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Educational Attainment in Denmark: The role of parents' education and childhood living conditions

By Mette C. Deding and Mohammad Azhar Hussain*

Abstract

We consider the importance of parental education and childhood living conditions on children's educational attainment in Denmark. Data are two surveys of living conditions merged with register data and children included are children of interviewees' aged 25–35 in 1998. We estimate educational attainment by applying multinomial logit models, both with and without living condition variables. Parents' education is found to be very important, and especially regarding mother's education. Thus, having a better-educated mother is more important for the educational attainment than having a better-educated father. Introducing living conditions in the model decreases the importance of parents' education, but only marginally. Dividing the sample into sons and daughters, an asymmetry is found. Generally, mothers matter most for their daughters, while fathers matter most for their sons. In addition, sons and daughters are affected by different living condition variables.

Zusammenfassung

Wir untersuchen die Wichtigkeit elterlicher Bildung und die damit zusammenhängenden Lebensbedingungen der Kinder auf den Bildungsabschluss von Kindern in Dänemark. Die Daten beziehen sich auf zwei Erhebungen von Lebensbedingungen verbunden mit Register-Daten. Die Kinder der befragten Personen von 1998 sind zwischen 25 und 35 Jahre alt. Indem wir multinomiale Logit-Modelle anwenden, können wir die Bildungsabschlüsse schätzen und zwar mit und ohne Lebensbedingungs-Variablen. Die elterliche Bildung erweist sich dabei als sehr wichtig, vor allem die Bildung der Mutter. Eine höher gebildete Mutter ist für den Bildungsabschluss der Kinder wichtiger als ein höher gebildeter Vater. Die Einbeziehung der Lebensbedingungen im Modell mindert die Wichtigkeit der elterlichen Bildung jedoch nur geringfügig. Bei der Trennung des Samples in Töchter und Söhne haben wir eine Asymmetrie festgestellt. Im Allgemeinen kümmern sich Mütter eher um die Töchter, während sich Väter eher um die Söhne

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kümmern. Darüber hinaus sind Töchter und Söhne von verschiedenen Lebensbedingungs-Variablen betroffen.

JEL Classifications: I 21, N 3

1. Introduction

Educational attainment is important for a variety of reasons. First of all, education is an important determinant of success in the labour market and economic well-being in general (Solon 1999). Numerous studies demonstrate higher risk of unemployment, low pay, poverty, or labour market marginalisation for individuals with low education compared to individuals with higher education. Second, education is one of the fundamental sources of long-term macroeconomic growth. The fact that one out of four young Danes never attain a qualifying education is thus of concern for the future of the welfare state.

The existence of an intergenerational link between parents' education and children's education is well established in the literature. Several mechanisms are at play: for instance, better-educated parents may be able to invest more money in their children's education. Children also inherit an ability to perform in the educational system from their parents. In addition, the link between parents and children may be of a different kind: for instance, the stress of having unemployed or ill parents may have consequences for the child's educational attainment. Although for instance educational attainment and risk of unemployment is correlated, it is of interest to study the impact of parents' education as well as different indicators on childhood living conditions for the educational attainment of children.

The aim of this paper is to study educational attainment of young people in Denmark. In particular, we focus on the role of parents' education as well as childhood living conditions. Using surveys on living conditions merged with register data, we are able to link a sample of young people aged 25–35 with their parents' educational level as well as to childhood living conditions. By estimating multinomial logit models both with and without living condition variables, new insight into the importance of parents' education and childhood circumstances in Denmark is gained.

The paper is organised as follows. In the next section, previous literature on the determinants of education is reviewed. Data are presented in Section 3, while the results from the econometric analysis are presented in Section 4. Finally, concluding remarks are found in the last section.

2. Previous studies

As previous research has shown, a variety of factors affect the educational attainment of children. The educational achievement of a child is the outcome of a complex process, involving choices and decisions by government, parents, and children (e.g. Haveman/Wolfe 1995). The final educational choice thus depends on both economic and social considerations. In the classical human capital framework, the optimal level of schooling is determined by the marginal cost and the marginal benefit of education. But an educational decision is also a social decision with consequences for the relationship with social networks, e.g. family, friends and relatives, see Akerlof (1997). Thus, a wide range of both economic and non-economic factors is important. In the following, the factors relevant for this study are discussed.

Parents' education

Parents' education is a very important factor for the educational outcome of the children. One reason is that educational attainment depends on the genetic endowment (ability). And as far as this endowment is inherited by children from parents, a correlation between their educational attainments will exist. Another reason is that parents act as natural role models for their children: for instance a home with books on the shelves and a daily newspaper in the letterbox is likely to make reading more natural for the children. In addition, more educated parents may be more capable of assisting children with their homework.

Many studies have found a positive relationship between parents' and children's educations, for instance Solon (1989) for the USA and Dearden, Machin, and Reed (1997) for Britain. Ermisch and Francesconi (2001) discuss the assumptions under which the effect is causal and find two cases: if parents are "too poor" to make financial transfers to their children, or if children's earnings are separable from parents' consumption in the parents' utility function. According to Ermisch and Francesconi, these assumptions are met for an important part of the population.

