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**The externalities of crime:
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of parents on the educational
attainment of their children**

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and Henriëtte Maassen van den Brink*

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**THE EXTERNALITIES OF CRIME: THE EFFECT OF CRIMINAL INVOLVEMENT OF
PARENTS ON THE EDUCATIONAL ATTAINMENT OF THEIR CHILDREN**

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Abstract

The empirical literature on education and crime suggests that both criminal behavior and educational attainment are transferred from parents to children. However, the impact of criminal involvement of parents on educational outcomes of children tends to be ignored, even though the entailed social costs may be substantial. This study examines the effects of parents' criminal involvement on the educational attainment of their children. A multinomial probit model is applied in combination with a Mahalanobis matching approach to identify this effect. The findings suggest that having criminally involved parents: (1) increases the probability of only finishing primary education by 8 percentage points, and (2) decreases the probability of having a higher education degree by 13 percentage points.

JEL Codes: I21, J13, J24, K14

Keywords: Educational attainment - Criminal involvement - Intergenerational effects

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1. Introduction

It is widely recognized that crime involves different types of social costs. These are related to security measures, property loss, victim services and so forth. It also entails intangible costs such as anxiety, inconvenience or suffering of close family members of the criminal person. Children are in particular affected by the criminal involvement of their parents as the social environment in the family becomes more unstable, which may result in their criminal behavior and emotional difficulties (e.g. Van de Rakt et al. 2010; Geller et al. 2009; Wilbur et al. 2007). This may in turn negatively influence educational outcomes of children. Thus, crime can have substantial negative long-term social costs also because it is transmitted to the children of criminals.

This study examines the effect of parents' criminal involvement on educational attainment of children. For this purpose data are used from the nationally representative 'Netherlands Kinship Panel Study' (NKPS) that were collected between 2002 and 2004 through self-reported questionnaires among 8,155 Dutch citizens. These data include information on parents' past criminal involvement and on the educational attainments of parents and their children. Criminal involvement of parents is measured by asking respondents if they or their family members have ever been convicted in a criminal court or have ever been in contact with the police as a consequence of delinquent behavior, other than for traffic offences (Dykstra et al. 2004; Dykstra and Valk 2007).

The adopted estimation strategy is a multinomial probit model in combination with a statistical matching model that uses Mahalanobis distances. A multinomial probit model is used because observed educational attainment categories are not naturally ordered. The statistical matching approach is applied in order to compare children whose parents were criminally involved to children whose parents were not criminally involved, but otherwise have similar observable background characteristics. This is of importance because parents who have no criminal past can have different characteristics than parents who were criminally involved, and these differences may bias the estimated impact of parents' criminal involvement. The matching analysis also enforces that

the parents' education levels are identical for the paired children, as we assume that parental education is a proxy for a child's inherent ability.

The contributions of this study to the empirical literature are threefold. First of all, it focuses on whether the educational attainment of children is influenced by their parents' criminal involvement. The intergenerational literature on crime and education focuses mainly on the intergenerational transfer of either criminal behavior or educational attainment from parent to child. It thereby ignores that criminal behavior of parents may affect the educational outcomes of their children. Investments in crime prevention or reduction may, therefore, externally increase the educational attainment of future generations.

The second contribution is that information from a nationally representative survey is used, whereas previous studies primarily employed small samples of imprisoned parents with limited information on the background characteristics of these parents and their children (see the review by Murray et. al 2012). Exception are the studies by Foster and Hagan (2007, 2009) and Haskins (2009) who control for a wide range of important covariates using rich survey data. We recognize that a disadvantage of using survey data is that respondents often underreport their (or their family members') criminal involvement (Thornberry and Krohn 2000). The matching analysis partly offsets this problem because it takes into account the likelihood of underreporting behavior conditional on the background characteristics of the respondent. It is noteworthy that underreporting criminal involvement leads to lower bound estimates in this study, such that finding a significant effect would be a strong empirical result.

Finally, this study uses data for the Netherlands whereas previous studies have employed data from the United States. The patterns of criminal involvement and criminal justice in the Netherlands are comparable to many developed countries in Europe, but are quite different from the United States (ISPS 2012; Foster and Hagan 2009). Therefore, our study contributes by comparing the estimation results for the Netherlands to the estimation results of previous studies for the U.S.

The paper proceeds as follows. Section 2 shortly reviews the empirical literature on crime and education. Section 3 discusses the data and descriptive statistics. Section 4 explains the estimation strategy and reports the empirical results. In Section 5 robustness checks are performed. Section 6 concludes.

