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Siblings and Educational Attainment in West Germany

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Motivation

Analysis of the relation between number and gender of siblings and educational attainment

Few studies were carried out in Germany in this field

Theories and previous works

Model	Methods
Sociology	
Resource dilution model	Educational attainment of children depends on inputs of time and money from parents
Economics	
Parental allocation of time model	Family maximizes an utility function: U (n, q, Z) • Non discriminatory time allocation attitude • Achievement maximization attitude • Compensatory resource allocation attitude
Psychology	
The confluence model	Family's intellectual environment is equivalent to the weighted average of the mental ages of all members of the family

Authors	Data Set	Findings
Butcher and Case (1994)	PSID NLSW CPS	Effects on women
Hauser and Kuo (1995)	OCG NSFH SIPP	No effects (a composition of positive and negative effects)
Kaestner (1996)	NLSY	No effects on whites Positive effects on blacks
Conley (2000)	PSID	Effect of opposite sex siblings
Bauer and Gang (2000)	GSOEP	Cultural affiliation

Aim of the study

- **study of the situation in West Germany**
- **control for the unobservable heterogeneity (Matching procedure)**
- **analysis of the effects of the educational attainment of an elder sibling (Ordered Probit)**

Data

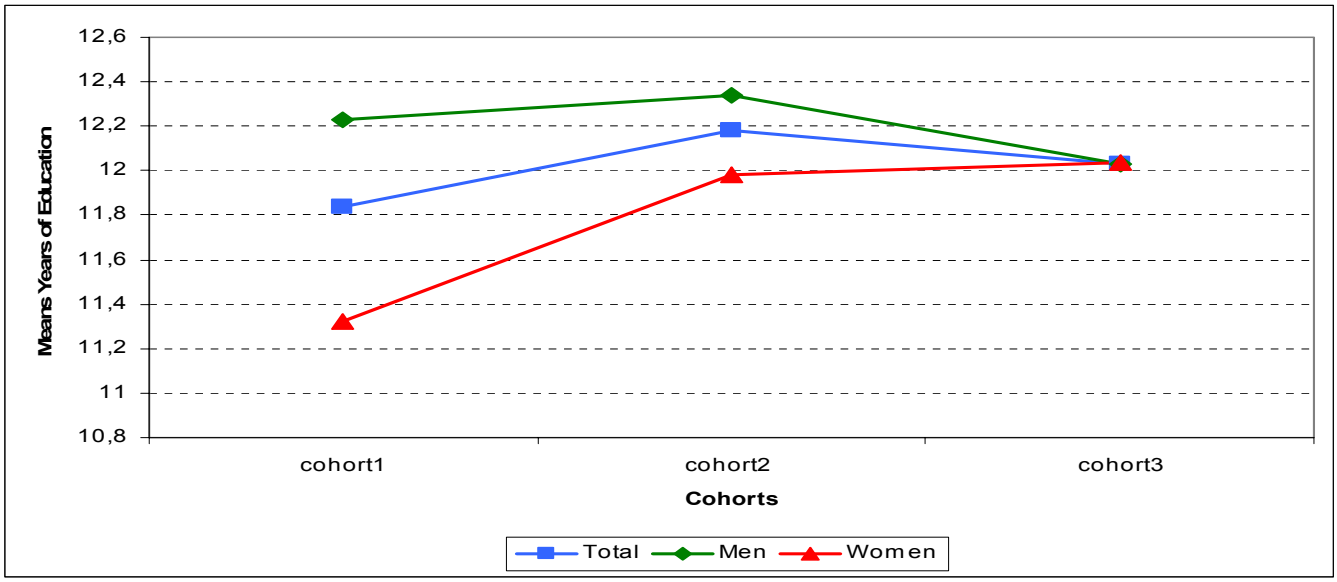
- **are drawn from the German Socio Economic Panel (Gsoep)**
- **result from the 13th Wave (1996)**
- **are restricted to individuals:**
  - **of West German nationality**
  - **aged between 22 and 56**
  - **who finished their studies and work**
- **individuals with the same mother are considered as siblings**

Educational Attainment in West Germany

Increase in the last six decades but reduction since the 80s

- **school attainment of women has increased distinctly**
- **women's level of education reaches the level of the men for individuals born between 1962 and 1974**