Typically, studies find that the mother's education *matters* more than the father's education (e.g. Dearden 1998; Ermisch/Francesconi 2001). In the case of Germany, however, Gang and Zimmermann (2000) discuss one of the rare cases where the father's education has a significantly higher effect on children's educational attainment than the mother's education.

In Denmark, only few studies exist of the effect of parents' education. Examples include Nielsen, Rosholm, Smith and Husted (2001) who estimate the probability of having completed a qualifying education for second generation immigrants and ethnic Danes. They find a significant effect of parents' educa-

tion for ethnic Danes, but not for the second generation immigrants. Another example is Davies, Heinesen and Holm (2002), who test implications of a relative risk aversion hypothesis: that educational choices are made to minimize the risk of ending up with a lower level of education than one's parents. The empirical evidence is partly in favour of this hypothesis.

Family structure

Although the educational level of the parents is clearly important for children's educational outcomes, other factors should also be considered. For instance, the family institution generates links between parents' and children's characteristics (Parsons 1975). Most children live in nuclear families with both a mother and a father. If the child grows up with a single parent or in a step-parent family, a possible consequence is less investment in the child's education, due to lack of economic or psychological resources. In addition, deviation from the social norm can create problems in terms of missing role models and the resulting disorientation and stress can lead to low educational attainment, see Wu and Martinson (1993). Painter and Levine (2000) find a negative effect of growing up in a family without the biological father in the USA. Blundell, Dearden, Goodman, and Reed (1997), and Gregg and Machin (1998) find similar results for the United Kingdom. Furthermore, Jonsson and Gähler (1997) find negative effects of family dissolution on Swedish data, although the net effect is small after controlling for socio-economic background factors.

Another interesting issue is whether sons and daughters are treated differently. Alderman and King (1998) model the gender gap in education and find that if the investment returns realized by parents (e.g. the probability of transfers from the child to the parents) differ between girls and boys, then this results in gender differences in educational investment. This could for instance be the case if the boys are expected to earn more as adults than the girls. Davies and Zhang (1995) test the potential different investment in boys and girls on data from the Philippines and find that daughters are slightly favoured. However, gender discrimination by parents is not the only reason for different outcomes for girls and boys. Differences in opportunity costs of studying may be another rationale. Also number of siblings and birth order may be important, as resources can become more scarce in large families, thus resulting in reduced educational attainment (Blundell *et al.* 1997).

Parents' employment

Parents' employment and especially the mother's employment during childhood have also attracted some attention. The effect is two-sided, as employ-

ment increases income and therefore the amount of resources invested in the child, but at the same time reduces the amount of time spent on the child. Ermisch and Francesconi (2000) develop an economic model providing conditions under which a causal interpretation can be given between parental employment during childhood and subsequent educational attainment of children. Controlling for genetic endowment heterogeneity through sibling estimations and family income, they find a negative and significant effect on the child's educational attainment of the extent of mother's full-time employment when the child was aged 0–5. Furthermore, a negative effect of mother's part-time employment and father's employment is found. Haveman, Wolfe, and Spaulding (1991), however, find the opposite for US data, i.e. mothers' work has a positive effect on children's education. Empirical findings are thus ambiguous.

Childhood living conditions

The last group of variables considered is “childhood living conditions”. Living conditions during childhood can be both material and non-material. Financial problems, malnutrition, insufficient housing, bad neighbourhood, and health problems are some examples of poor living conditions that may have an affect on children's educational attainment. Living in a bad neighbourhood may result in the adoption of negative behaviour. A result of insufficient housing may be that the child cannot do his or her homework in a quiet place. Physically or mentally ill parents can be a burden on the child, so that educational achievement becomes less important.

Data on especially non-material living conditions are scarce. However, O'Brian and Jones (1999) stress the importance of material well-being and factors like maternal praise. In addition, financial problems have been found to affect educational attainment negatively in Britain (Dearden 1998) and in the USA (Duncan 1994).

3. Data

The data used in the analysis are three waves of a survey of living conditions in Denmark merged with register data. The Danish National Institute of Social Research collected the Survey of Living Conditions in 1976, 1986, and 2000. The first survey, in 1976, included a representative sample of individuals aged 20–79 years. The same persons were interviewed again in 1986 with a sub-sample of the 1976 questions (a few persons were added in order to correct for sample attrition). In 2000, the individuals were re-interviewed with basically the same questions as in the first wave. As the youngest individuals in the original sample turned 44 in 2000, a new random sample of people aged 20–43 years was added. The survey includes questions on demographic vari-

ables and numerous living condition variables, including labour market attachment, neighbourhood characteristics, housing quality, childhood living conditions and the interviewees' parents' employment and education.

About 4,900 individuals in the 2000 survey agreed that survey information could be merged with administrative files for research purposes. For these persons, the register data include information about the interview person, the spouse (if present sometime during the period 1980–1998) and the children (whether living with the parents or not). The register data include information on education, demographics (gender, age, family type and composition, etc.), wages, income, and labour market attachment, for most variables from 1980 to 1998.

The variable of interest in this analysis is the education of children of interviewed persons. Education is defined as the highest level attained and grouped into six categories: lower secondary school, upper secondary school, vocational training, short further education, medium further education, and long further education. For a detailed description of the Danish educational system see Davies, Heinesen and Holm (2002).