2. Literature

Previous research on education and crime has generally suggested that there is a negative relationship between criminal behavior and educational attainment (e.g. Lochner and Moretti 2004; Machin et al. 2011; Groot and Maassen van den Brink 2010; Meghir et al. 2011). Moreover, these studies imply that children of criminally involved parents tend to have relatively low educated parents.

A considerable amount of studies examine whether there is intergenerational transmission of criminal behavior and educational attainment from parents to children. The empirical findings of these studies support a causal relationship between parents' and children's education levels (De Haan and Plug 2009; Ermisch and Pronzato 2010; Holmlund et al. 2011) and that parents' criminal behavior is transferred to their children (Farrington 2002; Van de Rakt et al. 2010; Hjalmarsson and Lindquist 2011).

There have been few studies that examine how criminal involvement of parents can influence the educational outcomes of their children. These studies use information on imprisoned parents' and show that educational outcomes of children with imprisoned parents are significantly lower (Parke and Clarke-Stewart 2002; Murray and Farrington 2008; Gordon 2009; Neal 2009; Sarri et al. 2011). Other studies focus specifically on imprisoned mothers (Stanton 1980; Trice and Brewster 2004; Sharp 2008) or imprisoned fathers (Foster and Hagan 2007, 2009) and find similar results. Typical control groups that are used for identification purposes are children who are separated from their parents for other reasons than imprisonment, such as hospitalization, parental death or divorce (e.g. Murray and Farrington 2008; Neal 2009), children of mothers on probation

(Stanton 1980) and best friends of children whose parents are imprisoned (Trice and Brewster 2004). Although most of these studies discuss the generally low educational attainment of prisoners, they do not control for the education level of imprisoned parents, such that the estimation results may represent the fact that criminally involved parents have a relatively low education level. Foster and Hagan (2007, 2009) and Haskins (2009) are rare exceptions. Foster and Hagan (2007, 2009) analyze the effect of fathers' imprisonment on children's educational attainment, using the Add Health study data – a large-scale survey among U.S. adolescents which reports their personal characteristics and those of their parents. These studies include father's education and several socio-economic characteristics as control variables. The results suggest a strong negative effect (the estimates range from -0.18 to -0.72, depending on the estimation method used) of the father's incarceration on the years of education for their children. Haskins (2009) combines OLS estimation and propensity score matching and control for parental education in order to analyze the effect of parental imprisonment on school readiness of 5-year-old children. The study exploits the Fragile Families and Child Wellbeing Study and finds that children whose parents were in prison have lower levels of non-cognitive skills that are vital for entry into formal schooling, while the effect on cognitive readiness is not significant.

There are also studies showing that criminal involvement of parents has a negative influence on family stability and financial circumstances, and, as a result, on the general well-being of children (Roguski and Chauvel 2009; Travis and Waul 2003). Children whose parents are criminally involved are more likely to come into contact with the criminal justice system and tend to have emotional difficulties later in life (Van de Rakt et al. 2010; Geller et al. 2009; Wilbur et al. 2007). Additionally, these children are more frequently stigmatized by their peers at school (Gadsden and Jacobs 2007; Nesmith and Ruhland 2008) and experience school-related problems (Hungerford 1993; Peniston 2006). It follows that children with criminally involved parents live in a socio-economic environment that is more unstable, and this may negatively affect both children's cognitive and non-cognitive skills development. From the perspective of the Technology of Skill Formation, children

with criminally involved parents and children whose parents have no criminal past receive different investment (i.e. parents' investments) in the skills of the child (Cunha and Heckman 2007). Even if such differences can be temporary, the fact that skills and investments are complementary over time can greatly accelerate initial differences in skill formation in the long run. Therefore, the implications for children's educational outcomes can be substantial.

3. Data and descriptive statistics

This study uses data from the Netherlands' Kinship Panel Study (NKPS), a nationally representative two-wave survey held from 2002 to 2004 and from 2006 to 2007 among 8,155 Dutch citizens aged between 18 and 79 (Dykstra et al. 2004). The NKPS data were collected through self-reported questionnaires. This study uses only information from the first NKPS wave because it contains information on the past criminal involvement of the parents and on the educational attainments of the parents and their children. Furthermore, there is information on many demographic and socio-economic characteristics of respondents and their closest family members, in particular their spouses and children. Respondents answered questions about their children aged 15 and older.²

Households are not considered in the analysis if respondents had no children and if there were missing values for the educational or criminal involvement variables. The data are coded such that the observation unit is the child for whom there is information available on their and their parents' background characteristics. The resulting number of child-parent observations is 5,822.