Figure 1: Educational Attainment by Cohort and by Gender



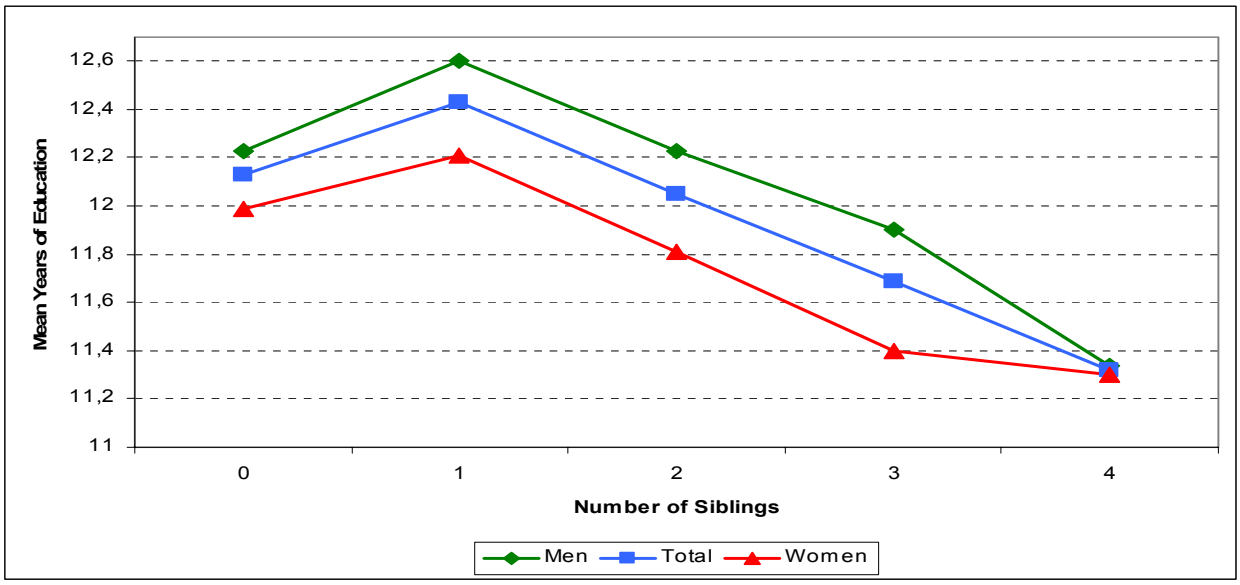
1940-1950: cohort1 1951-1961: cohort2 1962-1974: cohort3

Siblings and educational attainment

The same trend is observable for both men and women

- **an increase in educational attainment from one-child families to two–child families**
- **the relation between education attainment and the number of siblings is negative for families with more than two children**

Figure 2: Educational Attainment by Number of siblings



Basic Model

- **educational attainment: school duration in years (dependent variable)**
- **sibling composition: number and sex**
- **social backgrounds: parent's education**
- **control variables: sex and age**

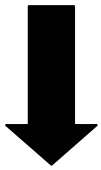
Table 5: Effects of the sibship sex composition on educational attainment with OLS

Variable	Coeff.	Coeff.
Age	0.005	0.005
Father's education	0.200***	0.202***
Mother's education	0.195***	0.195***
Sex	-0.331***	-0.328***
Number of siblings	**-0.162*** **	**-0.248*** **
Number of sisters		**0.171*** **
Constant	8.676***	8.666***
R^2	0.233	0.236
N	2935	2935

Significance Level: *=p<10%, **=p<5%, ***=p<1%

Matching Procedure

Unobservable Heterogeneity



Matching Procedure

A non-parametric method to the problem of identifying the treatment impact on outcomes

This procedure is based on the model of causal effects

- The treatment or causal effects

$$Y^1 - Y^0$$

- The average treatment effect

$$E(Y^1 - Y^0 \mid X)$$

- The treatment on the treated

$$E(Y^1 - Y^0 \mid X, S = 1)$$

with

Y^1 the potential outcomes if there is participation in a treatment

Y^0 the potential outcomes if there is no participation in the treatment

X the set of observable characteristics (see basic model)

