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ABSTRACT

Single Motherhood and (Un)Equal Educational Opportunities: Evidence for Germany*

We examine the effect of single motherhood on children's secondary school track choice using a sample of 14 years old children drawn from the German Socio-Economic Panel. In line with previous studies for the U.S., the U.K. and Sweden, we find a negative correlation between disrupted family structure and children's educational outcome. Looking for alternative explanations for this correlation, we use ordered probit regression models to control for factors related to single motherhood such as lower educational background, lower household income and higher labor supply of the mother. Our evidence suggests that single parenthood reduces school attainment mainly because it is associated with lower resources (income and time) available for the child.

JEL Classification: I21, J12

Keywords: school choice, educational attainment, ordered response model, German Socio-Economic Panel

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1 Introduction

Equal opportunity education for children, while an appealing principle, is clearly not a reality in modern societies. The reasons for inequalities in educational opportunities are many, but we focus in this paper on a particular - and maybe most important - one, namely parental background, and its interaction with a country's educational institutions. To what extent does a "disadvantaged" family background, appropriately defined, lead to diminished educational opportunities?

We will study this issue in the context of Germany. Germany is an interesting case because only the first four primary school years are shared by a cohort of pupils. After that, children are sorted into three different school tracks, only one of which allows to enter university directly. Dustmann (2004) reports that the correlation between attending the highest school track and entering university is almost 1, whereas the correlation between attending the lowest school track and entering university is almost -1. Therefore, the decision about the long-term educational opportunities, for instance whether a child enters a university or not, is effectively made at the age of ten, very much unlike in the U.K., where this decision is made at the age of 16 or in the U.S., where a large majority of a cohort completes high school. With the school track decision being made at such an early stage, the role of parental background becomes even more important.

Previous studies for Germany (Buechel et al. 2001, Jenkins and Schluter, 2002, Dustmann, 2004) have found that parental income and education have an important effect on a child's educational attainment. The novelty of our paper is that we analyze a further dimension of parental background, single parenthood, an aspect that has received only scant attention so far. How does growing up with a single parent affect one's educational opportunities, as measured by the school track visited at the age of 14? As more and more children grow up in single parent families, this issue will become increasingly important.

A second innovation, again for Germany, is that we carefully analyze timing aspects of single parenthood. In particular, we hypothesize that early childhood experiences - those in the years preceding formal education - may have a disproportionate effect on school attainment, following recent insights on the determinants of mental development from psychology and educational research. And indeed, for the U.K. and the U.S., previous evidence from large household surveys supports such an argument. A series of papers by Ermisch and Francesconi for the U.K. shows that family characteristics in early childhood strongly influence children's educational attainment (Ermisch and Francesconi, 2001*a*, 2001*b*, 2002). Also with data for the U.K., Fronstin et al (2001) demonstrate that parental disruption during early childhood causes substantial reductions in later educational attainment for males and females. For the U.S., Haveman and Wolfe (1995) present a comprehensive review of methods and findings, concluding that disrupted family structures have negative consequences on children's educational attainment (see also Gransky, 1995).

In Germany, research on single motherhood and educational outcomes is not as evolved as in the U.S. or the U.K. The aforementioned study by Dustmann (2004) uses the German Socio-Economic Panel (GSOEP) to investigate parents' influence on children's school choice. He finds that parents' educational background and professional class are strongly related to the secondary school choice and to subsequent educational achievements but he does not directly address the early childhood issue. Jenkins and Schluter (2002) examine the impact of family household income on secondary school choice. Also with data from the GSOEP they find that late-childhood income is more important for secondary school choice than early-childhood income, and income effects do not differ systematically between poor and rich households. The magnitudes of the income effect are small. Only large income changes generate noticeable differences in the probability to attend the highest secondary school level.

This paper adds a new aspect to the previous discussion on educational attainment in Germany, namely the effect of childhood specific family structure. We analyze the effect of single motherhood on children's educational attainments for early- and late-childhood periods in an educational production function framework (Hanushek, 1979). Within this framework, we examine three possible explanations for lower educational outcome of children growing up in single-parent households, distinguishing between a *psychological effect*, a *resources effect* and a *selection effect*. The data used in this study are drawn from the GSOEP. While the outcome variable – school attainment at age 14 – is cross-sectional, the annual panel information is important for reconstructing the social and economic environment of the child during early and later childhood.