Criminal involvement of parents is measured by asking respondents if they or their family members have ever been convicted in a criminal court or have ever been in contact with the police for delinquent behavior, other than for traffic offences (Dykstra et al. 2004; Dykstra and Valk 2007). Based on this information a dummy variable is generated, that takes a value of 1 if at least one parent

² In case there are more than two children, respondents reported on two children of their choice (aged 15 and older).

in the household has ever been arrested and/or convicted, and 0 otherwise. The data show that 242 children had either one or two criminally involved parents, 97 of whom were convicted. The frequency and duration of this criminal involvement is unknown. Furthermore, criminal involvement can be underreported. As a comparison, the prison population rate in the Netherlands in 2004 was 123 per 100,000 inhabitants.³

Table 1 shows descriptive statistics on various background characteristics. Columns 2 and 3 show the means and standard deviations for children whose parents have no criminal past (N = 5,580), while columns 4 and 5 show the means and standard deviations for children whose parents have been criminally involved (N = 242). The education categories presented in the table represent highest achieved education levels.

The table shows that children of parents who were criminally involved are, on average, younger, more often non-Dutch, have lower education levels and more often have parents with only a primary education level as highest education level compared to children whose parents were not criminally involved. The data show that the majority of parents who were born in a foreign country came from Morocco, Turkey, Suriname and the Netherlands Antilles. A more detailed discussion on why households with these ethnic backgrounds entered the Netherlands is given in Van Klaveren, Van Praag and Maassen van den Brink (2011).

The descriptive statistics show that children of criminally involved parents differ in their characteristics from children of parents who were not criminally involved which should be accounted for in the empirical analysis.

³ See http://www.prisonstudies.org/info/worldbrief/wpb_country.php?country=157

Table 1. Descriptive statistics⁴

	Parents who were not criminally involved (N = 5,580)		Parents who were criminally involved (N = 242)		Mean differences	
	Mean	Std. Dev.	Mean	Std. Dev.	Δ	Std. Err.
Parents/household:						
Criminally involved mother	-	-	0.32	0.47	-	-
Age	59.14	10.14	55.63	8.96	3.51***	0.66
Single-parent household	0.16	0.25	0.16	0.26	-0.01	0.02
Household income (Euro)	1497.46	1253.21	1512.39	980.12	-14.93	81.62
Number of children	2.71	1.17	2.66	1.33	0.04	0.08
Child:						
Dutch	0.98	0.11	0.96	0.18	0.02***	0.01
Female	0.50	0.50	0.45	0.50	0.05*	0.03
Age child	31.92	10.28	28.32	9.58	3.60***	0.67
Urbanized residence area	0.63	0.48	0.63	0.48	0.01	0.03
Parents' educational attainment:						
(1) Primary Education	0.13	0.34	0.23	0.42	-0.10***	0.02
(2) Lower Secondary Education	0.36	0.48	0.32	0.47	0.04	0.03
(3) General Secondary Education	0.07	0.25	0.03	0.18	0.03**	0.02
(4) Intermediate Vocational Education	0.18	0.38	0.18	0.39	-0.01	0.03
(5) Higher Education	0.27	0.44	0.24	0.43	0.03	0.03
Children's educational attainment:						
(1) Primary education	0.11	0.32	0.21	0.41	-0.10***	0.02
(2) Lower Secondary Education	0.23	0.42	0.29	0.45	-0.06**	0.03
(3) General Secondary Education	0.15	0.36	0.14	0.35	0.01	0.02
(4) Intermediate Vocational Education	0.21	0.41	0.22	0.41	-0.01	0.03
(5) Higher Education	0.29	0.46	0.14	0.34	0.16***	0.03

Note: */**/** denotes statistical significance at the 10/5/1 percent level.

4. Estimation strategy and empirical findings

4.1 Multinomial probit estimation

Children's educational attainment is measured on a five-point scale. The categories are not naturally ordered because it is not straightforward if general secondary education should be regarded as a higher education level than intermediate vocational education. The different education categories,

⁴ These descriptive statistics are somewhat different than in the original dataset because only households with children are considered.

moreover, differ in the number of education years needed to achieve a diploma and differ in terms of educational content.

