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**Thünen-Series of Applied Economic Theory**  
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Working Paper No. 95

Parental Labor Market Success and Children's  
Education Attainment

von

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# Parental Labor Market Success and Children's Education Attainment

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## Abstract

This study examines the effects of parental labor market activities on children's education attainment. In contrast to the existing literature we consider parental experiences until the children graduate from school. In addition, the effects of the regional economic environment during teacher's decision about the secondary school track are analyzed. Using data drawn from the German Socio-Economic Panel an ordered probit estimator is used to model children's education attainment. With respect to parental labor market participation we find that father's full-time and mother's part-time employment have significant positive effects on children's education attainment. Furthermore, we obtain evidence that the regional GDP growth rate and the regional unemployment rate when children are 10 years old are significantly related to the education that these children ultimately achieve. Our interpretation is that regional economic conditions affect teachers' recommendations for the secondary school track, which are given during the last year of primary school. The results reveal the less successful parents are on the labor market, the lower the average education level of their children. A second important conclusion is that children who live in regions which experience a poor economic performance over a longer period are, on average, less educated than children who live in more affluent regions.

*Keywords:* education attainment, parental labor supply, macroeconomic uncertainty, family structure, intergenerational link

*JEL classification:* I21, J22, E24, J10, J24

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# 1 Introduction

This study examines the effects of success or failure in parental labor market participation and regional economic performance on children's education attainment. With respect to the impact of maternal (and in a few cases of paternal) employment on child cognitive development nearly all studies concentrate on the pre-school years.<sup>1</sup> In contrast, we expand the analysis to the complete schooling period. Our hypothesis is that parent's success in the labor market is positively related to the education level of their children.

In the literature on children's education attainment, a wide consensus exists that family background affects children's school performance. Hence, regarding the economic development at the regional level we argue that unfavorable circumstances, like recessions or high unemployment, could have negative effects on children's ultimate level of education. More precisely, we focus on the economic conditions at the end of primary school when teachers make their recommendations for the secondary school level. According to our hypothesis, poor regional economic performance at this time has negative effects on children's education attainment.

In the traditional view, parental labor supply has two main effects on children's education level. First, household income increases with labor supply and this, in turn, increases the education attainment of children. Second, a child whose parents have regular employment has, on average, a lower education level because there is less family support for learning activities. This is particularly true for the maternal labor supply during the first three years of the child's life.<sup>2</sup> In this paper we argue that there is a non pecuniary effect in addition to these pecuniary and time budget effects. First, it is likely that the time budget effect is diminished for adolescents.<sup>3</sup> Particularly, when children go to school they could value the time with friends more highly than they do the time spent with their parents. Second, parental success in the labor market could generate mental stability or positive non pecuniary effects that affect all family members.<sup>4</sup> With respect to the economic effect at the end of the primary school period, we argue in a similar way. From economics of happiness it is known that economic conditions affect well-being of adults in a significant way. Children could be affected indirectly by this effect, if parents transmit their economic uncertainty to all family members. The novelty of this paper lies in the analysis of such effects on children's education attainment that arise from a mother's and a father's economic

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<sup>1</sup>See, for example, Baydar and Brooks-Gunn (1991), Blau and Grossberg (1992), Desai et al. (1989), Harvey (1999), Leibowitz (1977), Moore and Driscoll (1997), Mott (1991), Parcel and Menaghan (1994), Stafford (1987), Vandell and Ramanan (1992), Ruhm (2004). See Ruhm (2004) and Bernal and Keane (2006) for a discussion of different studies.

<sup>2</sup>See, for example, Ruhm (2004) for a detailed discussion.

<sup>3</sup>Haveman and Wolfe (1995) refer this to as additional income effect.

<sup>4</sup>Alternatively, one could also argue that the role model may be of importance.

experiences until their children graduate from school.

As the end of the baby boom and the persistent decline in fertility rates fundamentally change the relative population shares of younger and older age groups in most developed countries, it is of particular importance to analyze the impact of parental labor market activities and regional economic performance on the education attainment of the next generation. Put differently, the demographic change has reduced the "renewable resources" on the labor market and this trend will continue for the next 15 to 20 years. Under these circumstances the average education level of future generations is of major importance for growth and international competitiveness.

Using data drawn from the German Socio-Economic Panel, an ordered probit estimator is used to model children's education attainment. With respect to parental labor market participation we find that father's full-time and mother's part-time employment have significant positive effects on their children's education attainment. Parental unemployment is not significantly related to the education level of their children. Furthermore, we obtain evidence that the regional GDP growth rate and the regional unemployment rate when children are 10 years old are significantly related to the education level of that these children ultimately achieve. Our interpretation is that the regional economic conditions affect teachers' recommendations for the secondary school track, which is given during the last year of primary school when most children's are 10 years old. The results reveal the less successful parents are on the labor market the lower the average education level of the next generation. A second important conclusion is that children who live in regions which experience a poor economic performance over a longer period are, on average, less educated than children who live in more affluent regions.

Another interesting finding of this study is that the omission of parental labor market participation effects induces a bias on standard variables like father's education level, the birth order index, and mother's age at first birth. While the latter is no longer significant, the first two variables have a much stronger effect on children's education attainment, when parental experiences on the labor market are considered.

The paper is organized as follows. The next section gives an overview of the literature on parental labor market participation and children's education attainment. In section 3 we provide some theoretical considerations. Section 4 describes the data. The econometric model and results are provided in section 5 while section 6 contains further analysis with respect to the robustness of the results. Section 7 concludes.

## 2 Related Literature

Maternal employment and its impact on child cognitive development have been analyzed in a number of prior studies. Comprehensive surveys of these studies can be found in Bernal and Keane (2006), Haveman and Wolfe (1995), and Ruhm (2004). The focus is in almost all cases on the effects on pre-school children. The effect of the maternal labor supply on children's education attainment is mostly negative. In addition, there is evidence that the negative effect diminishes as the maternal education level rises. However, paternal employment effects have been neglected more often than not. According to Bernal and Keane (2006) and Haveman and Wolfe (1995) a number of these studies use simple correlations without additional controls for family and child characteristics, or use small and sometimes nonrandom samples. This could explain the mixed results. As pointed out in Ruhm (2004), many studies use the National Longitudinal Survey of Youth (NLSY) but come to different conclusions with respect to the estimated effect.