2 Theoretical and Empirical Framework

From the standpoint of human capital theory, education is on the one hand costly in terms of money and time, and, on the other hand, increases one's productivity and therefore pays off in terms of future earnings. Hence, individuals choose an educational level which maximizes their net return and they continue to invest in education until marginal returns for an additional investment equals marginal costs (Becker, 1975). In Germany, secondary school choice, which to a large extent determines the pupil's further career, is made when children are aged between 9 and 10 years. At this age, children (or parents) are unlikely to be able to calculate the educational level that maximizes their future net return of schooling. Therefore, the human capital literature only inappropriately captures children's secondary school choice and the consideration of an educational production function seems to be more realistic.

In the education production function literature educational attainment is viewed as a function of input factors such as family characteristics, including time and money allocated to the children, and

school quality and other neighbourhood effects. Changing any of the inputs will change educational attainment, determined by the technology and the other inputs of the household (Hanushek, 1979 and 1986). In our context, the educational attainment is measured by the secondary school level at age 14. As we pointed out earlier, secondary school level in Germany is closely correlated with overall educational attainment, including post-secondary education.

Following Hanushek (1979) we assume the existence of an educational production function:

$$EA_i = f(B_i, P_i, I_i)$$

where EA_i is the educational attainment of the ith child measured by the secondary school level, B_i is a vector of family background characteristics including family structure, number of children in household and mother's labor supply, P_i is a vector of parental investments in time and monetary inputs and I_i is a vector of innate abilities. Following on from this, educational attainment directly depends on family structure like single parenthood, which is the main subject of this paper, as well as other factors typical of disrupted families such as lower income, higher working hours of the mother, and possibly lower educational background of the parents.

From the theoretical model above and the previous research, three separate channels can be identified, each of which might contribute to a correlation between single motherhood and children's secondary school track.[1] First, single motherhood can have an influence on educational attainment *per se*. The new living situation after a separation may cause emotional stress that adversely affects the child's education. The mother's own difficulties in combining family duties and work may make her less responsive to the psychological and emotional needs of the child. Also, the

[1]Since single parenthood in all but the most exceptional cases means single motherhood, we speak of single motherhood from now on. In our empirical analysis, we do not consider instances of single fatherhood since it is not possible to identify the biological father in the data.

father's influence as a role model is absent. Besides the emotional stress, different socialization of children in single mother households may also influence their educational attainment through different rules, communication styles and reasoning the children experience in their family (Seltzer, 1994). We call this the psychological effect, and this effect is partly represented by B_i in the educational production function.

Secondly, household resources, mainly parents' income and time available for children may also explain children's school achievement. In two-parent households the available resources are likely to be higher than in only-mother households, because the activities of working and raising children can be shared by two partners. A better supervision and support of children improves their development and therefore the educational attainment (Astone and McLanahan, 1991; Wojtkiewicz, 1993; Boggess, 1998). Neidell (2000) demonstrates that taking care of children during the first year without interruption has a positive effect on the child's cognitive and non-cognitive outcomes. Jonsson and Gähler (1997) report among other things that for Sweden the loss of the parent with the higher education or social position and therefore the loss of household resources negatively influences children's educational attainment. They call this the downward social mobility of separation. Lang and Zagorsky (2001) show that the absence of a father is in general much more severe for children's educational attainment than the absence of a mother.

The *resources effect*, both in terms of money and time, has been studied intensively in the past. Indeed, it is at the core of the economic analysis of the family, where it gave rise, among other things, to the quantity-quality distinction of Becker and Lewis (1973), and to the hypothesis of sibling rivalry (Becker and Tomes, 1986). Its various implications have been subject to intensive empirical scrutiny. Evidence is also accumulating that the timing of resource constraints matters. Duncan et al. (1998) find that family economic conditions have the greatest impact in early childhood.