Educational outcomes depend on earlier educational outcomes, in the sense that children can choose to follow a higher educational track only if they have completed a higher secondary educational track. It implies that the ratio of the probabilities of choosing between two alternatives is affected by the total set of available alternatives (Luce 1969; McFadden 1970). As a consequence, a multinomial probit estimation model (MNP) is preferred to other multinomial estimation models (such as the multinomial logit model), because it allows each outcome to depend on the alternative outcome (Hausman and Wise 1978). This study therefore estimated the effect of parents' criminal involvement on educational attainment probabilities by means of the following MNP estimation model:

$$U_{ij} = \alpha_i X + \delta_j D + \varepsilon_{ij}, \text{ for } j=1, \dots, 5, \quad (1)$$

where U_{ij} indicates that child i has attained one of the five educational levels j , X represents a vector of background characteristics, and D is a dummy variable indicating criminal involvement of parents in the household. The control variables included in the estimation model are similar to those presented in Table 1. As usual, the $\varepsilon_{ij}, \dots, \varepsilon_{i5}$ are distributed independently and identically standard normal. In the empirical analysis, higher education is chosen as a base category.

The nonlinear nature of the multinomial probit analysis causes that the estimation parameters represent log odds ratios, which are difficult to interpret. Therefore, we calculate the marginal effects (ME) for the D -variables that show how the probability of completing education level j changes if children have parents who were criminally involved, for the mean individual. More precisely, the marginal effects of D_j on the probability of observing outcome j are given by

$$\frac{\partial p_j}{\partial D_j} = \frac{\partial \Phi(\cdot)}{\partial D_j} = \phi(\delta_j \cdot D) \times \delta_j, \quad (2)$$

where Φ is for the cumulative normal distribution function, ϕ is the standard normal density function and, δ_j are the estimation parameters D_j (Greene 2003).

The multinomial probit results are shown in Table 2, and columns 2 and 3 present the estimated log odds ratios and associated standard errors, while columns 5 and 6 present the calculated marginal effects and associated standard errors. The estimated coefficients of D are all positive and significant. Hence, having criminally involved parents increases the probability of completing lower education levels relatively to completing a higher education level.

The MNP results can also be interpreted in terms of relative risks. The relative risk ratio is the probability of finishing a certain category of education over the probability of finishing higher education (reference category), and it is simply the exponentiated coefficient, as shown in Table 2, column e^x . The results show that for children with criminally involved parents relative to children whose parents have no criminal past, the relative risk of finishing primary education relative to having higher education degree increases by a factor of 1.91 holding the other variables in the model constant. The relative risk of finishing lower secondary education, general secondary education, and intermediate vocational education shows an increase by 1.66, 1.39 and 1.54, respectively⁵.

The calculated marginal effects suggest that the probability of having a primary education level as the highest educational attainment increases by four percentage points if at least one of the parents was criminally involved. Moreover, the results show that the probability of having a higher education degree as the highest educational attainment decreases by 12 percentage points if at least one of the parents was criminally involved.

⁵ The means of the control group for children's educational attainment are presented in Table 1.

Table 2. Multinomial probit results

Children's educational attainment	Coef.	Std. Err.	e ^x	MFX	Std. Err.
(1) Primary Education					
<i>D</i>	0.65***	0.20	1.91	0.04*	0.02
Children's characteristics:					
Female	-0.16**	0.07			
Age	-0.14***	0.01			
Dutch	0.04	0.33			
(2) Lower Secondary Education					
<i>D</i>	0.51***	0.18	1.66	0.05	0.04
Children's characteristics:					
Female	-0.05	0.06			
Age	-0.05***	0.01			
Dutch	-0.16	0.31			
(3) General Secondary Education					
<i>D</i>	0.33*	0.17	1.39	-0.01	0.03
Children's characteristics:					
Female	0.04	0.06			
Age	-0.06***	0.01			
Dutch	-0.55*	0.29			
(4) Intermediate Vocational Education					
<i>D</i>	0.43***	0.18	1.54	0.03	0.04
Children's characteristics:					
Female	-0.03	0.01			
Age	-0.03***	0.06			
Dutch	0.16	0.31			
(5) Higher Education (Reference group)					
<i>D</i>	-	-		-0.12***	0.03
Control variables			Yes		
Number of observations			5,822		

Note: */**/** denotes statistical significance at the 10/5/1 percent level. Standard errors are clustered at the family level. Log-pseudolikelihood = - 7994.2009.