We restrict the sample to children aged 25–35 years in 1998. The lower age limit of 25 years is imposed, because a large share of the younger individuals has not yet completed education and we want to study final educational attainment.¹ The upper age limit of 35 years is imposed for data reasons: Being 35 in 1998 implies being 17 in 1980, which is the first year for which we have register data. If individuals are older than 35, they are only in the register as adults and the childhood variables are thus not available. In addition to the age restriction, we also limit the sample to children where educational attainment for both parents is available. Imposing these restrictions reduces the sample size to 1,523 individuals.

The explanatory variables are both from the survey data and the register data. From the survey, we find information on home ownership (i.e. whether the family owns or rents its home) as well as the size of the home (number of rooms per family member). Furthermore, variables concerning non-material factors in the childhood are constructed, i.e. whether the interviewed individual – that is either the father or the mother of the child – had:

- Substantial unemployment: main occupation during the year,
- Health problems: illnesses or other deficiencies reducing physical mobility or movements, or
- No friends: e.g. no friends frequently visited, no friends who could be visited without invitation, or no friends with whom personal problems could be discussed.

¹ Although the majority of the children have completed their education by the age of 25, some still remain in the category of long further education. However, by setting the age limit at 25 we reduce the problem of including students.

The survey variables refer to one point in time of the child's childhood. Childhood living conditions, however, may vary considerably over the years. Since we only have the choice of survey information for two points in time – 1976 and 1986, we have chosen to use information from the survey carried out closest to when the child was in his or her early teens. The survey variables for children aged 25–30 in 1998 are thus taken from the 1986 survey, at which time the children were aged 13–18. Similarly, the variables for children aged 31–35 in 1998 are from the 1976 survey, when the children were aged 9–13.

Several problems are related to the use of the survey data. One problem is that we only have information on one of the parents. Hence, we capture potential problems of one of the parents, irrespective of the condition of the other parent. Another problem is the so-called window problem. Ideally, we would observe living conditions throughout childhood; however, information is only available at one point in time. Using the survey variables as proxies for information over the entire childhood may cause the estimates of interest to be biased downward (see Wolfe/Haveman/Ginther/An 1996). Still, though, using the survey information allows us to study a new dimension of the inter-generational transmission of education in Denmark, although the downward bias must be kept in mind.

From the register data, information is available on educational attainment of both the mother and the father of the child. Furthermore, variables on family composition are constructed: number of siblings, family type (whether the child lives with one or two adults), and number of family type changes (i.e. the child is living with two adults in year t , but only with one adult in year $t + 1$ or the other way around) that occur during the period the child is in the register (between 1 and 11 years). Because the children are in the register for varying durations, these variables are normalised with respect to the register duration.

The sample consists of a total of 1,523 children: 776 boys and 747 girls.² Sample means are presented in Table 1 for all the children and in Table 2 for boys and girls, respectively. From the sample means, we see that the children in the sample are more educated than their parents on average. Thus, only 18 percent of the children have only completed lower secondary school, while this is the case for 38 percent of the fathers and 49 percent of the mothers. Almost half of the children have vocational training as their attained level of education (45 percent), while 6 percent have short further education, 13 percent have medium further education, and 9 percent have completed a long further education.

² The 1,523 children are the number of children aged 25–35 years in 1998 of the 4,900 interviewees in the Survey of Living Conditions in 2000.

Table 1
Sample means: All children

		Mean	St.dev.
	Girl	0.491	0.500
<i>Education</i>	Age of child	29.865	3.138
	Lower secondary school	0.184	0.388
	Upper secondary school	0.079	0.270
	Vocational training	0.449	0.498
	Short further education	0.060	0.238
	Medium further education	0.135	0.341
	Long further education	0.093	0.291
<i>Parents' education</i>	Father's schooling (years of education)	12.108	2.814
	Father: Lower secondary school	0.385	0.487
	Father: Upper secondary school	0.012	0.108
	Father: Vocational training	0.395	0.489
	Father: Short further education	0.049	0.217
	Father: Medium further education	0.093	0.290
	Father: Long further education	0.066	0.249
	Mother's schooling (years of education)	11.466	2.645
	Mother: Lower secondary school	0.492	0.500
	Mother: Upper secondary school	0.014	0.117
	Mother: Vocational training	0.323	0.468
Mother: Short further education	0.053	0.223	
Mother: Medium further education	0.097	0.296	
Mother: Long further education	0.021	0.144	
<i>Living conditions during childhood</i>	House owner	0.765	0.424
	Number of rooms per person	1.216	0.473
	Father or mother were unemployed ^{a)}	0.037	0.190
	Father or mother had health problems ^{a)}	0.207	0.405
	Father or mother had no friends ^{a)}	0.189	0.392
	Number of family dissolutions per year	0.033	0.096
	Living with single parent	0.034	0.126
	Number of siblings	1.265	0.858
Number of observations		1,523	

^{a)} See text for definitions.