Recent studies of the effect of maternal employment effects fall into three groups: some studies find positive effects (Haveman et al. (1991), Vandell and Ramanan (1992), Parcel and Menaghan (1994)), other find negative effects (Leibowitz (1977), Stafford (1987), Mott (1991), Harvey (1999), Han et al. (2001), Ruhm (2004), Mahler and Winkelmann (2004)), and a third group find positive or negative effects depending on specific circumstances (Desai et al. (1989), Baydar and Brooks-Gunn (1991), Blau and Grossberg (1992), Boggess (1998), Ermisch and Francesconi (2000), Waldfogel et al. (2002), James-Burdumy (2005)). According to Ruhm (2004) the "overall impact of maternal job-holding during the first three years is fairly small, with deleterious effects during the first year offset by benefits for working during the second and third." In addition, there seem to be little evidence that the effect of parental labor market participation turns out to be positive and significant with the increasing age of the child.

There are several explanations for the effects of parental employment on children's education attainment in the literature. According to Hoffman (1980) parental employment may generate stress and this, in turn, leads to less and a lower quality of family interaction. Coleman (1988) alludes to a possible negative relationship between parental employment and the provision of social capital for children. In contrast to this, Blau et al. (2002) and Haveman and Wolfe (1995) conclude that job-holding, especially by mothers, can have positive effects on older children. This conclusion is based on the theory of the role model: a person compares himself or herself to reference groups of people who hold the social role to which that person aspires. The reference group can consist of people who exemplify a positive behavior. In this context it is a parent. Another explanation is given by Price (2008), who finds that the amount of parent-child quality time decreases as children get older. As a result, parents have more time for other activities.

Another important link comes from research on life satisfaction and work satisfaction. Women’s and men’s life satisfaction is influenced positively by whether or not they have a job. Bellows (2007) and Zuo (1992) provide evidence for life satisfaction/happiness interactions in the family and Clark (2003) has shown that not only an individual’s unemployment but also a partner’s unemployment significantly decrease life satisfaction. These results seem to be consistent with findings of Gregg and Machin (2000), in which a father’s long-term unemployment has negative effects on the school attendance of his children. In addition, according to Currie and Thomas (2001) education outcomes at around age seven are strongly correlated with a range of later outcomes (education level, employment, and earnings).

Finally, from economics of happiness it is known that individual life satisfaction is negatively related to recessions and overall unemployment.<sup>5</sup> In addition, Giuliano and Spilimbergo (2008) show that macroeconomic volatility changes the belief in individual success and Ruhm (2000) provides evidence for a relationship between recessions and individual health. Hence, if social interaction in the family is in good order, macroeconomic conditions are likely to affect not only parents but also their children.

### 3 Theoretical Framework

Based on the literature discussed in the previous section, the following three hypotheses that refer to parental labor market participation and regional economic performance effects on children’s education attainment are to be analyzed:

1. Parental labor market success could provide mental stability for all family members. This means that the education level of the child is positively related to father’s and mother’s part-time or full-time employment experiences and continuity, respectively.
2. Unemployment could have negative effects on children’s achievement, because this causes mental instability, disorientation, frustration, and depressions of parents.
3. A poor regional economic performance can cause uncertainty and, hence, anxiety about the future. Hence, children achieve a lower education level if parents transmit this at a particular time (e.g. at the end of primary school).

We use a reduced-form model, where the labor market experiences of parents and regional economic environment have an effect on children’s schooling,  $S_i^c$ :

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<sup>5</sup>See, for example, Di Tella et al. (2001) and Di Tella et al. (2003).

$$S_i^c = \alpha_1 E_i^m + \alpha_2 E_i^f + \alpha_3 U_i^m + \alpha_4 U_i^f + \alpha_5 P_i + \sum_j \beta_j X_{ij} + \epsilon_i$$

Subscript  $i$  indexes the individual children and the superscript differentiates the child ( $c$ ), the mother ( $m$ ), and the father ( $f$ ).  $E_i$  indicates individual full- or part-time employment experience,  $U_i$  is the unemployment experience,  $P_i$  is the regional economic condition at a specific children's age,  $X_{ij}$  are child specific family characteristics that serve as control variables (see section 4), and  $\epsilon_i$  is a child-specific characteristic.

$P_i$  is related to the region where the family resides and to the age of each child.<sup>6</sup> We focus on economic performance during the child-specific primary school phase. In Germany, compulsory school attendance begins around the age of 6 and ends at the age of 16. After four years of primary school (which is identical for all) students continue their education in a secondary school. At the end of the primary school track, teachers give a recommendation in terms of the secondary school track, based on the average performance. In most cases, parents follow the teachers' recommendation. A scaling up after the realized decision is not possible. This is an important difference from other countries. That is, we want to know if the regional economic conditions at the end of children's primary school phase may have an effect on the ultimate education level. In doing so, we focus on the average economic performance at the children's age of 9 to 10.

## 4 Data

The data used for this study are drawn from the German Socio-Economic Panel (GSOEP), an annual panel survey of a random sample household in Germany. We considered school leavers between 1984 and 2005, which yields information for almost 1500 children. All children who have attended either lower level of secondary school, intermediate secondary school or upper level secondary school were kept in the sample.<sup>7</sup>

For children's education attainment we differentiate among five levels: early school leavers without school leaving certification (1), lower level of secondary school (2), intermediate secondary school (3), upper level secondary school but not entitled to enter university (4), upper level secondary school and entitled to enter university (5). While the first group consists of dropouts without a formal certification, the fourth group contains dropouts

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<sup>6</sup>The specific value of  $P_i$  will be the same for twins. However, in the used sample are 11 twin pairs only. For the remaining children the values are the same if they are born in the same region and the same year.