The other education categories do not seem to correlate with the parents' criminal involvement status. It is, however, interesting that the estimated marginal effect for general secondary education is negative, while the estimated marginal effect for lower secondary and vocational education are positive. General secondary education provides children access to higher education, while lower secondary education provides children access to vocational education. The estimation results, therefore, suggest that children of parents who were criminally involved are more likely to attend lower secondary and intermediate vocational educational tracks, and are less likely to attend general secondary education.

At the same time, the results show the non-causal nature of the multinomial probit analysis. The results may simply reflect that children whose parents were criminally involved are more likely to be ‘lower ability’ children from disadvantaged families/neighborhoods who follow, on average, lower educational tracks compared to children whose parents were not criminally involved. The estimation results, therefore, may simply be the result of comparing children with criminally involved parents to non-comparable children whose parents were not criminally involved. As a consequence, the dummy variable D does not estimate the educational attainment of children with criminal parents in case their parents would not have been criminally involved. To ensure that we compare children ‘with criminal parents’ to comparable children ‘without criminal parents’ a matching approach is adopted.

4.2 Matching analysis

Matching is used to obtain treated and control samples with the most similar covariance distributions. We apply a nearest neighbor matching approach (Rubin 1973), where the distances between neighbors are computed using a Mahalanobis distance measure.⁶ Matching links each child whose parents were criminally involved to the best look-a-like child whose parents were not criminally involved conditionally on a vector of background characteristics, \mathbf{x} . The matching variables represent the characteristics included in the multinomial probit model⁷, and they are presented in the form of binary indicators (e.g. gender, nationality) and continuous variables (e.g. age).

⁶ This subsection relies on De Witte and Van Klaveren (2012) and Rubin (2006).

⁷ We exclude household income, because income of parents can be endogenously driven by past criminal involvement. To check whether the results would change, we also provide matching using the household income variable. The empirical results are available on request.

Let N_1 and N_0 denote the number of children whose parents were, respectively, criminally and not criminally involved. The matching approach then gives weights to the k^{th} observation that could serve as a potential match for student i in N_1 . This weight function is denoted by $w(i, k)$ with $\sum_j w(i, k) = 1$. The average treatment effect on the treated can be represented by the following matching estimator:

$$\Delta = \frac{1}{N_1} \sum_{i \in \{D=1\}} [U_{1,ij} - \sum_k w(i, k) U_{0,ij}], \quad (3)$$

where $0 < w(i, k) < 1$, $\{D=1\}$ is the set of children whose parents were criminally involved and k represents a child from the set N_0 . The weights are obtained by minimizing the Mahalanobis distances of the observed child characteristics:

$$w(i, k) = 1 \text{ if } k = \arg \min_{k=1, \dots, N_1} (\mathbf{x}_i - \mathbf{x}_k)' \Sigma^{-1} (\mathbf{x}_i - \mathbf{x}_k), \quad (4)$$

where Σ^{-1} represents the within sample covariance matrix and where $w(i, k) = 1$ if a match is possible. We note that alternative matching approaches, such as kernel or propensity score matching, are not necessarily inferior to Mahalanobis matching (see Cameron and Trivedi 2005, and Rubin 2006). The reason why the Mahalanobis distance method was chosen is because it does not rely on any functional form or distribution. Yatchew (1998) points out that assuming a functional form may impose a specification bias on the estimated effect of parents' criminal involvement on children's educational outcomes. Additionally, Mahalanobis matching is considered as a reliable approach when the vector of matching characteristics is not highly dimensional (Gu and Rosenbaum 1993;

Rubin and Thomas 2000). To validate the robustness of the Mahalanobis estimator, we also applied propensity score matching and kernel matching. The results generated by these matching estimators were comparable to the Mahalanobis matching results.⁸

A well-established result in the empirical literature is that educational outcomes of children are causally related to their parents' educational outcomes (see Holmlund et al. 2011 and references therein). Therefore, we establish an exact match on parental education by dividing the children into different subgroups according to their parents' education level. We emphasize that 96 % of parents considered in this study have completed schooling and were not in any educational program at the time the questionnaire was taken, while only four percent were enrolled in education, in addition to their educational level used in the analysis. This study assumes that parental education is a proxy for children's ability and that by establishing an exact match on parents' educational attainment we control for inherited ability differences between children in N_0 and children in N_1 .

We also establish an exact match on the respondent's (parent's) gender in the same manner as described above. The reason for this choice is that male respondents may answer the questionnaire differently than female respondents, and that single-mother families and single-father families may differently impact children's educational outcomes.