Table 2

Sample means: Sons and daughters

		Sons		Daughters	
		Mean	St.dev.	Mean	St.dev.
<i>Education</i>	Age of child	29.849	3.166	29.882	3.111
	Lower secondary school	0.199	0.399	0.169	0.375
	Upper secondary school	0.067	0.250	0.091	0.288
	Vocational training	0.474	0.500	0.423	0.494
	Short further education	0.057	0.231	0.064	0.245
	Medium further education	0.099	0.299	0.171	0.377
<i>Parents' education</i>	Long further education	0.104	0.306	0.082	0.274
	Father's schooling (years of education)	12.072	2.843	12.145	2.784
	Father: Lower secondary school	0.396	0.489	0.374	0.484
	Father: Upper secondary school	0.014	0.118	0.009	0.096
	Father: Vocational training	0.380	0.486	0.411	0.492
	Father: Short further education	0.049	0.216	0.050	0.217
	Father: Medium further education	0.093	0.290	0.092	0.290
	Father: Long further education	0.068	0.252	0.064	0.245
	Mother's schooling (years of education)	11.504	2.706	11.426	2.581
	Mother: Lower secondary school	0.494	0.500	0.491	0.500
	Mother: Upper secondary school	0.013	0.113	0.015	0.121
	Mother: Vocational training	0.317	0.466	0.329	0.470
	Mother: Short further education	0.045	0.208	0.060	0.238
	Mother: Medium further education	0.106	0.308	0.088	0.284
Mother: Long further education	0.026	0.159	0.016	0.126	
<i>Living conditions during childhood</i>	House owner	0.767	0.423	0.763	0.426
	Number of rooms per person	1.214	0.478	1.217	0.467
	Father or mother were unemployed ^{a)}	0.037	0.190	0.038	0.190
	Father or mother had health problems ^{a)}	0.226	0.418	0.187	0.391
	Father or mother had no friends ^{a)}	0.197	0.398	0.181	0.385
	Number of family dissolutions per year	0.029	0.090	0.036	0.102
	Living with single parent	0.031	0.119	0.038	0.133
	Number of siblings	1.281	0.873	1.249	0.843
	Number of observations	776		747	

^{a)} See text for definitions.

There is a gender difference in educational attainment (Table 2). Thus, sons are more likely to have vocational training than daughters (47 percent vs. 42 percent), whereas daughters are more likely to have completed medium further education than sons (17 percent vs. 10 percent). In addition, on average the daughters are better educated than the sons – 17 percent of the daughters and 20 percent of the sons only have lower secondary school. This reflects the educational development in Denmark over the past decades: the general educational attainment has increased especially for girls and, thus, in many university departments the majority of students are now women.

Note that parents' educations are transformed into years of education in Table 1 and 2. This transformation follows the official duration of educations. In order to operationalise the estimations presented in the next section, we use years of education for both father's and mother's education instead of dummies for each of the educational groups. The transformation of educational categories into years of education is presented in the Appendix.

4. Econometric analysis

The educational attainment of the children in the data set is estimated using a multinomial logit model.³ Two different model specifications are applied: one with only parental education and another with both parental education as well as living condition variables. Results from the first specification are presented in Table 3, while results from the second specification are presented in Table 4. The tables include estimated coefficients as well as marginal effects in percentage-points. The marginal effects express the effect from the variable of interest on the probability of belonging to a specific educational group.

Looking at the effect of parents' education in both models, we find that parents' educations are indeed important for the educational attainment of their children. Except for one case – the impact of father's education on the probability of attaining vocational training – all estimated coefficients are highly significant. Looking at the marginal effects, we find that having better-educated parents increases the probability of having completed secondary school, short, medium, and long further education, but decrease the probability of completing vocational training. Both parents matter, but as in most other analyses we find that the mother matters more than the father. Thus, having a mother with one more year of education seems to be more important for the educational attainment of the child than having a father with one more year of

³ We have tried several other statistical specifications, including OLS and ordered categorical estimators. However, the multinomial logit captures the variability in the data the best. A well-known problem with the MNL estimator is the assumption of independence of irrelevant alternatives, but has been tested to be non-binding.

Table 3: Estimation of educational attainment: categorical groups compared to no qualifications. Model I

	Secondary school			Vocational training			Short further education			Medium further education			Long further education		
	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect
Intercept	-2.768**	(1.376)		-0.955	(0.863)		-6.994***	(1.488)		-6.418***	(1.157)		-10.479***	(1.373)	
Girl	0.518**	(0.227)	2.421	0.054	(0.143)	-5.370	0.309	(0.244)	0.713	0.737***	(0.192)	7.140	0.014	(0.222)	-1.909
Age of child	-0.113***	(0.039)	-0.989	0.017	(0.023)	0.000	0.073*	(0.040)	0.321	0.055*	(0.031)	0.476	0.075**	(0.036)	0.494
<i>Parent's education</i>															
Father's education	0.175***	(0.046)	0.736	0.042	(0.030)	-1.330	0.108**	(0.050)	0.193	0.130***	(0.039)	0.707	0.189***	(0.044)	0.893
Mother's education	0.246***	(0.050)	0.854	0.078**	(0.034)	-2.379	0.204***	(0.054)	0.451	0.226***	(0.043)	1.260	0.431***	(0.050)	2.069

Model estimated by MNL. */**/** indicate significance at 10/5/1%, respectively. Marginal effects in percentage-points.

education. Especially regarding “long further education” the marginal effect of mother’s education is large. An explanation could be that since an educated mother is more infrequent than an educated father, she has a larger impact as a role model. Another explanation could be that the mother’s education represents unobserved factors better than the father’s education. This result is parallel to Dearden (1998), who finds for the UK that mother’s education has an effect about twice as high as the effect of the father’s education.