<sup>7</sup>Children visiting a so called *Gesamtschule* (comprehensive school) had to be dropped since the ordering of this school type relative to the other is ambiguous.



of the upper level secondary school. They have finished the 12th grade but, in contrast the fifth group, not the 13th. The consequence is that they are not allowed to study at a university, but are eligible to attend a technical college.

Using the GSOEP allows us to control for personal and family characteristics. Since we are interested in the development of specific family characteristics between birth and school leaving, the number of children considered is smaller than the number of children available in the sample. Table 1 depicts the number of observations available in the data set (complete sample) and available after consideration of control variables (considered sample) ordered by children's education level. The distribution does not change much when we consider the set of control variables.

To account for the possibility of intergenerational mobility and household background effects we control for different family characteristics. Parental labor market experiences are approximated by full- and part-time employment and unemployment. All three variables are measured as aggregated experiences in years until the child leaves school. Standard variables that have significant effects on children's education attainment are parental education level and household income. Parental education has the same five categories as the children have. In addition, we consider a dummy variable that is equal to 1 if the respective parent has a university degree. Household income is measured as equivalence income after taxes and government transfers in 1000 Euro averaged over the period between birth and school leaving of the child.<sup>8</sup>

To consider the quantity-quality trade of (Becker and Lewis (1973)) and the hypothesis of sibling rivalry (Becker and Tomes (1986)) we control for the number of siblings and the birth order. Black et al. (2005), Booth and Kee (2005), and Plug and Vijverberg (2003) have shown that the birth order effect is important in addition to the number of children. The birth order index is calculated as suggested by Booth and Kee (2005). Single parenthood is an important control variable, since the number of single parent households has increased steadily in Germany.<sup>9</sup> Single parenthood is measured by an index that is calculated by the number of years in a single parent household between birth and school leaving of the child. Furthermore, there is evidence in the literature that girls have, on average, a higher education level and the timing of birth has significant effects on the education level of the child. The latter is measured by mother's age at first birth. In addition, we consider regional dummies at the state level. Basically, this is to consider the differences in the formal curriculum at the state level. In case of a removal in another state during the schooling phase, the respective child

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<sup>8</sup>Equivalence income weights are calculated as suggested by Buhmann (1988).

<sup>9</sup>See Mahler and Winkelmann (2004) for detailed discussion of this point and estimates for Germany.

has more than one entry equal to 1 in the dummy vector.

Further control variables that will not be discussed are: nationality of the students (we differentiate between native and nonnative with a dummy), number of moves between birth and school leaving of the child, divorce of parents (one dummy for the pre-school phase and an additional dummy for the primary school phase), attendance in a Kindergarten, dummies for child care of mothers and fathers in first year of children's life, dummies for deviations from teacher's recommendation for secondary school track<sup>10</sup>, and a dummy for a repeat of a school year. In the appendix we provide summary statistics for all variables.

## 5 Estimation and Results

A standard ordered probit estimator is used to model children's education attainment. Table 2 provides the estimation results of three different specifications. Regression 1 comprises the standard variables only, regression 2 also contains the variables for parental labor market experiences, and regression 3 is the full specification including the regional economic performance. In principle, the results of regression 1 are in line with the existing literature. Parental education affects children's education attainment positively and, with the exception of mother's university degree, significantly. Household income has the expected positive effect.<sup>11</sup> Children's education attainment increases, on average, the older a mother is at first birth. Based on the index that measures the proportion of time in a single parent household until the child graduates from school, children complete a lower level of education if one parent is absent. However, the effect is not significant. Finally, boys have, on average, a lower education level, and the number of siblings as well as the birth order have negative effects on children's education attainment. Hence, even if we control for the number of siblings, birth order matters.<sup>12</sup>

Regression 2 also contains the variables that approximate parental labor market activities. With respect to the employment variables, the sign of the respective parameters is always as expected in the above mentioned hypothesis and the effects are significant. In addition, the effects are considerably larger for part-time work and, in general, for fathers. However,

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<sup>10</sup>In Germany teachers give a recommendation for the secondary school track in the last year of the primary school phase. In case of parents choose a higher education track for their child as recommended by the teacher a dummy variable takes the value 1. In any other case this variable has the value of 0. An additional dummy is used to control for the parental deviation from teachers recommendation in the other direction.

<sup>11</sup>Presumably parental income is correlated with their abilities. Hence, it is not clear to what extent income really matters. However, we will not control for this possible bias, since the primary focus in this paper is not on family income effects. For a detailed discussion of this issue see, for example, Shea (2000).

<sup>12</sup>Similar results are obtained by Booth and Kee (2005) for UK and Black et al. (2005) for the US.

if parents have more experience with employment (part- or full-time) the time remained for interaction with children decreases. The latter effect is expected to diminish children’s achievement. In other words, the estimated parameters are underestimated with respect to the pure employment effect. Children’s education attainment decreases if fathers experience unemployment; however, the effect is not significant.

One criticism is that a consideration of parental education level, labor supply, and household income does not allow coherent conclusions. It is argued that household income is a function of parental education and labor supply. This view fails to consider that higher parental education at given income has a quality effect on children’s achievement and labor market activities could have non pecuniary effects, as described above. In all three regressions in table 2 we control for average household equivalence income. The results for the regressions 2 and 3 reveal that the estimated effects decrease somewhat but remain significant if we consider the labor market and regional economic performance variables.<sup>13</sup> Moreover, in particular father’s full-time and mother’s part-time experiences are highly significant. That is, parental labor market activities comprise direct and indirect (via income) effects on children’s education attainment. Hence, the non pecuniary effects of parental success and failure on the labor market are of importance.