Exact matching on parents' education level and gender yields ten subgroups, and for each subgroup we perform one-to-one nearest neighbor matching with replacement and link each child from the set N_1 to the one best look-a-like control child from the set N_0 .

Table 3 shows the descriptive statistics for the children whose parents were criminally involved (N=242) and the children of the constructed control group, namely the children whose parents have no criminal past (N=242). The last two columns of the table indicate that the mean differences are not statistically significantly different. Hence, we conclude that the background

⁸ The empirical results generated by these alternative matching estimators are available on request.

characteristics of the constructed control group are comparable to those of the children whose parents have past criminal involvement.

Table 3. Descriptive statistics: Matched sample

Children's characteristics	Parents who were not criminally involved (N = 242)		Parents who were criminally involved (N = 242)		Mean differences between groups	
	Mean	Std. Dev.	Mean	Std. Dev.	Δ	St. Err.
Household's characteristics						
Single-parent household	0.16	0.26	0.16	0.26	0	0.02
Number of children	2.62	1.20	2.66	1.33	-0.05	0.12
Dutch	0.96	0.18	0.96	0.18	0	0.02
Female	0.45	0.50	0.45	0.50	-0.01	0.05
Age (years)	28.52	9.37	28.32	9.58	0.20	0.86
Urbanized residence area	0.64	0.48	0.63	0.48	0.02	0.04

The table does not show the descriptive statistics on parental education as the control sample is exactly identical in this respect to the sample of children whose parents were criminally involved and the descriptive statistics of the latter group is already presented in Table 1. It was previously discussed that individuals who were criminally involved have a higher probability of having lower educational attainment. Still, criminal parents are quite evenly divided over the five educational categories (with the exception of the general secondary education level).

Descriptive statistics on educational outcomes for the children in the control sample and the children whose parents were criminally involved are shown in Table 4. The last two columns present the mean differences between the two considered child groups and associated standard errors, and indicate that children whose parents were criminally involved more often have primary education as the highest level of education attained and less often have higher education.

Table 4. Educational attainment of children in the matched sample

Children's educational attainment	Parents who were not criminally involved (N = 242)		Parents who were criminally involved (N = 242)		Mean differences between groups	
	Mean	Std. Dev.	Mean	Std. Dev.	Δ	St. Err.
(1) Primary Education	0.14	0.35	0.21	0.41	-0.07**	0.03
(2) Lower Secondary Education	0.29	0.45	0.29	0.45	-0.01	0.04
(3) General Secondary Education	0.14	0.35	0.14	0.35	0.01	0.03
(4) Intermediate Vocational Education	0.23	0.42	0.22	0.41	0.01	0.04
(5) Higher Education	0.20	0.40	0.14	0.34	0.06**	0.03

*/**/*** denotes statistical significance at the 10/5/1 percent level, respectively.

To increase the efficiency of the matching estimates (Rubin 1973, 1979; Rubin and Thomas 2000) we apply the multinomial probit model for the matched sample. The MNP estimation results are shown in Table 5 and they are comparable to the results presented in Table 2. The estimated D -parameters are all positive and significant, indicating that having criminally involved parents increases the probability of completing a lower education level relatively to completing higher education. In terms of relative risks, for children with criminally involved parents relative to children whose parents have no criminal past the probability of finishing primary education, lower secondary education, general secondary education, and intermediate vocational education relative to completing higher education is an increase by 2.60, 2.05, 1.80, 1.71, respectively, holding all other variables in the model constant.⁹

The marginal effects are somewhat different than the estimation results presented in Table 2. In particular, the probability of finishing only primary education level increases by eight percentage points if at least one of the parents was criminally involved (while it is four percentage points in

⁹ The means for children's educational attainment are in Table 4.

Table 2). The probability of having a higher education degree decreases by 13 percentage points if at least one of the parents was criminally involved¹⁰.