One direct implication is that birth order matters since later born children face the resource rivalry from early childhood on. One example is Black et al (2004) who confirm that for Norway the later born child gets less education than the earlier born child. However, some unintuitive results are available for Germany. First, Gang and Bauer (2001) find no evidence for sibling rivalry (measured by relating educational outcomes to the siblings sex composition) in Germany. Also Jenkins and Schluter (2002) point out that late-childhood household income is more important than household income during early childhood.

Thirdly, the correlation between family structure and children's secondary school track choice might be due to a *selection*, or *family effect*. According to this hypothesis, the incidence of single motherhood does not arise randomly but rather is systematically related to other family specific factors that diminish educational outcomes. Such other family specific factors might include observable characteristics such as the education levels of mother and father but also unobservables such as the "quality" of the partnership, i.e., whether it is a happy or an unhappy one. The problem with such selection effects, in particular the unobserved ones, is that they will tend to lead to an overestimation – in absolute value– of the causal effect of single motherhood on attainment. In this paper we control for the selection on observables by including as many relevant variables in the regression as possible. This includes the mother's education, mother's age at birth and an indicator variable for foreigner households.

One possible approach for addressing selection on unobservables would be to compare the children's educational attainments before and after parental separation. In this spirit, Piketty (2003) shows that for France children from divorced parents have lower educational attainments already before the separation. De Galdeano and Vuri (2004) provide similar results for the U.S. Alternative methods require either the availablity of an instrument (such as state level variation in divorce laws

as in Gruber, 2005), or the availability of siblings data in order to remove the family effect through differencing (see e.g. Ginther and Pollak, 2000, and Björklund and Sundström, 2002). But neither is there in Germany regional variation in the divorce laws - and thus in the probability of single motherhood -, nor are there sufficiently many siblings observed in the GSOEP data to allow any reasonable analysis. With our data, therefore, we cannot satisfactorily address selection due to unobservables and it is possible that our estimates overstate the causal effect of single motherhood. However, should it be the case that no effect is found once we control for selection on observables, this whole issue can be safely ignored.

The empirical reasoning is then as follows: if we compare the educational attainment of children from intact and non-intact families, the difference gives us a combination of the psychological, resources and selection effects. In order to decompose the overall effect into its constituent parts, we need to include the resource and selection variables in addition to the single motherhood indicator. The coefficient of the latter measures then the psychological effect, i.e. the specific effect of single motherhood keeping resources and family background constant. If the parameter related to the psychological effect becomes insignificant after controlling for selection and resources, whereas the resource effect is significant, we can conclude that single motherhood causally affects educational attainment, but that the reasons for this effect lie in the realm of diminished economic resources rather than in the realm of psychology.

For the empirical implementation, we have to understand the hierarchical structure of the German school system.[2] In Germany, compulsory school attendance begins at the age of 6 and ends at the age of 16. Primary school provides basic education, which is identical for all pupils. After four years of primary school pupils continue their education in a secondary school. The secondary school level is divided into three main tracks, lower level secondary school (*Hauptschule*), intermediate

[2]See Winkelmann (1996) for a more detailed presentation of the German education system.

secondary school (*Realschule*) and upper level secondary school (*Gymnasium*). After *Hauptschule* graduates often start a career as a blue collar worker. At a higher level, there is the *Realschule*, which prepares pupils for a white collar track or enables them to enrol in schools for further education. Pupils from *Hauptschule* as well as *Realschule* often start an apprenticeship after leaving school. Graduates from *Gymnasium* are entitled to enter university. The transition from primary to secondary school is based on recommendations of the primary school teacher although parents frequently influence this decision. Dustmann (2004) shows that in Germany parents' education and profession indeed affects children's educational attainment.