In regression 3 we control also for average regional economic performance at the children’s age of 9 to 10. Both variables, the regional GDP growth rate and the regional unemployment rate are significant at the 5% level. That is, average regional economic performance at the children’s age of 9 to 10 has significant effects on the level of education that they eventually complete.<sup>14</sup> With respect to the labor market experiences we find that for fathers the effect remains highly significant for full-time employment, while the effect for mother’s part-time employment remains significant at the 1% level. The latter is not surprising, because in the majority of cases mothers work part-time, especially as long as children have completed the schooling period.<sup>15</sup>

With respect to the control variables we find interesting changes if we consider the variables of main interest in the regressions 2 and 3. The omission of parental labor market variables induces an omitted variable bias on

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<sup>13</sup>The drop of the income parameter in the regressions 2 and 3 can be explained theoretically. According to the theory of household production, particularly early income (when the child is up to three years old) creates a positive environment for success in school. It might be that this income effect diminishes when the children reach school-age. A similar argument is given by Blau (1999), whereby the effect of current income on children’s cognitive development is small. However, it should be noted that our average equivalence family income variable may be a rather crude proxy of the economic resources available.

<sup>14</sup>This is in line with findings of Currie and Thomas (2001) for the US whereby education outcomes at around age seven are strongly correlated with a range of later outcomes (education level, employment, and earnings).

<sup>15</sup>See Paull (2008) for a detailed discussion of that point.

some standard variables in the analysis of children’s education attainment. First, the schooling effect of parents, and in particular that of fathers, has increased. In addition, the university degree effect is significant only for fathers. It seems that father’s positive employment effect has a downward bias on the education effect in regression 1. Hence, when controlling for this bias, father’s schooling is at least as important as mother’s. Frequently it is argued that it is especially mother’s time that increases children’s education attainment.<sup>16</sup> Ruhm (2004) conclude that father’s time is similarly important, which implies a substitutability between father’s and mother’s. In addition, more recent studies (Behrman and Rosenzweig (2002), Plug (2004), and Plug and Vijverberg (2005)) find that the positive effect of mother’s schooling disappears when assortative mating and heritable abilities are taken into account. Even Antonovics and Goldberger (2005), who are critical of the methodological issues in Behrman and Rosenzweig (2002), come to the conclusion that the effects of a father’s education on his children are greater than the effects of a mother’s.

Second, the effect of the birth order is much stronger when we control for parental labor market activities. According to our results, the estimated effect of the birth order index in regression 1 comprises a positive bias. The index effect has tripled when controlling for parental labor market participation. It is interesting to see that the number of children is not much affected by the inclusion of labor market variables. These results are in line with findings of Price (2008). He argues that parents give roughly equal time to each child. From this it follows that the first child will get most of the time, followed by the second, and so on. Hence, the birth order effect becomes stronger, the more hours parents are working.

Third, mother’s age at first birth is no longer significantly related to children’s education attainment if parental labor market experiences are considered. The positive bias disappears, after controlling for parental labor market activities. Usually it will be argued that mother’s experience with education of children increases with her age. Our interpretation is that with increasing age of parents at first birth, calmness and resilience decrease. Hence, there are opposing effects. Mother’s age at first birth and full-time employment are positively correlated ( $r=0.23$ ) in our sample. That is, the seemingly positive effect of mother’s age disappears as soon as we control for labor market activities.

In addition to the statistical significance the economic relevance of these variables is of importance. For this we compare the marginal probability effects (MPEs) based on a one unit change and one standard deviation change of the variables. Table 3 provides the respective ranking based on the MPEs. According to the results for a one-unit change the birth order index has the

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<sup>16</sup>See, for example, Murnane et al. (1981), Heckman and Hotz (1986), Schultz (1993), Haveman and Wolfe (1995), and Hill and King (1995).

strongest effect. With respect to the impact this variable is followed by household income, single parent household (which is not significant in the estimates), and the number of siblings. After these standard variables the labor market and regional economic performance variables follow. Hence, based on the one-unit change approach the standard variables (with the exception of the birth order index) are more important. The order of importance changes if we consider the one standard deviation approach. Now the largest impact on children's education attainment comes from father's experience with full-time work, followed by the birth order index, regional unemployment, mother's experience with part-time work, regional GDP growth, household income, and the number of siblings. Hence, based on the one standard deviation approach the labor market and regional economic performance variables are more important. With respect to the interpretation of the economic relevance of the variables this approach is superior to the method based on one-unit change. That is, parental labor market experiences and regional economic performance are important to explain children's education attainment.

## 6 Fact or Fiction?

The results for parental labor market success obtained in the previous section are contradictory to most of the empirical findings for pre-school children. In this section we analyze if the estimated effects for parental labor market participation and regional economic conditions are robust with respect to alternative specifications of the model. There is no doubt that the ordering of five education levels may have driven some of the results and the regional effects could be spurious or correlated with unobserved regional effects. First we take a closer look at the data and then we run additional regressions.

In the first instance we compare the education level of the children with that of their parents. Table 4 provides the distribution of education for children and parents. The entries in the matrix would have the largest value on the principal diagonal if parents have the same education level as their children. According to Haveman and Wolfe (1995) a mother's education level is usually more closely related to that of her children. Using the GSOEP data we find no evidence for parental differences if we add the matches on the principal diagonal. For mothers and children we get 329 equal education levels, while for fathers and children 322 pairs have the same schooling level. Moreover, in our sample mothers are, on average, less educated. This finding is in line with Plug and Vijverberg (2005).

Children's education level 1 implies no formal education and level 4 means that high school students leave the school before they finish their last school year. That is, the two groups consist of early school leavers, though the second group at a higher level. Most parents of children with-

out a school leaving certification have a very low or no formal education level. For children with an education level of category 4 the distribution of parental education has more in common with that of level 3 (intermediate secondary school) children than with that of level 5 (completed upper level secondary school) children. Since level 4 and level 5 children are at the same school it is somewhat surprising that this self selection process is correlated with parental education. One possible interpretation is that these early school leavers are afflicted with social pressure, due to parental education background.