Table 5. Multinomial probit results for the matched sample

Children's educational attainment level	Coef.	Std. Err.	e ^x	MFX	Std. Err.
(1) Primary Education					
<i>D</i>	0.96***	0.26	2.60	0.08**	0.04
Children's characteristics:					
Female	-0.04	0.26			
Age	-0.15***	0.02			
Dutch	-0.27	0.96			
(2) Lower Secondary Education					
<i>D</i>	0.72***	0.24	2.05	0.06	0.05
Children's characteristics:					
Female	-0.05	0.22			
Age	-0.07***	0.01			
Dutch	-1.80**	0.73			
(3) General Secondary Education					
<i>D</i>	0.59**	0.24	1.80	0.01	0.04
Children's characteristics:					
Female	-0.05	0.23			
Age	-0.08***	0.01			
Dutch	-1.08	0.89			
(4) Intermediate Vocational Education					
<i>D</i>	0.54**	0.23	1.71	-0.01	0.05
Children's characteristics:					
Female	-0.10	0.23			
Age	-0.03**	0.01			
Dutch	-0.84	0.78			
(5) Higher Education (reference group)					
<i>D</i>	-	-		-0.13***	0.04
Control variables			Yes		
Number of observations			484		

Note: */**/** denotes statistical significance at the 10/5/1 percent level, respectively. Standard errors are clustered at the family level. Log-pseudolikelihood = - 643.44173.

¹⁰ The results estimated from the sample where household income is used as a matching variable suggest a similar pattern of marginal effects. Only the magnitude of the effect on higher education attainment is smaller, reflected by a decrease of six percentage points when parents have past criminal involvement. The results are available on request.

We mentioned above that the results in Table 2 may simply indicate that children whose parents were criminally involved are more likely to be ‘lower ability’ children from deprived neighborhoods who, as a result, have lower education levels compared to children whose parents were not criminally involved. However, in the matching analysis we compare children whose parents were criminally involved to comparable children whose parents have no criminal past. The estimated marginal effects in Table 5 have the same pattern, but the magnitude of the effects has changed. Therefore, we conclude that having criminal parents increases the probability of having a primary education level and decreases the probability of higher education attainment.

5. Robustness analyses

In this section we estimate two alternative estimation models to check the robustness of our results. The first model is estimated taking unfinished educational spells of children into account. The dependent variable constructed in Section 4 indicates the highest education level of children given that they obtained a diploma at the time the questionnaire was taken. Therefore, the estimation results in Section 4 may be biased if the probability of still being in education is related to having parents who were criminally involved.

The data contains information on whether children are still in education at the moment the questionnaire was taken. There are 93 children in the matched sample enrolled in education, which represents 19 % of the sample. To check if the estimated *D*-parameters in Section 4 were biased due to the unfinished education spells, we estimate the model (1) for the full and the matched sample while assuming that all children who are still in educational attainment will finish their education level with a diploma. Practically, this means that children, who were still in education when the questionnaire was taken, receive one education level on top of educational attainment used in the analysis. We examine if the occurrence of unfinished spells impose a bias on the previously estimated *D*-parameters (i.e. the estimates in Table 5).

Table 6 shows that the estimation results are comparable to the estimates presented in Table 5. Therefore, unfinished education spells that are observed in the data do not impose a bias on the estimated *D*-parameters.

Table 6. Multinomial probit results for the matched sample, including unfinished education spells

Children's educational attainment level	Coef.	Std. Err.	e ^x	MFX	Std. Err.
(1) Primary Education					
<i>D</i>	1.08***	0.25	2.93	0.10***	0.03
Children's characteristics:					
Female	-0.24	0.26			
Age	-0.12***	0.02			
Dutch	-0.62	0.95			
(2) Lower Secondary Education					
<i>D</i>	0.58***	0.22	1.78	0.04	0.05
Children's characteristics:					
Female	-0.01	0.21			
Age	-0.05***	0.01			
Dutch	-1.76**	0.75			
(3) General Secondary Education					
<i>D</i>	0.43*	0.23	1.54	-0.01	0.03
Children's characteristics:					
Female	0.07	0.23			
Age	-0.06***	0.01			
Dutch	-1.23	0.88			
(4) Intermediate Vocational Education					
<i>D</i>	0.50**	0.21	1.66	0.01	0.05
Children's characteristics:					
Female	-0.07	0.21			
Age	-0.03**	0.01			
Dutch	-1.12	0.76			
(5) Higher Education (reference group)					
<i>D</i>	-	-		-0.14***	0.04
Control variables				Yes	
Number of observations				484	

Note: */**/** denotes statistical significance at the 10/5/1 percent level, respectively. Standard errors are clustered at the family level. Log-pseudolikelihood = - 662.0682.

The second alternative estimation model addresses that convicted parents are 'more criminal' than parents who were just in the contact with police for their criminal behavior. Therefore, the MNP

model is estimated only for convicted parents¹¹ and the estimation results are shown in Table 7. The estimation results are comparable to the results shown in Table 5, even though the effect on the probability that children with convicted parents have a primary education level is now more pronounced with 12 percentage points. Hence, we conclude that the probability that children have lower educational attainment increases if the criminal offense of parents was more serious.