As in Dustmann (2004) and Jenkins and Schluter (2002), we therefore model educational attainment as a standard ordered probit model (see Greene, 1997, ch. 19.8, for further details). The model is

$$y_i^* = x_i\beta + u_i, \quad u_i|x_i \sim Normal(0,1)$$

$$y_i = \begin{cases} 0 & \text{if } y_i^* \leq \alpha_1 \qquad \text{“Hauptschule”} \\ 1 & \text{if } \alpha_1 < y_i^* \leq \alpha_2 \quad \text{“Realschule”} \\ 2 & \text{if } y_i^* > \alpha_2 \qquad \text{“Gymnasium”} \end{cases}$$

y_i^* describes a latent variable and y_i is the observed secondary school track. The vector x_i contains B_i and P_i, mentioned earlier, as well as other socio-economic factors and excludes a constant. β is a conformable parameter vector, α_1 and α_2 are unknown threshold parameters to be estimated, and u_i subsumes the ith child's unobservables like innate abilities and an idiosyncratic error. The novelty of our paper is the detailed control for the incidence and timing of single motherhood episodes during childhood. In particular, we distinguish between two childhood periods, early childhood from age 0 to age 6, and late childhood from age 7 to age 14.

3 Data

The data used for this study are drawn from the German Socio-Economic Panel (GSOEP), an annual panel survey of a random sample of households in Germany (see Haisken-DeNew and Frick, 2002, for further details). In West Germany, the collection began in 1984, and since 1990 East German households are included in the survey as well. The GSOEP contains a broad amount of information about household and personal characteristics of their members. Each member older than 16 years answers his own personal questionnaire. For younger children some basic information such as current schooling is provided by the household head in a separate questionnaire. This information is essential for the following analysis.

For each year between 1994 and 2001, records for 14 years old children were extracted from the GSOEP and checked for their schooling status. All children who visited either *Hauptschule*, *Realschule* or *Gymnasium* were kept in the sample. The few children visiting a so-called *Gesamtschule* (comprehensive school) (less than 8.5 percent) had to be dropped since the ordering of this school type relative to the other three dominant types is ambiguous. The age of 14 was chosen because the final decision about the secondary school track has effectively been made by then.

These children live in households with either a West German or "foreigner" household head. The "foreigner" sample of the GSOEP includes households with either Turkish, Italian, Spanish, Greek or Yugoslavian heads. Observations from former East Germany are excluded from the sample because the school system was different there. In order to analyze specific childhood period effects, childhood is divided into two periods. Early-childhood from 0 to 6 years before children enter school, and late-childhood from 7 to 14 years after schooling has started.

For each wave, family structure, average household income, mother's labor force participation, mother's highest educational degree, mother's age at birth, the average number of members in

household for both childhood periods and the birthorder were determined and merged with the information from the children's sample.[3] Family structure means here whether the child lived in a single mother or in a two-parent household. A two-parent family is one where the mother lives together with a partner who may or may not be the biological father of the children.[4] The family structure variable *single mother* is a dummy which is equal to 1 if the child ever lived in a single mother household during the respective childhood period.[5]

Our income measure is an average over the respective childhood periods, i.e. early childhood from age 0 to 6 or late childhood from age 7 to 14. The averages were taken over the annual household income after taxes and government transfers provided in each wave, deflated to 1995 and on a per-capita equivalence scale, where the following weights were used: The first adult in a household has a weight of 1, each additional adult 0.7 and each child in the household 0.5 (Buhmann, 1988). The mother's labor force participation history is measured as average working hours per weekday, again averaged over the two childhood periods, and the mother's highest educational degree can be no degree, compulsory school degree, completed apprenticeship or tertiary education. It was not possible to include the highest educational degree of the father or partner. Because of the large number of missing data on this variable, the sample size would have been reduced too much.

Finally, the eight subsamples for the years 1994 to 2001 were pooled together. Controlling for missing values, the final data set consists of 704 children. Note that due to the panel structure of the GSOEP and its annual survey, we do not need to rely on retrospective information. The information about the constructed variables stem from the particular year rather than from retrospective

[3] See the Appendix for a full description of the variables.

[4] For instance, in all cases where single motherhood during early childhood is followed by a two-parent family situation during later childhood, it is highly likely that the new partner is not the biological father.

[5] An alternative would be to measure the exposure to single parenthood by the fraction of childhood years (or months) spent with one parent only (Björklund and Sundström, 2002).

answers. We consider this a great strength of our analysis that should increase the reliability of the results.