To underline this hypothesis we compare parental education levels (table 5). Here the entries in the matrix have the largest value on the principal diagonal, with the exception of category 4. Even if we add the two upper secondary school levels (4 and 5), the pattern is not clear. The distribution of father's education seems to be quite equal across the lower level, intermediate secondary level, and upper secondary level, if mothers have the education level 4. For mothers the distribution is in favor of level 3, if fathers have a level 4 education.

Now we take a closer look at parental labor market experiences. Table 6 gives information on parental employment and unemployment ordered by children's education level. The average unemployment experiences of fathers decreases with the education level of the children, however, the value in category 4 (0.69) is larger than those of the categories 3 and 5. The same applies to the share of fathers with unemployment experiences. This is in line with the education distribution of parents discussed above. With respect to fathers and part-time work we find a similar pattern. Fathers of children with the education level 4 have, on average, more experience with part-time work. Finally, education attainment of children is positively correlated with father's full-time employment experiences.

For mothers we find no clear cut pattern with respect to the relation of mean duration of unemployment and children's education attainment. The same applies to the share of mothers with unemployment experiences. In addition, both the mean duration of unemployment and the share of mothers with unemployment experiences have a smaller interval than do fathers. For mother's part-time employment we find a positive correlation between mean duration and children's education attainment, while for the shares of mothers with part- and full-time employment experiences we find no peculiar pattern. The difference between mother's and father's part-time experiences is noticeable. Almost three-fourths of mothers have part-time employment experiences. This explains why the estimated part-time effects are significant for mothers but not for fathers.

To eliminate the possible effect of drop outs we disregard early school leavers without a formal education degree (former level 1) and add the two upper secondary school levels (4 and 5) and run the regressions again. For children's education attainment we now differentiate among three levels:

lower level of secondary school (1), intermediate secondary school (2), and upper level secondary school (3). The latter comprises the former levels 4 and 5.

Table 7 contains the regression results for the sample excluding the drop outs without a formal education degree. In principle, the results are similar to those in table 2. Merely the significant labor market participation effects are somewhat stronger. The parameters for parental experiences with unemployment are now both positive, but still insignificant. A cautious conclusion would be that father's and mother's unemployment increases the likelihood for children to drop out and leave school early, respectively. Unfortunately, we have no information on school leavers of other levels than the former categories 1 and 4. With respect to the former five education levels this means that we cannot control for a change from level 5(4) to level 3 and from level 3 to level 2. These two cases would imply early school leaving with a lower school leaving certification.

The statistical power for the regional economic performance proxy variables is unchanged, compared to table 2. Hence, the average regional effects are robust with respect to the change in the aggregation of children's education levels. However, the results could still be driven by an omitted variable bias.

While it is hard to identify such a possible variable, we will consider different specifications of the model to shed light on this issue. The variables considered so far are regional average values for children ages 9 to 10. For most children, school enrollment begins at age 6. In some cases children are 7 years old. While a school year runs from summer to summer, the economic information is annual. Children's age at the end of primary school is usually 10. If they are 11 years old, they were born in the first half of the year and the economic performance of this year is already known at the end of that year. Hence, we expect that the impact of regional economic performance on children's education attainment increases between ages 8 to 10, and becomes unimportant at age 11.

Table 8 provides the estimation results for the macro variables for all four years.<sup>17</sup> The basic specifications are equal to the regression 3 in table 2 (5 education levels) and regression 3 in table 7 (3 education levels). Regression 1 in table 8 contains the regional information at age 8, regression 2 that at age 9, and so on. As expected, the impact of the regional economic performance first increases with children's age and becomes less important or unimportant after the children enter the secondary school track. Again, the effects are slightly stronger for the specification with 5 education levels. In addition, the effect of the regional unemployment rate is not significant in the 3 education level specification. With respect to the significance level the GDP growth rate is more important than the unemployment rate. Based on

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<sup>17</sup>Complete regression results are available upon request.

the results we can conclude that the estimated effects for the average values of regional variables at children’s age 9 to 10 seem to be reliable, at least for the GDP growth rate.

In a final specification we consider two additional extensions. First, the parental annual labor market experiences at children’s age 8 to 11 are included. Second, we estimate the regional economic effects for all four years at once. That is, we control for a possible correlation with the individual experiences and on the regional level across time. Table 9 provides the main results. In regression 1 children’s education attainment has 5 levels, while in regression 2 we exclude the drop outs again. For both regressions we find that regional economic conditions affect children’s education attainment significantly, when they are about 10 years old. More precisely, we argue that these conditions affect teachers’ recommendation for the secondary school track. Subject to the German school law this recommendation is irreversible in most cases. Hence, our hypothesis whereby poor regional economic performance at the end of primary school has, on average, negative effects on children’s education attainment cannot be rejected.

A further effect, which is not shown in the table, is that father’s unemployment experiences at children’s age of 10 have significant negative effects on education attainment in regression 1. However, this effect diminishes in regression 2. Again, our interpretation is that drop outs are more sensitive to parental experiences with unemployment. Another interesting finding is that in both regressions the effect of mother’s age at first birth turns out to be significantly negative. As mentioned above we argue that there are opposing effects. According to the results it seems that the effect of increasing calmness and resilience dominates the increasing education experience effect, after controlling for labor market experiences. Regarding both findings further research is needed.

## 7 Conclusions

This study examines the effects of parental labor market activities on children’s education attainment. In contrast to the existing literature we consider parental experiences until the children graduate from school. In addition, the effects of the regional economic performance during teacher’s decision about the secondary school track are analyzed. Using data drawn from the German Socio-Economic Panel an ordered probit estimator is used to model children’s education attainment.

With respect to parental labor market participation we find that father’s full-time and mother’s part-time employment have significant positive effects on their children’s education attainment. Parental unemployment experiences are not significantly related to the education level of children. Furthermore, we obtain evidence that the regional GDP growth rate and the



regional unemployment rate at children's age of 10 are significantly related to the education level that children ultimately achieved. Our interpretation is that regional economic conditions affect teachers' recommendations for the secondary school track, which is given during the last year of primary school when most children are 10 years old.