Table 7. The MNP for children with convicted parents for the matched sample.

Children's educational attainment level	Coef.	Std. Err.	e ^x	MFX	Std. Err.
(1) Primary Education					
<i>D</i> [Conviction]	1.14***	0.39	3.12	0.12**	0.06
Children's characteristics:					
Female	0.20	0.30			
Age	-0.18***	0.03			
Dutch	1.23	1.63			
(2) Lower Secondary Education					
<i>D</i> [Conviction]	0.69*	0.36	1.43	0.08	0.07
Children's characteristics:					
Female	-0.30	0.25			
Age	-0.08***	0.02			
Dutch	-0.49	0.78			
(3) General Secondary Education					
<i>D</i> [Conviction]	0.47	0.35	1.60	-0.01	0.05
Children's characteristics:					
Female	0.02	0.27			
Age	-0.08***	0.02			
Dutch	-1.10	0.96			
(4) Intermediate Vocational Education					
<i>D</i> [Conviction]	0.32	0.35	1.38	-0.06	0.06
Children's characteristics:					
Female	-0.14	0.26			
Age	-0.02	0.01			
Dutch	0.28	0.92			
(5) Higher Education					
<i>D</i> [Conviction]	-	-		-0.13**	0.05
Control variables				Yes	
Number of observations				339	

Note: */**/** denotes statistical significance at the 10/5/1 percent level, respectively. Standard errors are clustered at the family level. Log-pseudolikelihood = - 457.9979.

¹¹ In this model, we excluded children whose parents were in contact with police for their delinquent behavior.

Finally, we would like to discuss that the estimation results may be biased due to the fact that respondents underreport their past criminal involvement. Even though we cannot examine how this underreporting behavior biases the estimation results, we emphasize that the matching analysis compares households with similar background characteristics. This partly offsets the problem of underreporting because the probability of being criminally involved and the extent to which respondents underreport is equal for children whose parents were and were not criminally involved conditionally on the matching covariates. We also tend to assume that underreporting criminal involvement can lead to lower bound estimates in our study, such that the established significant effect is a strong empirical result.

Secondly, some parents may have been criminally involved shortly before the questionnaire was taken while other parents had criminal involvement a long time before the questionnaire was taken. The data include information on whether parents have been criminally involved between the time the questionnaire was taken and one year ago, or whether the criminal offense happened earlier. The estimation results for both subgroups were, however, very similar. Moreover, the official statistics on the recidivism rates in the Netherlands show that up to 50 % of criminals are prosecuted again within two years (Wartna et al. 2010), implying that some parents in our data were involved in criminal behavior more than once.

6. Conclusion

A growing body of literature examines the effect of educational attainment on criminal involvement and how parental education influences the educational outcomes of children. The literature has, however, paid little attention to the effect that criminal involvement of parents may have on children's educational outcomes. In this paper, we study this effect on educational attainment of children.

Unique survey data are used from the Netherlands' Kinship Panel Study. These data are collected through self-reported questionnaires and contain information on past criminal involvement

of the parents, on educational levels of parents and children and on a wide range of socio-economic background characteristics. To identify the effect of parents' criminal involvement on educational outcomes of their children we apply a multinomial probit model combined with a Mahalanobis matching model. The multinomial probit model allows for the use of categorical and non-ordered dependent variables, while the matching analysis ensures that children whose parents were criminally involved are compared to children whose parents were not criminally involved.

The empirical findings suggest that having parents with criminal behavior increases the probability of completing lower education levels relatively to completing a higher education level. More specifically, they indicate that having criminally involved parents: (1) increases the probability of only finishing primary education with eight percentage points, and (2) decreases the probability of having a higher education degree with 13 percentage points.

Robustness checks indicate that the probability of having a primary education level as highest education increases with 12 percentage points if we consider only parents who were convicted. Moreover, the estimation results do not depend on the timing of criminal involvement. Finally, the estimated effects are not driven by the observed unfinished educational spells of children.

Based on the results we conclude that children of criminal involved parents tend to have lower educational attainment, even if we control for socio-economic background characteristics and parental education by adopting a matching technique. Thereby, this study confirms and extends previous findings on the effect of parents' criminal behavior on children's educational outcomes, and emphasizes the persistent negative externalities of crime and corresponding social costs of crime. This study has important implications for the design of policies to reduce educational inequality of children caused by criminal involvement of their parents.

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