4 Results

A first impression of the data is offered by some basic descriptive statistics in Table 1. First of all, we notice that the incidence of single motherhood is relatively low. Of the 704 14 year olds observed in our sample, only 94 (or 13.4 percent) have ever experienced an episode of single motherhood. Of those 94 cases, 18 involved single motherhood during early childhood only, the majority of 43 cases involved single motherhood during late childhood only, and the remaining 33 cases involved single motherhood during both early and late childhood.

The remainder of the table shows some bivariate associations between family situation during childhood and the main variables of interest, namely educational attainment and the main confounding variable *highest education of mother*, *income*, and *work*. First, the school attainment at age 14 seems indeed to vary as a function of family situation. Among those children who never experienced single motherhood, 37 percent attend Hauptschule, 28 percent Realschule and 35 percent Gymnasium. On the other hand, children who had single motherhood periods during both early and late childhood are more likely to attend Hauptschule (49 percent) and less likely to attend Gymnasium (21 percent). However, standard errors are quite large so that neither the +11 percentage point difference in Hauptschule nor the -14 percentage point difference in Gymnasium are significantly different from zero at conventional levels of significance. If one compares the difference between single motherhood during early childhood and single motherhood during late childhood, one finds that the early childhood experience matters more. Indeed, there is hardly any difference in school attainment between children who experience single motherhood during late childhood

only and those who never experience it.

Next, we consider the association between family situation and the educational attainment of the mother. We know that the intergenerational transmission rates of education are quite high. In Table 1, we find no simple relationship between single motherhood and level of formal education. The educational attainment of mothers is measured not by school type – as it makes sense when considering 14 year olds – but rather by highest qualification, including school, vocational or tertiary. As these women went to school some decades ago, we also find women who left school without graduating at all, something that would be very rare at present. Consider again the contrast between "never single mothers" and mothers with episodes of single parenting during both early and late childhood. We see that none of the mothers in the latter group left school without qualification, whereas 10 percent of the mothers in the former group did so, possibly a cohort effect. The university graduation rate is higher among the never single mothers, albeit at a very low level (6 percent as opposed to 3 percent - the difference is insignificant). All in all, the two groups of mothers are quite similar with respect to their schooling. When considering mothers who were single parent either during early or late childhood, the main differences are higher rates of university graduation and lower rates of vocational training. Again, these may be cohort effects. Taken together, it seems unlikely that the mother's education is responsible for the lower educational attainment of single parenthood children.

By contrast, the income effect points in the expected direction: single motherhood tends to go along with lower disposable household income. The effect is most pronounced for the "always" category: during early childhood the average equivalent income was DM 5200, or by 26 percent, below the average equivalent income of the intact family comparison group. During late childhood the income gap slightly narrows to DM 4800, or 22 percent. Table 1 also contains a justification for

our implicit assumption that income is a resources effect (single motherhood leads to lower income) rather than a selection effect (lower income families are more likely to separate). In particular, we find that the early childhood income of children where the separation occured in late childhood is the highest among all categories, and in particular also higher (although not statistically significantly so) than the early childhood income of children who never experienced single parenthood.

The working hour effect also goes in the expected direction: single mothers spend more time working than mothers with partner, time that is not available for the child. The effect is most pronounced in late childhood, where single mothers spend on average about 4.8 hours working per day (the weighted average of 4.89 hours and 4.63 hours), whereas partnered mothers spend 3 hours working.

The regression results are displayed in Table 2. The ordered dependent variable is the secondary school track at age 14, with categories (in that order) *Hauptschule*, *Realschule* and *Gymnasium*. A positive regression coefficient means that an increase in the corresponding regressor increases the probability of attending Gymnasium and reduces the probability of attending Hauptschule. The direction of the effect on the middle category is ambiguous - it depends on the other regression coefficients as well as on the values of the regressors. While it would be possible to compute the correct marginal probability effects for all three categories, we for simplicity concentrate in our discussion on the signs – i.e. the direction of the change in the probability of attending Gymnasium –, significance, and relative magnitudes of the coefficients.