Another interesting finding is that the omission of parental labor market participation effects induces a bias on standard variables like father's education level, the birth order index, and mother's age at first birth. While the latter is no longer significant, the first two variables have a much stronger effect on children's education attainment, when parental experiences on the labor market are considered.

The results reveal the less successful parents are on the labor market the lower the average education level of the next generation. To some extent this finding could explain international differences in children's education attainment, because national labor market conditions show large differences. For example, the labor market participation rate in the second half of the 1990s was 77.3% in the US and 71.2% in Germany.<sup>18</sup> At the same time the unemployment rate was 4.6% in the US and 9.0% in Germany. In addition, the share of long-term unemployed was about 50% in Germany, but less than 10% in the US. Hence, on average, the success in parental labor market participation is lower in Germany and the effects on children's school performance (if existing) are stronger.

A second important conclusion is that children who live in regions which experience a poor economic performance over a longer period are, on average, less educated. As mentioned earlier, the demographic change has reduced the "renewable resources" on the labor market and this trend will continue for the next 15 to 20 years. Under these circumstances the average education level of future generations is of major importance for growth and international competitiveness. From this point of view, our results enrich the debate about intergenerational education effects.

Further research is needed to analyze if the regional economic effect is specific to the German school system. In addition, the possible relation between early school leavers and parental unemployment experiences has to be analyzed in detail. Finally, it would be interesting if the effect of mother's age at first birth yields similar results in other data, when parental labor market participation is taken into account.

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<sup>18</sup>The labor market participation rate for men (women) in the second half of the 1990s is 84.1% (70.6%) in the US and 79.9% (62.2%) in Germany. In the same period, the labor market participation rate of the low skilled is 61.4% in the US and 56.5% in Germany and the corresponding unemployment rates are 9.3% in the US and 15.0% in Germany.

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## 9 Appendix

Table 1: Distribution of Children's Education Attainment

	complete sample		considered sample	
	frequency	% of all	frequency	% of all
1	24	1.62	6	0.73
2	339	22.91	170	20.71
3	531	35.88	298	36.30
4	94	6.35	51	6.21
5	492	33.24	296	36.05
$\Sigma$	1480	100.00	821	100.00

Table 2: Children's Education Attainment (five levels)

	<i>Regression 1</i>		<i>Regression 2</i>		<i>Regression 3</i>	
	<i>coef.</i>	<i>se</i>	<i>coef.</i>	<i>se</i>	<i>coef.</i>	<i>se</i>
unemployment mother			0.030	(0.027)	-0.045 <sup>#</sup>	(0.024)
unemployment father			-0.011	(0.030)	-0.002	(0.051)
full-time mother			0.018 <sup>†</sup>	(0.008)	0.017 <sup>#</sup>	(0.010)
full-time father			0.059 <sup>‡</sup>	(0.010)	0.057 <sup>‡</sup>	(0.009)
part-time mother			0.037 <sup>‡</sup>	(0.008)	0.037 <sup>‡</sup>	(0.009)
part-time father			0.094 <sup>#</sup>	(0.052)	0.085	(0.053)
gdp growth rate					0.036 <sup>†</sup>	(0.013)
unemployment rate					-0.044 <sup>†</sup>	(0.017)
school level mother	0.178 <sup>‡</sup>	(0.063)	0.230 <sup>‡</sup>	(0.066)	0.218 <sup>‡</sup>	(0.034)
uni degree mother	0.182	(0.138)	0.188	(0.140)	0.236	(0.146)
school level father	0.109 <sup>#</sup>	(0.061)	0.218 <sup>‡</sup>	(0.066)	0.205 <sup>‡</sup>	(0.048)
uni degree father	0.519 <sup>‡</sup>	(0.145)	0.517 <sup>‡</sup>	(0.150)	0.523 <sup>‡</sup>	(0.101)
mothers age at 1. birth	0.033 <sup>‡</sup>	(0.012)	-0.016	(0.016)	-0.014	(0.016)
single parent household	-0.978	(0.934)	-0.067	(0.933)	-0.265	(1.012)
family income	0.343 <sup>‡</sup>	(0.123)	0.233 <sup>†</sup>	(0.117)	0.273 <sup>‡</sup>	(0.069)
boy	-0.488 <sup>‡</sup>	(0.085)	-0.494 <sup>‡</sup>	(0.087)	-0.516 <sup>‡</sup>	(0.088)
number of siblings	-0.138 <sup>‡</sup>	(0.047)	-0.162 <sup>‡</sup>	(0.051)	-0.158 <sup>‡</sup>	(0.042)
birth order	-0.271 <sup>†</sup>	(0.120)	-0.776 <sup>‡</sup>	(0.143)	-0.745 <sup>‡</sup>	(0.167)
<i>pseudo R</i> <sup>2</sup>	0.1928		0.2295		0.2352	

Notes: Dependent variable: children's education (five levels); estimation method: ordered probit; number of observations: 821; robust standard errors in parenthesis; standard errors for regression 3 also corrected for clustering; additional control variables: nationality (dummy for non native), move (number of moves), dummy for divorce in the first six years of life, dummy for divorce during primary school, dummy for Kindergarten, dummies for child care of mothers and fathers in first year, dummies for deviation from teacher's recommendation for secondary school track, dummy for repeater; all regressions include federal state fixed effects; <sup>‡</sup>: significant at the 1% level; <sup>†</sup>: significant at the 5% level; <sup>#</sup>: significant at the 10% level.

Table 3: Ranking for the Impact on Education Attainment

	one unit change	one std. dev. change
mothers age at first birth	12	11
single parent household	3	12
family income	2	6
number of siblings	4	7
birth order	1	2
unemployment mother	7	10
unemployment father	13	13
full-time mother	11	8
full-time father	6	1
part-time mother	9	4
part-time father	5	9
regional gdp growth rate	10	5
regional unemployment rate	8	3

Notes: Calculation based on regression 3 in table 2. The ranking is based on marginal probability effects. In the column "one unit change" the ranking is based on a one unit change of each variable. In the column "one std. dev. change" the calculation is based on the standard deviation of the variables.



