high income group. As it turns out, this group consists of an above-average proportion of children whose fathers have not attended university, thus permitting the child to change 'social class'.

What are the implications of our findings for Germany? Low income *per se* appears to be no barrier to attendance at the school type with the best career prospects, the Gymnasium. However, more worrisome is the strong parental background effect. The lower that parental educational attainment is, the lower is a child's chance of attending Gymnasium. (It is this factor that gives rise to large raw correlations between school type and income.) Many poor parents have relatively low educational qualifications.

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Table 1. The "Gymnasium premium": mean and standard deviation of earnings in 1994 of male full time earners aged between 26 and 59. N= 3025.

School leaving qualification	Mean (DM per year)	Mean, as percentage 'Hauptshule' mean	Standard deviation
Other qualification	49709	87	17380
Hauptschule	57179	100	27585
Realschule	61241	107	45853
Technical training college (Fachhochschule)	82303	144	39108
Gymnasium	84265	147	44479

Table 2. School type at age 14 and contemporaneous income quartile group, row percentages (column percentages in parentheses)

School type	Quartile group of household income of child at age 14				
	1	2	3	4	Total
Hauptschule	30 (46)	32 (49)	24 (38)	14 (22)	100 (39)
Realschule	30 (34)	25 (29)	29 (33)	16 (18)	100 (28)
Gymnasium	15 (20)	17 (22)	22 (30)	46 (60)	100 (33)
Total	25 (100)	25 (100)	25 (100	25 (100	100 (100)

Table 3. Correlations between household income of child during the three childhood stages[a]

Corr(early childhood income, middle childhood income)	0.77
Corr(early childhood income, contemporaneous income)	0.61
Corr(middle childhood income, contemporaneous income)	0.79

[a]: Early childhood is ages 0–5 years; middle childhood is ages 6–10; 'contemporaneous' refers to ages 11–14.

Table 4. Parental educational qualifications (column percentages)

Highest educational qualification	Father	Mother
No qualifications	7	12
Haupt- or Realschule	7	15
Other	12	12
Apprenticeship	60	56
University	13	5

Table 5 Summary statistics.

	Mean	S.D.
Income variables		
Average income, child aged 0-5	53150.5	20268.2
Average income, child aged 6-11	63336.5	25305.2
Average income, child aged 11+	72756	31068.3
Father's highest educational qualification:		
Haupt- or Realschule	0.0712	0.2573
Other	0.1250	0.3310
Apprenticeship	0.6019	0.4900
University	0.1288	0.3354
Mother's highest educational qualification:		
Haupt- or Realschule	0.1500	0.3574
Other	0.1154	0.3198
Apprenticeship	0.5692	0.4957
University	0.0500	0.2182
Household demographics:		
Child's sex is female	0.4923	0.5004
Father's age at child's birth	30.6962	6.3111
Mother's age at child's birth	26.9231	5.2906
Number of children	2.0269	1.0121
Guestworker household	0.3288	0.4702
Mother's labour supply:		
Years of work during child age 0–5	0.3269	0.8695
Years of work during child age 6–10	0.6538	1.4370
Years of work during child age 11+	0.6827	1.3100
Family breakdown and re-partnering:		
Ever in lone parent household	0.1077	0.3103
Breakdown during child ages 0–5	0.0231	0.1503
Breakdown during child ages 6–10	0.0481	0.2141
Breakdown during child ages 11+	0.0308	0.1729
Years of lone parenthood	0.5269	1.7501
Re-partnering during child ages 0–5	0.0038	0.0620
Re-partnering during child ages 5–10	0.0192	0.1375
Re-partnering during child ages 11+	0.0173	0.1305

Table 6: School type at age 14 (ordered logit model estimates)