There is nonlinearity in the results: concerning mother’s education, the largest marginal effects are found for long further education followed by medium further education, while the marginal effect for vocational training is negative. Concerning father’s education, on the other hand, the marginal effects for secondary school, medium, and long further education are similar. Obviously, there are differences across educational groups, and especially vocational training stands out with a negative or insignificant marginal effect.

In addition, the estimation in Table 3 shows that girls are more likely than boys to have secondary school education or medium further education, while there are no significant difference between boys and girls concerning the other educational groups. This result is well in line with the general picture of girls being better educated than boys. And especially concerning secondary school and medium further education, girls are in the majority.

Finally, we see from Table 3 that the older the child, the lower the probability of having secondary education, and the higher the probability of having a short, medium, or long further education. This is of course a consequence of some young people completing their qualifying degrees late. Thus, the older the child, the higher the probability of completing secondary school, medium, or long further education. Regarding vocational training, age is not important. However, this education, which is usually obtained through apprenticeship training, is typically completed earlier than other types of education.

Turning to the model including living condition variables in Table 4, we find that including these variables has very little effect on the education coefficients. The estimated coefficients are slightly lower in all cases, but still significant in all cases except the impact of father’s education on vocational training. Adding living condition variables apparently does not change the impact of parents’ education significantly.

Looking at the living condition variables, generally the expected results are found. On the whole, we thus find that bad living conditions are associated with a lower probability of attained education beyond basic schooling. The estimated parameters are not highly significant, but this is partly due to the relatively low sample sizes in each educational group. In addition, the possible downward bias of the estimated coefficients due to the window problem should be kept in mind, cf. the discussion in the previous section.

Table 4: Estimation of educational attainment: categorical groups compared to no qualifications. Model II

	Secondary school			Vocational training			Short further education			Medium further education			Long further education		
	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect
Intercept	-2.744*	(1.531)		-0.493	(0.968)		-6.711***	(1.647)		-6.682***	(1.300)		-11.690***	(1.545)	
Girl	0.529**	(0.232)	2.329	0.058	(0.147)	-5.625	0.331	(0.247)	0.748	0.767***	(0.196)	7.264	0.051	(0.227)	-1.775
Age of child	-0.132***	(0.041)	-1.055	0.007	(0.025)	-0.042	0.062	(0.042)	0.311	0.039	(0.033)	0.388	0.070*	(0.038)	0.529
<i>Parent's education</i>															
Father's education	0.151***	(0.047)	0.630	0.027	(0.032)	-1.382	0.092*	(0.051)	0.171	0.113***	(0.040)	0.620	0.177***	(0.046)	0.863
Mother's education	0.243***	(0.051)	0.818	0.072**	(0.035)	-2.446	0.202***	(0.055)	0.451	0.223***	(0.044)	1.206	0.419***	(0.051)	1.976
<i>Living conditions</i>															
House owner	0.261	(0.306)	-1.100	0.395**	(0.179)	2.193	0.398	(0.318)	0.124	0.421*	(0.250)	0.471	1.032***	(0.344)	4.532
Number of rooms per person	0.861***	(0.279)	3.938	0.178	(0.196)	-6.339	0.203	(0.323)	-0.990	0.702***	(0.242)	4.562	0.819***	(0.277)	3.612
Father or mother were unemployed	-0.474	(0.548)	2.082	-0.717**	(0.323)	-3.883	-1.005	(0.767)	-1.682	-1.413**	(0.643)	-6.974	-1.188	(0.798)	-3.174
Father or mother had health problems	-1.080***	(0.344)	-4.330	-0.354**	(0.168)	-1.092	-0.414	(0.308)	-0.361	-0.324	(0.233)	0.586	-0.492*	(0.287)	-0.793
Father or mother had no friends	-0.309	(0.291)	0.639	-0.619***	(0.179)	-9.813	-0.380	(0.311)	0.057	-0.192	(0.234)	2.811	-0.528*	(0.290)	-1.134
Number of family breaks per year	-2.561	(1.635)	-3.973	-2.184***	(0.754)	-21.328	-5.480**	(2.251)	-6.346	-3.692***	(1.354)	-11.871	-3.208**	(1.585)	-6.528
Child living with single parent	-0.391	(1.173)	-3.353	0.360	(0.637)	8.360	0.202	(1.284)	0.146	-0.088	(0.990)	-3.047	0.261	(1.173)	0.983
Number of siblings	0.015	(0.149)	0.002	-0.068	(0.091)	-2.815	0.076	(0.156)	0.426	0.084	(0.122)	0.997	0.155	(0.144)	1.212

Model estimated by MNL. */**/** indicate significance at 10/5/1%, respectively. Marginal effects in percentage-points.