Table 4: Children's and Parental Education Level

	Children's education level				
	1	2	3	4	5
Mother's education					
1	2	7	6	1	4
2	2	104	106	18	52
3	2	52	156	27	159
4		2	4	2	16
5		5	26	3	65
Father's education					
1	2	11	8	2	4
2	1	97	125	21	57
3	3	47	117	17	114
4		3	11	4	19
5		12	37	7	102

Notes: 1 = early school leaver without school leaving certification, 2 = lower level of secondary school, 3 = intermediate secondary school, 4 = upper level secondary school but not entitled to enter university, 5 = upper level secondary school and entitled to enter university.

Table 5: Parental Education Mix

	Education level of ...				
	Fathers	Mothers			
	1	2	3	4	5
1	18	8	1		
2	2	189	93	11	6
3		55	210	6	27
4		13	18	2	4
5		17	74	5	62

Notes: 1 = early school leaver without school leaving certification, 2 = lower level of secondary school, 3 = intermediate secondary school, 4 = upper level secondary school but not entitled to enter university, 5 = upper level secondary school and entitled to enter university.

Table 6: Children's Education and Parental Labor Market Activities

	Children's education level				
	1	2	3	4	5
<i>Father's unemployment</i>					
mean duration	1.22	0.90	0.40	0.69	0.23
share with unemployment experience	0.50	0.34	0.28	0.41	0.23
<i>Father's part-time employment</i>					
mean duration	0.00	0.16	0.19	0.17	0.28
share with part-time employment experience	0.00	0.16	0.13	0.25	0.15
<i>Father's full-time employment</i>					
mean duration	21.6	21.8	23.8	25.8	25.1
share with full-time employment experience	1.00	1.00	1.00	1.00	1.00
<i>Mother's unemployment</i>					
mean duration	0.60	0.70	0.75	0.72	0.62
share with unemployment experience	0.33	0.41	0.40	0.35	0.29
<i>Mother's part-time employment</i>					
mean duration	1.90	4.36	5.12	5.70	5.93
share with part-time employment experience	0.83	0.72	0.71	0.73	0.73
<i>Mother's full-time employment</i>					
mean duration	13.1	7.70	10.5	11.6	11.7
share with full-time employment experience	1.00	0.89	0.95	1.00	0.96

Notes: mean in years, share are percentages of those who have experiences with (un)employment; 1 = early school leaver without school leaving certification, 2 = lower level of secondary school, 3 = intermediate secondary school, 4 = upper level secondary school but not entitled to enter university, 5 = upper level secondary school and entitled to enter university.

Table 7: Children's Education Attainment (three levels)

	<i>Regression 1</i>		<i>Regression 2</i>		<i>Regression 3</i>	
	<i>coef.</i>	<i>se</i>	<i>coef.</i>	<i>se</i>	<i>coef.</i>	<i>se</i>
unemployment mother			0.020	(0.029)	0.034	(0.024)
unemployment father			0.011	(0.036)	0.024	(0.050)
full-time mother			0.025 <sup>‡</sup>	(0.009)	0.024 <sup>†</sup>	(0.011)
full-time father			0.064 <sup>‡</sup>	(0.010)	0.063 <sup>‡</sup>	(0.011)
part-time mother			0.040 <sup>‡</sup>	(0.009)	0.040 <sup>‡</sup>	(0.009)
part-time father			0.083 <sup>#</sup>	(0.051)	0.073	(0.052)
gdp growth rate					0.031 <sup>†</sup>	(0.014)
unemployment rate					-0.041 <sup>†</sup>	(0.019)
school level mother	0.173 <sup>‡</sup>	(0.067)	0.236 <sup>‡</sup>	(0.071)	0.223 <sup>‡</sup>	(0.037)
uni degree mother	0.133	(0.143)	0.129	(0.149)	0.177	(0.139)
school level father	0.111 <sup>#</sup>	(0.065)	0.233 <sup>‡</sup>	(0.070)	0.222 <sup>‡</sup>	(0.059)
uni degree father	0.491 <sup>‡</sup>	(0.153)	0.482 <sup>‡</sup>	(0.160)	0.488 <sup>‡</sup>	(0.110)
mothers age at 1. birth	0.032 <sup>‡</sup>	(0.012)	-0.024	(0.016)	-0.022	(0.017)
single parent household	-0.827	(1.053)	0.107	(1.069)	-0.158	(1.255)
family income	0.358 <sup>‡</sup>	(0.132)	-0.242 <sup>†</sup>	(0.125)	-0.278 <sup>‡</sup>	(0.076)
boy	-0.514 <sup>‡</sup>	(0.090)	-0.537 <sup>‡</sup>	(0.092)	-0.557 <sup>‡</sup>	(0.088)
number of siblings	-0.152 <sup>‡</sup>	(0.049)	-0.171 <sup>‡</sup>	(0.053)	-0.167 <sup>‡</sup>	(0.048)
birth order	-0.225 <sup>#</sup>	(0.128)	-0.800 <sup>‡</sup>	(0.152)	-0.771 <sup>‡</sup>	(0.184)
<i>pseudo R</i> <sup>2</sup>	0.2192		0.2661		0.2712	

Notes: Dependent variable: children's education (three levels); estimation method: ordered probit; number of observations: 815; robust standard error in parenthesis; standard errors for regression 3 also corrected for clustering; additional control variables: nationality (dummy for non native), move (number of moves), dummy for divorce in the first six years of life, dummy for divorce during primary school, dummy for Kindergarten, dummies for child care of mothers and fathers in first year, dummies for deviation from teacher's recommendation for secondary school track, dummy for repeater; all regressions include federal state fixed effects; <sup>‡</sup>: significant at the 1% level; <sup>†</sup>: significant at the 5% level; <sup>#</sup>: significant at the 10% level.