Covariate	Model 1 Coefficient (s.e.)	Model 2 Coefficient (s.e.)	Model 3 Coefficient (s.e.)	Model 4 Coefficient (s.e.)
Income variables [$\times 10^{-6}$]				
Average income, child aged 0–5	16.092	14.243	13.734	16.770
	(7.211)	(7.036)	(7.052)	(5.188)
Average income, child aged 6–11	1.800	4.869	4.698	
	(8.346)	(7.969)	(8.109)	
Average income, child aged 11+	6.498	4.025	5.748	
	(5.563)	(5.409)	(5.465)	
Father's highest educational qualification:				
Haupt- or Realschule	0.094	0.087	0.119	0.118
	(0.565)	(0.563)	(0.562)	(0.561)
Other	0.601	0.647	0.641	0.631
	(0.456)	(0.455)	(0.455)	(0.454)
Apprenticeship	0.996	1.029	0.99	1.007
	(0.447)	(0.448)	(0.448)	(0.445)
University	2.334	2.339	2.288	2.782
	(0.567)	(0.566)	(0.565)	(0.548)
Mother's highest educational qualification:				
Haupt- or Realschule	0.717	0.749	0.742	0.709
	(0.428)	(0.426)	(0.426)	(0.422)
Other	1.012	0.985	0.992	0.990
	(0.407)	(0.407)	(0.407)	(0.404)
Apprenticeship	0.806	0.808	0.813	0.953
	(0.384)	0.384)	(0.384)	(0.382)
University	1.871	1.889	1.867	2.164
	(0.681)	(0.676)	(0.681)	(0.656)
Household demographics:				
Child's sex is female	0.140	0.133	0.140	0.128
	(0.178)	(0.176)	(0.175)	(0.174)
Father's age at child's birth	0.001	0.001	0.004	0.019
	(0.022)	(0.022)	(0.022)	(0.021)
Mother's age at child's birth	–0.016	–0.018	–0.020	–0.010
	(0.027)	(0.027)	(0.027)	(0.026)
Number of children	–0.220	–0.214	–0.222	–0.169
	(0.102)	(0.102)	(0.101)	(0.095)
Guestworker household	–0.062	–0.094	–0.056	–0.306
	(0.296)	(0.294)	(0.294)	(0.284)
Mother's labour supply:				
Years of work during child age 0–5	–0.056	–0.03	–0.046	
	(0.153)	(0.151)	(0.151)	
Years of work during child age 6–10	–0.240	–0.232	–0.217	
	(0.115)	(0.114)	(0.114)	
Years of work during child age 11+	0.156	0.148	0.123	
	(0.100)	(0.097)	(0.097)	
Family breakdown and re–partnering:				
Ever in lone parent household			–0.153	–0.290
			(0.305)	(0.283)
Breakdown during child ages 0–5	–0.091			
	(0.684)			
Breakdown during child ages 6–10	–0.391			
	(0.488)			
Breakdown during child ages 11+	0.033			
	(0.523)			
Years of lone parenthood		–0.091		
		(0.055)		
Re-partnering during child ages 0–5				

Re-partnering during child ages 5–10	0.652			
	(0.767)			
Re-partnering during child ages 11+	–1.035			
	(0.787)			
Ancillary parameters:				
κ_1	1.618	1.505	1.615	1.167
	(0.892)	(0.893)	–0.889	–0.859
κ_2	3.123	3.008	3.111	2.635
	(0.900)	(0.900)	–0.896	–0.865
Pseudo R^2	0.137	0.136	0.133	0.123
Log likelihood	–490.570	–491.144	–492.398	–498.191

Standard errors in parentheses. The reference categories for the highest educational qualification variables are 'no qualifications'.

Table 7: Marginal effects on school type at age 14 (Model 4).