Three different models with an increasing number of regressors were estimated. Apart from a set of time dummy variables common to all three models, the first specification only includes three additional indicator variables describing the family structure: single mother during early childhood only, single mother during late childhood only, and single mother during both early and

late childhood. The second specification adds controls for observed selection: education and age of the mother, and an indicator for guestworker household. The final third specification includes the main resource variables, namely income, time spent working plus the family size, birthorder, and the child's gender.

From a statistical point of view, Model (3) is the preferred model: a likelihood ratio test of Model (2) against Model (1) has a test statistic of 156 with p-value of 0; A likelihood ratio test of Model (3) against Model (2) has a test statistic of 110, again with p-value of 0. Nevertheless, we will consider the two other models in turn first, mainly, because the changes to the estimated single parenthood coefficients across the three models can tell us something about the nature of the linkage between family structure and educational attainment.

From Model (1) we learn the following: children who spent both childhood periods with a single mother are significantly (at the 5 percent level of significance) less likely to attend Gymnasium than children from intact families. The point estimate for the early childhood only group is similar, although the standard error is now larger and the hypothesis of no effect cannot be rejected. Children with a single mother episode in later childhood only are practically identical to children from intact families with respect to school track.

There is indeed a very strong transmission of educational attainment from mother to child, as the results from Model (2) show. The coefficient of "mother has a tertiary education" is very large. Statistically significant positive effects on the probability of attending Gymnasium are also observed for the mother's age and for living in a non-Guestworker household. Interestingly, these selection variables cannot explain away the single parenthood effect. To the contrary, the effect of having lived in single mother household during both childhood periods has now a larger negative effects on the probability of Gymnasium and the t-statistic increases to 2.4.[6]

[6]This result is compatible with the finding of Björklund and Sundström (2002) that the effect of single parenthood

Now consider the results for Model (3), our preferred specification. The main additional variables of interest are the resource variables, i.e. the childhood period specific average household income and the mother's working hours. The effects are as expected: the probability of attending Gymnasium depends positively on income. The effect is significant for both periods but, as already reported by Jenkins and Schluter (2002), larger for the later period. On the other hand, a child's educational attainment is negatively affected by the mother's working hours during childhood. Here, the time pattern is opposite to the one for income: working during early childhood matters more. The later childhood coefficient is smaller by about one third, and only marginally significant (the p-value is 6.8 percent for a one-sided test). Finally and importantly, all three coefficients of the family structure variables are very close to zero and statistically insignificant in this extended model. Therefore, we find as conjectured that the observed correlation between single parenthood and secondary school track is mostly attributable to the resources effect. According to the evidence in our data, both selection and psychological effects play subordinate roles only.

5 Conclusions

This paper examines the effect of family structure - defined as single motherhood - on children's secondary school track choice at the age of 14 in Germany, using data from the German Socio-Economic Panel and ordered probit regression models. An innovative aspect of the paper is that these effects are investigated separately for two childhood periods, namely early childhood, between 0 and 6 years and late childhood, between 7 and 14 years.

There are two main findings. First, the observed correlation between single parenthood and secondary school track is mostly attributable to the resources effect. When controlling for household

does not disappear once the highest education is controlled for.

income and mother's labor force participation the estimate for the variable *single mother* becomes insignificant for both childhood periods. The lower educational attainment of children growing up in single mother households is therefore due to the diminished resources associated with single motherhood.

Secondly, the most important determinants of a child's probability to enroll in *Gymnasium* are household income and the educational background of the mother. However, there is no systematic evidence that resources during early childhood are more important than resources during later childhood: while this is the case for mother's working hours, the opposite holds for income.