We find that living in an owner-occupied house has a positive effect on the probability of attaining vocational training, medium, or long further education. Furthermore, a larger home (number of rooms per person) increases the probability of attaining secondary schooling, medium or long further education. These two variables work similarly. A family owning its own residence may indicate a better and more stable financial situation and thus less stress on the child. Likewise, the larger the dwelling, the better the circumstances might be for the child to study in peace and quiet. However, the size of the dwelling could also represent an income effect, because house size and income are likely to be positively correlated. Looking at the marginal effects, home ownership is especially important for long further education followed by vocational training, while number of rooms is especially important for medium further education followed by secondary school and long further education.

If the father or mother experienced unemployment when the child was growing up the probability of attaining vocational training or medium further education is lower. Parents' unemployment can be important for several reasons: first of all, the family's financial situation is affected, but also social relations both within the family and with outsiders may be influenced (stigmatisation). The fact that unemployment is the cause of anxiety and other illnesses has been shown by other studies (e.g. Agerbo/Mortensen/Westergaard-Nielsen 1998).

Parents' social relations are also important for children's educational attainment, as the coefficient to father or mother having no friends shows (marginal effects are significantly negative for vocational training and long further education). Also father or mother's health problems have a negative impact (significantly negative for secondary school, vocational training and long further education). The number of breaks in the family is an indicator of family stability. Family instability causes stress on both children and parents, and is thus expected to have a negative impact on educational attainment. This is confirmed in the analysis: family changes – i.e. adults moving in or out of the family – affect the probability of attaining vocational education, short, medium, and long further education negatively.

Also in Sweden, family is found to matter: both longitudinal and cross-sectional estimations demonstrate that children experiencing family dissolution show lower educational attainment at age 16 than children in stable two-parent families (Jonsson/Gähler 1997). For the USA, the number of parental separations negatively affects the probability of high school graduation and parental remarriages have a positive effect, but both effects are insignificant (Haveman/Wolfe/Spaulding 1991). Also on American data, but with length of education as the dependent variable, Graham, Beller and Hernandez (1994) find a negative effect of “non-intact families”. The question is whether the observed correlation between family instability and lower educational attainment is causal or due to selection. Björklund and Sundström (2002) find that Swedish evidence is mostly in favour of the selection explanation.

Finally, number of siblings is included in the analysis. However, we find that the coefficient to this variable is insignificant across all educational groups. Thus, at least in this data set, we find neither a negative nor a positive effect of having siblings.

Sons and daughters

In order to analyse the differences in educational choice of boys and girls, we split the sample into sons and daughters, respectively. In Tables 5 and 6, results from the model without living conditions are presented. As before, we find that mother's education is more important than father's education for both sons and daughters. A difference between the genders is that the education coefficients in general are more significant for sons than for daughters. Thus for sons, both father's and mother's educations are significant across all educational groups, whereas for daughters, father's education is insignificant for vocational training and short further education, while mother's education is insignificant for vocational education. Parents' education is thus a poor predictor for girls with vocational training, compared to the other educational groups.

Comparing marginal effects of father and mother's educations, the overall picture is that fathers matter more for sons than for daughters, whereas mothers matter more for daughters than for sons (with a few exceptions to the rule). Also in Halpern-Felsher *et al.*'s (1997) American study, which excludes father's education, the effect of mother's education for sons is found to be smaller than the effect for daughters. It is natural to imagine mothers being greater role models for their daughters than for the sons, and vice versa for the fathers, which may explain this finding.

Interestingly, age is not very important when looking at the split samples of sons and daughters. The only significant effects found are that the older the sons, the more likely they are to have long further education, and the older the daughters, the less likely they are to have secondary schooling.

In Table 7 and 8, we present the results for the model including living conditions for sons and daughters, respectively. Similar to the estimation for all children, we find that the education parameters are reduced only slightly in size. However, especially the significance of father's education is reduced. Thus for daughters, father's education is only significant for the probability of attaining secondary schooling and long further education, while for sons father's education is only significant for the probabilities of attaining secondary schooling, medium and long further education. Including living conditions in the estimations thus emphasises the result that mother's education is more important than fathers' education.

Table 5: Estimation of educational attainment: categorical groups compared to no qualifications. Sons. Model I

	Secondary school			Vocational training			Short further education			Medium further education			Long further education		
	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect
Intercept	-5.188***	(1.965)		-2.412**	(1.179)		-6.309***	(2.063)		-7.148***	(1.715)		-10.953***	(1.794)	
Age of child	-0.039	(0.054)	-0.516	0.041	(0.031)	0.251	0.058	(0.056)	0.113	0.073	(0.046)	0.337	0.091*	(0.047)	0.493
<i>Parent's education</i>															
Father's education	0.215***	(0.067)	0.783	0.072*	(0.042)	-0.988	0.119*	(0.070)	0.139	0.148**	(0.058)	0.519	0.226***	(0.060)	1.166
Mother's education	0.231***	(0.071)	0.544	0.115**	(0.046)	-1.655	0.178**	(0.075)	0.162	0.226***	(0.063)	0.802	0.402***	(0.065)	2.534

Table 6: Estimation of educational attainment: categorical groups compared to no qualifications. Daughters. Model I