Table 8: Regional Effects at Children's Age 8 to 11 Years

		children's age of ... years			
		8	9	10	11
education		<i>Reg1</i>	<i>Reg2</i>	<i>Reg3</i>	<i>Reg4</i>
5 levels	<i>gdp</i>	0.006	0.037 <sup>‡</sup>	0.046 <sup>‡</sup>	0.039 <sup>†</sup>
		(0.009)	(0.012)	(0.013)	(0.017)
	<i>ur</i>	0.004	-0.030 <sup>#</sup>	-0.025 <sup>#</sup>	-0.021
		(0.021)	(0.017)	(0.014)	(0.013)
		<i>Reg5</i>	<i>Reg6</i>	<i>Reg7</i>	<i>Reg8</i>
3 levels	<i>gdp</i>	0.008	0.034 <sup>‡</sup>	0.040 <sup>‡</sup>	0.030 <sup>#</sup>
		(0.010)	(0.013)	(0.014)	(0.017)
	<i>ur</i>	0.007	-0.026	-0.022	-0.014
		(0.023)	(0.020)	(0.016)	(0.015)

Notes: Dependent variable: children's education attainment; Estimation method: ordered probit; standard errors in parenthesis are robust and corrected for clustering; specification: regression 3 in table 2 and regression 3 in table 7; *gdp*: average GDP growth rate in respective federal state; *ur*: average rate of unemployment in respective federal state; <sup>‡</sup>: significant at the 1% level; <sup>†</sup>: significant at the 5% level; <sup>#</sup>: significant at the 10% level.

Table 9: Regional Effects at Children's Age 8 to 11 Years

		at children's age of ... years			
		8	9	10	11
<i>Reg1</i>	<i>gdp</i>	-0.001 (0.010)	-0.001 (0.019)	0.051 <sup>†</sup> (0.022)	-0.016 (0.022)
	<i>ur</i>	0.012 (0.026)	-0.001 (0.026)	-0.038 <sup>†</sup> (0.016)	-0.009 (0.009)
<i>Reg2</i>	<i>gdp</i>	0.002 (0.012)	-0.003 (0.021)	0.054 <sup>‡</sup> (0.022)	-0.031 (0.023)
	<i>ur</i>	-0.001 (0.029)	0.011 (0.033)	-0.042 <sup>†</sup> (0.018)	-0.003 (0.011)

Notes: Dependent variable: children's education attainment; estimation method: ordered probit; standard error in parenthesis are robust and corrected for clustering; *Reg1*: regression 3 in table 2 (five education levels); *Reg2*: regression 3 in table 7 (3 education levels); *gdp*: average GDP growth rate in respective federal state; *ur*: average rate of unemployment in respective federal state; <sup>†</sup>: significant at the 1% level; <sup>‡</sup>: significant at the 5% level; <sup>‡</sup>: significant at the 10% level.

Table 10: Variable definitions

Variable	Definition
education	1 = early school leavers without school leaving certification, 2 = lower level of secondary school, 3 = intermediate secondary school, 4 = upper level secondary school but not entitled to enter university, 5 = upper level secondary school and entitled to enter university
university degree	Dummy (equals to 1 if the respective parent has a university degree)
Mother's age at first birth	Age of mother at birth of the first child
single parent household	Index: Proportion of years in a single parent household between birth and school leaving
family income	Average equivalence income per capita after taxes and government transfers in 1000 Euro between birth and school leaving of the child
boy	Dummy (equals to 1 if the respective child is a boy)
number of children	Absolute number of children in the household
birth order	Index: Calculated as suggested by Booth and Kee (2005)
parental unemployment	Sum of unemployment experiences in years until school leaving of the child
parental full-time	Sum of full-time employment experiences in years until school leaving of the child
parental part-time	Sum of part-time employment experiences in years until school leaving of the child
gdp	Regional GDP growth rates at a specific children's age
ur	Regional unemployment rates at a specific children's age
regional dummy	Vector of state dummies (equal to 1 if the family lives in the respective federal state)
nationality	Dummy (equals to 1 if native)
move	Number of moves between birth and school leaving of the child
divorce	Dummies for pre-school and primary school phase (equal to 1 if parents get a divorce)
kindergarten	Dummy (equals to 1 if the child was in the kindergarten)
child care	Dummies (equal to one if mother or father stay at home in children's first year of life)
deviation	Dummies for deviation from teacher's recommendation for the secondary school track (equal to 1 if parents deviate)
repeater	Dummy (equals to 1 if the child repeats a school year)

Table 11: Summary statistics

variables	mean	std. dev.	min	max
education children	3.562	1.195	1	5
education mothers	2.878	0.969	1	5
university degree mothers	0.195	0.396	0	1
education fathers	2.998	1.147	1	5
university degree fathers	0.266	0.442	0	1
mother's age at 1. birth	24.022	4.037	15	41
index single parent	0.007	0.049	0	0.667
average equivalence income	1.320	0.569	0.421	6.631
boy	0.546	0.498	0	1
number of siblings	1.396	0.959	0	9
birth order index	0.990	0.351	0.286	1.778
mother's unemployment exp.	0.692	1.557	0	13
father's unemployment exp.	0.465	1.369	0	13.9
mother's full time exp.	10.426	7.619	0	40
father's full time exp.	24.002	6.381	0.8	45
mother's part time exp.	5.267	5.863	0	36
father's part time exp.	0.214	0.840	0	11
regional GDP growth rate	3.281	5.506	-0.725	28.893
regional unemployment rate	4.983	5.941	0	21.7
nationality	0.968	0.175	0	1
move	0.575	0.969	0	8
divorce at age 0-6	0.010	0.098	0	1
divorce at age 6-10	0.023	0.150	0	1
kindergarten	0.395	0.489	0	1
child care mother	0.217	0.412	0	1
child care mother	0.026	0.158	0	1
upgrading of recommend.	0.043	0.202	0	1
downgrading of recommend.	0.066	0.248	0	1
repeater	0.107	0.310	0	1

Notes: Observations = 821