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Tables

Table 1: Sample means by single motherhood

Single motherhood	**never**	**in early-childhood**	**in late-childhood**	**always**
Hauptschule	0.37	0.50	0.37	0.49
	(0.020)	(0.121)	(0.075)	(0.088)
Realschule	0.28	0.22	0.30	0.30
	(0.018)	(0.101)	(0.071)	(0.082)
Gymnasium	0.35	0.28	0.33	0.21
	(0.019)	(0.109)	(0.072)	(0.072)
Mother's highest education				
None	0.10	0.11	0.05	0.00
	(0.012)	(0.076)	(0.033)	(0.000)
School	0.26	0.33	0.28	0.36
	(0.018)	(0.114)	(0.069)	(0.085)
Apprenticeship	0.58	0.44	0.49	0.61
	(0.020)	(0.121)	(0.077)	(0.086)
Tertiary	0.06	0.12	0.18	0.03
	(0.010)	(0.076)	(0.060)	(0.030)
Early-childhood				
Income[1]	1.99	1.95	2.29	1.47
	(0.031)	(0.192)	(0.190)	(0.155)
Work[2]	2.13	4.28	3.32	2.82
	(0.111)	(0.749)	(0.397)	(0.527)
Late-childhood				
Income[1]	2.23	2.17	2.14	1.75
	(0.037)	(0.192)	(0.106)	(0.118)
Work[2]	3.00	3.86	4.89	4.63
	(0.116)	(0.783)	(0.449)	(0.601)
N	610	18	43	33

Data GSOEP, own calculations
Std. Err. in parentheses
1: equivalence income per capita in 10000 DM (1995) 2: average hours per weekday

Table 2. Ordered Probit Regression Results

Variable	*Model 1*	*Model 2*	*Model 3*
Single mother, child age 0 - 6	-0.313 (0.278)	-0.249 (0.298)	-0.125 (0.306)
Single mother, child age 7 - 14	-0.028 (0.180)	-0.297 (0.191)	-0.150 (0.203)
Single mother, child age 0 - 14	-0.415† (0.208)	-0.511† (0.213)	0.129 (0.254)
Mother's edu: School		0.706†† (0.192)	0.568†† (0.199)
Mother's edu: Apprenticeship		1.123†† (0.195)	0.717†† (0.205)
Mother's edu: Tertiary		2.336†† (0.296)	1.672†† (0.314)
Foreigner HH		-0.275† (0.118)	-0.063 (0.124)
Mother's age at birth		0.036†† (0.009)	0.045†† (0.012)
Income,[1] *child age 0 - 6*			0.452† (0.214)
Income,[1] *child age 7 - 14*			0.988†† (0.225)
Work,[2] *child age 0 - 6*			-0.048† (0.022)
Work,[2] *child age 7 - 14*			-0.033 (0.022)
Log avg # of persons in HH child age 0 - 6			0.275 (0.211)
Log avg # of persons in HH child age 7 - 14			-0.071 (0.295)
Child is female			0.140 (0.093)
Birth order			-0.287†† (0.075)
Log-likelihood	-760.9	-682.9	-628.3
χ^2	15.4	171.4	280.6

Notes: Standard errors in parentheses.

Significance levels: † 5 percent, †† 1 percent .

$N = 704$. All models include a time trend and two cutpoints.

[1] equivalence income per capita in 10000 DM (1995)

[2] average hours per working day.

Appendix: Variable Definitions

Variable	Definition
School	Secondary school type when the child is 14 years old, either Hauptschule (0), Realschule (1) or Gymnasium (2).
Single mother	Dummy variable that equals to 1 if the child ever lived in a single mother household during the respective childhood period.
Log avg # of persons in household	Natural logarithm of the average number of persons living in the household during the respective childhood period.
Child is female	Dummy variable that equals to 1 if the child is female and 0 otherwise.
Foreigner household	Dummy variable that equals to 1 if the child lives in a household with either a Turkish, Italian, Spanish, Greek or Yugoslavian head and 0 otherwise.
Mother's age at birth	Age of mother at child's birth.
Birthorder	Constructed assigning the number 1 to the first born child, number 2 to the second born child and so on.
Mother's highest education	Highest educational degree achieved by the mother: no degree (reference category), a school degree, completed an apprenticeship or a tertiary education.
Income	Equivalence income per capita after taxes and government transfers in 10000 DM deflated to 1995 using the annual average CPI published by the Federal Statistical Office Germany. The first adult in a family is weighted by 1, each additional adult by 0.7 and each child by 0.5.
Work	Mother's average working hours per workingday during the respective childhood period.