Covariate	Marginal effects		
	Hauptschule	Realschule	Gymnasium
Income variables [$\times 10^{-6}$]:			
Average income for child ages 0–5	–3.8	0.2	3.6
Father's highest educational qualification:			
Haupt- or Realschule	–0.026	0.001	0.025
Other	–0.130	–0.015	0.145
Apprenticeship	–0.229	0.026	0.204
University	–0.382	–0.215	0.597
Mother's highest educational qualification:			
Haupt- or Realschule	–0.145	–0.018	0.163
Other	–0.190	–0.042	0.232
Apprenticeship	–0.216	0.020	0.196
University	–0.304	–0.187	0.491
Household demographics:			
Father's age at child's birth [$\times 10^{-3}$]	–4.300	0.230	4.100
Mother's age at child's birth [$\times 10^{-3}$]	2.300	–0.120	–2.200
Number of children	0.038	–0.002	–0.036

Table 8: School type at age 14 (ordered logit model estimates).

Covariate	Model 5 (with spline for income)		Model 6 (separate regressions for below- and above-average income)			
			Early childhood income > mean		Early childhood income < mean	
	Coefficients (s.e.)	Marginal effects	Coefficients (s.e.)	Marginal effects	Coefficients (s.e.)	Marginal effects
Early childhood income variables, child aged 0–5 [$\times 10^{-6}$]						
income > mean			43.385 (11.662)	10		
income < mean					5.109 (15.006)	
Spline model with knot points at:						
Income decile 1	–14.057 (40.648)					
Income decile 2	46.484 (92.876)					
Income decile 3	–48.366 (119.433)					
Income decile 4	–101.03 (159.469)					
Income decile 5	476.505 (170.294)	100				
Income decile 6	–289.131 (117.795)	–61				
Income decile 7	184.703 (185.546)					
Income decile 8	–97.122 (95.299)					
Income decile 9	105.381 (52.125)	22				
Income decile 10	22.965 (16.696)					
Father's highest educational qualification: [ref. cat.: 'none']						
Haupt- or Realschule	0.130 (0.568)		0.091 (1.216)		–0.149 (0.722)	
Other	.665 (0.464)		–1.097 (1.086)		1.080 (0.535)	0.220
Apprenticeship	1.0771 (0.453)	0.216	–0.102 (1.074)		1.192 (0.534)	0.188
University	2.746 (0.557)	0.592	1.595 (1.160)		3.663 (0.888)	0.714
Mother's highest educational qualification: [ref. cat.: 'none']						
Haupt- or Realschule	0.709 (0.430)		3.609 (1.437)	0.634	0.644 (0.513)	
Other	1.144 (0.412)	0.269	4.478 (1.506)	0.673	0.646 (0.478)	
Apprenticeship	0.997 (0.388)	0.203	4.488 (1.470)	0.739	0.554 (0.453)	
University	2.338 (.691)	0.521	6.063 (1.633)	0.723	0.546 (1.407)	
Household demographics:						

Child's sex is female	0.122	0.257	0.166	
	(0.175)	(0.285)	(0.233)	
Father's age at child's birth	0.024	–0.046	0.048	
	(0.022)	(0.035)	(0.029)	
Mother's age at child's birth	–0.020	0.044	–0.042	
	(0.027)	(0.044)	(0.035)	
Number of children	–.1782	–0.112	–0.266	–0.045
	(0.097)	(0.164)	(0.125)	
Guestworker household	–0.324	–0.640	–0.095	
	(0.285)	(0.618)	(0.343)	
Ancillary parameters:				
κ_1	1.689	3.313	1.054	
	(1.350)	(2.054)	(1.047)	
κ_2	3.1902	4.810	2.629	
	(1.355)	(2.062)	(1.056)	
Pseudo R^2	0.136	0.208	0.086	
Log likelihood	–490.91	–196.726	–282.008	

Notes. All models use residuals from first stage income regression. "Marginal effects" refer to the marginal effects on Pr{school type = Gymnasium} and are only reported for statistically significant covariates.

Table 9. Income effects on Prob(school type = Gymnasium), by early childhood income levels and model.

Early childhood income value	Prob(school type = Gymnasium)	
	Model 4	Model 5
Mean	0.31	0.31
Mean – 1 std. dev.	0.24	0.31
Mean + 1 std. dev.	0.39	0.31
25^{th} percentile	0.26	0.31
75^{th} percentile	0.34	0.31