	Secondary school			Vocational training			Short further education			Medium further education			Long further education		
	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect
Intercept	0.113	(1.936)		0.831	(1.278)		-7.305***	(2.170)		-4.772***	(1.583)		-10.238***	(2.152)	
Age of child	-0.184***	(0.055)	-1.491	-0.010	(0.035)	-0.266	0.087	(0.057)	0.551	0.034	(0.042)	0.624	0.062	(0.056)	0.511
<i>Parent's education</i>															
Father's education	0.131**	(0.064)	0.651	0.007	(0.045)	-1.677	0.094	(0.071)	0.261	0.107**	(0.053)	0.914	0.145**	(0.067)	0.610
Mother's education	0.260***	(0.072)	1.211	0.029	(0.052)	-3.828	0.230***	(0.078)	0.731	0.221***	(0.060)	1.769	0.481***	(0.079)	2.086

Model estimated by MNL. */**/** indicate significance at 10/5/1%, respectively. Marginal effects in percentage-points.

Turning to the living condition variables, significant coefficients are relatively scarce. However, some gender differences are found. Living in an owner-occupied home thus only matters for sons (vocational training, medium and long further education), while numbers of rooms per person only matters for daughters (secondary school, medium and long further education). In addition, we find that sons show a negative effect of the father or mother having health problems (secondary school and vocational training) and of having no friends (vocational training and long further education). Daughters experience a negative effect of father or mother's unemployment on vocational training and medium further education, of health problems on medium further education, and of having no friends on vocational training.

Family breaks have a negative impact on the educational attainment of both sons (vocational training, medium further education and long further education) and daughters (vocational training, short and medium further education). Although significance and size of the marginal effects differ across educational groups, it is not possible to conclude that family breaks are more important for sons than for daughters, or vice versa. Somewhat contrary to this gender indifference, Krein and Beller (1988) find American boys to be more sensitive to "number of years in single-parent family" than girls, who are not affected. Finally, it should be mentioned that number of siblings has no effect on either sons or daughters.

All in all, the evidence does not imply that either sons or daughters are affected more by bad living conditions, but instead that different factors are of importance. Thus, girls might be vulnerable to another set of conditions than boys. This gender difference may be due to gender differences within households regarding the division of labour and various responsibilities.

5. Concluding remarks

In this paper, the relationship between educational attainment of children on one hand and parents' education and childhood living conditions on the other hand is analysed. The children included are children of interviewees from a survey of living conditions aged 25–35 years in 1998. We use information on living conditions from two waves of the survey – 1976 and 1986. Information on education and family composition are from register data.

On average, the children are better educated than their parents. The educational attainment of children is analysed using two models: The first model includes only parents' education, while the second model includes both parents' education as well as living condition variables. The models are estimated using a multinomial logit model.

Table 7: Estimation of educational attainment: categorical groups compared to no qualifications. Sons. Model II

	Secondary school			Vocational training			Short further education			Medium further education			Long further education		
	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect
Intercept	-4.977**	(2.208)		-2.251*	(1.308)		-6.454***	(2.261)		-8.074***	(1.936)		-11.727***	(2.007)	
Age of child	-0.050	(0.058)	-0.593	0.044	(0.034)	0.363	0.061	(0.058)	0.124	0.068	(0.049)	0.272	0.091*	(0.050)	0.489
<i>Parent's education</i>															
Father's education	0.184***	(0.068)	0.601	0.057	(0.043)	-1.214	0.109	(0.072)	0.134	0.153***	(0.059)	0.651	0.221***	(0.061)	1.163
Mother's education	0.215***	(0.074)	0.462	0.112**	(0.048)	-1.038	0.185**	(0.077)	0.294	0.203***	(0.064)	0.636	0.380***	(0.067)	1.900
<i>Living conditions</i>															
House owner	0.617	(0.461)	-0.055	0.559**	(0.241)	0.862	0.562	(0.451)	-0.068	1.212***	(0.426)	5.080	1.229***	(0.454)	4.795
Number of rooms per person	0.589	(0.395)	3.481	-0.064	(0.259)	-6.431	-0.139	(0.467)	-1.238	0.340	(0.364)	2.437	0.403	(0.363)	2.732
Father or mother were unemployed	n/a			-0.543	(0.444)	1.364	-0.871	(1.078)	-1.330	-0.672	(0.806)	-0.285	-1.359	(1.135)	-4.683
Father or mother had health problems	-1.788***	(0.632)	-5.838	-0.538**	(0.226)	-7.054	-0.206	(0.402)	1.142	0.085	(0.322)	5.493	-0.556	(0.377)	-1.168
Father or mother had no friends	-0.593	(0.432)	-0.526	-0.726***	(0.239)	-11.071	-0.736	(0.459)	-1.329	-0.033	(0.331)	5.118	-0.718*	(0.386)	-1.937
Number of family breaks per year	-4.192	(2.709)	-6.222	-2.334**	(1.116)	-24.082	-5.016	(3.353)	-5.753	-4.066*	(2.426)	-9.112	-3.662*	(2.122)	-8.240
Child living with single parent	1.047	(1.760)	4.732	0.541	(0.926)	6.133	-0.500	(2.409)	-3.487	-0.989	(2.173)	-7.674	1.000	(1.500)	6.278
Number of siblings	0.061	(0.223)	0.183	0.017	(0.124)	-0.616	0.184	(0.219)	0.883	0.050	(0.187)	0.163	0.027	(0.198)	-0.096

Model estimated by MNL. * / ** / *** indicate significance at 10 / 5 / 1 %. respectively. Marginal effects in percentage-points. n/a: not available due to too few observations.