S is a dummy variable, =1 if there is participation in the treatment

The matching estimator is given by

$$\hat{\beta}_{MM} = \sum_{i \in \{S_i = 1 \mid i \in C^*\}} \left\{ Y_i - \hat{Y}_i \right\} w_i ,$$

with

$$w_i = 1 / N_1^* \qquad \hat{Y}_i = \sum_{j \in C_{p_i}^0} W_{ij} Y_j \qquad \sum_{j \in C_{p_i}^0} W_{ij} = 1$$

The matching estimators are

- the nearest-neighbour matching estimator

- the kernel based matching estimator

Matching Results

Table 6: Effects of sisters on educational attainment with matching

The matching estimators	Treated	Controls	Difference	St.E*
Average treatment on the treated				
Nearest-neighbor	11.990	11.718	**0.272**	0.143
Gaussian kernel	11.990	11.633	**0.357**	0.090
Epanechnikov kernel	11.990	11.596	**0.394**	0.098
N	2131			
Average Treatment on the Untreated				
Nearest-neighbor	12.103	12.196	**0.093**	0.187
Gaussian kernel	12.103	12.270	**0.166**	0.133
Epanechnikov kernel	12.103	12.230	**0.127**	0.133
N	1719			

Table 7: Effects of brothers on educational attainment with matching

The matching estimators	Treated	Controls	Difference	St.E*
Average treatment on the treated				
Nearest-neighbor	11.917	11.857	**0.061**	0.122
Gaussian kernel	11.917	11.860	**0.057**	0.097
Epanechnikov kernel	11.917	11.801	**0.116**	0.100
N	2212			
Average Treatment on the Untreated				
Nearest-neighbor	12.207	12.186	**-0.021**	0.177
Gaussian kernel	12.207	12.197	**-0.011**	0.124
Epanechnikov kernel	12.207	12.178	**-0.029**	0.137
N	1638			

*** Bootstrapping: 300 replications**

The discrete choice model

The **ordered probit** estimates the relationships between an ordinal dependent variable and a set of independent variables (family characteristics, respondent characteristics…)

The model

Education is the ordered choice variable (ordinal dependent variable)

$$\text{Education} = \begin{cases} \text{level 1 : secondary school certificate or no vocational degree} \\ \dots \\ \text{level 5 : university certificate} \end{cases}$$

$$y_i^* = \beta' x_i + u_i$$

is not observed, but we observe

$$\begin{aligned} y &= 1 \text{ if } 0 < y^* \leq k_1 \\ y &= 2 \text{ if } k_1 < y^* \leq k_2 \\ y &= 3 \text{ if } k_2 < y^* \leq k_3 \\ y &= 4 \text{ if } k_3 < y^* \leq k_4 \\ y &= 5 \text{ if } y^* \geq k_4 \end{aligned}$$

The likelihood function is given by

$$L = \prod_{i=1}^{n} \prod_{j=1}^{J} [\Phi(k_j - \beta' x_i) - \Phi(k_{j-1} - \beta' x_i)]^{I_{ij}}$$

The effects of the education attainment of the elder sibling on educational decisions of the second child are

Table 9: Ordered-Probit Results

Variable	Coeff.	Std. Err.
Elder's education	**0.284*** **	0.049
Elder's sex	-0.120	0.214
Father's education	0.288***	0.068
Mother's education	0.079	0.086
Sex	0.026	0.207
Age	-0.009	0.050
Elder's Age	**0.083***	0.042
Cut 1	7.441	1.550
Cut 2	9.712	1.593
Cut 3	11.430	1.669
Cut 4	11.961	1.696
Log-likelihood	-129.188	
Pseudo-R^2	0.2709	
	Chi 2(13)	p>Chi 2
LR test	96.01	0.00
Number of Observations N=146		

Significance Level: *=p<10%, **=p<5%, ***=p<1%

Conclusions

- More than two children: the number of children has a negative impact on educational attainment
- The sibling sex composition has a significant effect on the educational attainment of women
- The educational attainment of an elder sibling plays a positive and significant effect on the educational decisions of the second child

Prudence with the interpretations

- The results from Bauer and Gang are different with the same type of data
- The diversity of American results show the complexity of the analysis

Next steps

- Longitudinal analysis with panel data
- Implications of the marital status of the parents
- Introduction of multiple treatment model (Matching)