Table 8: Estimation of educational attainment: categorical groups compared to no qualifications. Daughters. Model II

	Secondary school			Vocational training			Short further education			Medium further education			Long further education		
	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect	Coef.	Std. error	Mar. effect
Intercept	-0.204	(2.167)		1.613	(1.473)		-6.606***	(2.425)		-4.737***	(1.807)		-12.318***	(2.455)	
Age of child	-0.208***	(0.058)	-1.524	-0.034	(0.037)	-0.441	0.056	(0.061)	0.486	0.006	(0.046)	0.489	0.054	(0.059)	0.598
<i>Parent's education</i>															
Father's education	0.115*	(0.066)	0.647	-0.011	(0.047)	-1.633	0.074	(0.073)	0.243	0.074	(0.055)	0.628	0.119*	(0.069)	0.526
Mother's education	0.274***	(0.074)	1.252	0.024	(0.053)	-4.029	0.227***	(0.080)	0.666	0.234***	(0.062)	1.826	0.497***	(0.081)	2.104
<i>Living conditions</i>															
House owner	-0.105	(0.423)	-1.984	0.171	(0.273)	3.111	0.165	(0.457)	0.361	-0.121	(0.336)	-4.209	0.793	(0.534)	4.301
Number of rooms per person	1.245***	(0.412)	4.259	0.504	(0.311)	-6.945	0.679	(0.467)	-0.614	1.170***	(0.352)	7.314	1.422***	(0.441)	4.710
Father or mother were unemployed	-0.074	(0.637)	8.964	-0.975**	(0.487)	-8.370	-1.152	(1.100)	-1.833	-2.189**	(1.081)	-13.123	-1.201	(1.132)	-2.312
Father or mother had health problems	-0.721	(0.441)	-2.939	-0.130	(0.260)	6.028	-0.695	(0.499)	-2.122	-0.635*	(0.353)	-4.716	-0.480	(0.451)	-0.663
Father or mother had no friends	-0.071	(0.408)	1.849	-0.532*	(0.274)	-9.268	-0.046	(0.436)	1.620	-0.226	(0.339)	0.895	-0.289	(0.448)	-0.242
Number of family breaks per year	-1.216	(2.048)	3.799	-2.142**	(1.043)	-21.827	-5.682*	(3.082)	-6.883	-3.316**	(1.677)	-14.617	-2.188	(2.414)	-3.045
Child living with single parent	-1.298	(1.600)	-6.825	0.366	(0.897)	11.206	0.505	(1.551)	3.495	-0.035	(1.192)	-1.352	-0.865	(2.051)	-4.535
Number of siblings	-0.041	(0.210)	-0.225	-0.180	(0.138)	-5.102	-0.033	(0.227)	-0.062	0.088	(0.168)	1.936	0.306	(0.212)	2.476

Model estimated by MNL. */ ** / *** indicate significance at 10/5/1%, respectively. Marginal effects in percentage-points.

The main finding of the analysis is a relatively strong effect of mother's education in particular. Father's education also matters, but significantly less. When living conditions are included, the effects of both parents' education are reduced, but only marginally. Thus, including childhood living conditions does not change the direct relationship between children's and parents' educations.

The effects of childhood living conditions in the model are less clear. The importance of each variable thus differs across educational groups. However, in all cases the significant coefficients have the expected signs. Thus, we conclude that living conditions in childhood do matter, although they by no means outweigh the importance of father's and especially mother's education.

Not only do mother and father matter differently, sons and daughters also are different. In general, mothers' are more important for their daughters, while fathers' are more important for their sons. Both sons and daughters are affected by living conditions, but evidence suggests that different factors affect the two genders. For instance, number of rooms in the home affects daughters but not sons, while owning the home affect sons but not daughters. It thus seems that boys and girls respond differently to childhood factors, which in turn can be measured as differences in educational outcomes as adults.

Although new insight has been gained by the analysis in this paper about the intergenerational transmission of education in Denmark, there is still much to be learned. Thus using the existing data sources, the analyses in this paper hint at the importance of childhood living conditions relative to the direct impact of parents' education. The basic problem of course is that our available data only allows observation of childhood conditions at one point in time, and consequently we are not able to quantify the importance of the living conditions. Applying other data sources in future research will thus expand on our knowledge.

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Appendix

Table A1

Transformation of type of degree into number of years of education

Years of education	Type of Degree
9	No qualification, Lower secondary school: 9 th or 10 th grade
12	Upper secondary school: general or business school
13	Vocational training: e.g. office clerk, plumber
14	Short further education: E.g. policeman, laboratory assistant
16	Medium further education: Teacher, nurse
18	Long further education: Masters degree, e.g. economist, doctor