

## **The impact of domestic child care on school performance**

### **Summary**

GSOEP gives an intertemporal record for the time adults spend on child care. The time devoted to children in the past can thus be reconstructed and used as a variable for explaining children's success at primary school. Parents' education and some socio-economic features were used as further explanatory variables. Parents' education and the time mothers spent on child care turned out to be significant. Implications are discussed in a framework given by the New Political Economy.

### **1. Introduction**

OECD PISA is widely known as a comparison of national educational systems. What might be less known is that PISA also looks at family background and student performance. According to the OECD: "Identifying the characteristics of the students most likely to perform poorly can help educators and policy-makers to locate areas requiring action. Similarly, identifying the characteristics of students who may flourish academically can assist policy-makers to promote high levels of performance".<sup>1</sup> The present investigation is also concerned with the relationship between family background and school performance. In particular, the impact of the time devoted to child care on childrens' school performance in primary school will be investigated. The present analysis is based on GSOEP data. The advantage of using GSOEP data is that family history has been surveyed for each year since

1984.<sup>2</sup> The disadvantage is that GSOEP was not especially designed to measure childrens' school performance.

Though school performance cannot be measured directly, there is an indirect way to do this. To explain how this can be operationalized by using GSOEP data, some details of the German educational system must be known. These are given in the following section 2. Section 3 concerns the selection of variables, drop out problems and descriptive statistics. Section 4 refers to the estimation method, section 5 gives estimation results. Section 6 concludes.

## **2. The German educational system**

Children attend primary school ("Grundschule") from ages 7 to 10, and secondary school from 11 to 16. There are three kinds of secondary school<sup>3</sup>:

1. "Hauptschule" (HS) – extended elementary school that provides preparation for a vocational career.
2. "Realschule (RS) – secondary school that provides preparation for a vocational career.
3. "Gymnasium" (GYM) – secondary school which emphasizes languages. If this is attended succesfully until the age of 18, the "Abitur" (ABI) is awarded. This qualification gives access to the university.

Teachers recommend children for one of the three types of secondary school at the age of ten, i.e. in the last form of the primary school. In the southern states (Bavaria and Baden-Württemberg) these recommendations are graded explicitly. If marks are less than 3, then HS is advised. If marks are higher than 3 and less than 2.5 RS is advised. For better marks GYM

is advised.<sup>4</sup> In the other states, recommendations are not binding, but there is an implicit hierarchy.

Hence, if we know what kind of secondary school a pupil attends, we can use this as an instrument which measures success in primary school.

### **3. GSOEP data used in this investigation**

The GSOEP started in 1984. Adults were asked every year about their use of time, including time used in caring for children. So, the amount of domestic care they had during their childhood can be counted for all children born in 1984 and later. In 2000, all children born before 1990 were more than 10 years old. We can therefore find out whether these children had been recommended for HS, RS or GYM. As mentioned above, this can be used as an instrument for measuring success in primary school. Now child care received will certainly not be the only possible predictor for childrens' success at primary school. We therefore use further household and family related variables available in GSOEP:

- parents' school leaving qualifications
- child's sex and number of brothers and sisters
- whether the child lives in an immigrant household
- the share of food expenditures in the household budget as an instrument for measuring the welfare of the household
- whether a personal computer or internet access is available in the household
- the number of employment hours of the mother.

Table 1 gives an overview on variables used.

**Table 1 Variable description**

<b>Variable</b>	<b>Description</b>	<b>Label</b>
EDUK	Secondary school attended	2=HS, 3=RS, 4=GYM
SEX	Child's sex	0=boy ; 1=girl
KZAHL99	Number of children living in the household in 1999	1, 2, 3, 4, 5
ENGEL	Share of food expenditures in the household budget	
IMG	Immigrant Household	0=German ; 1=immigrant
PC	Personal computer	0=not available, 1=available
INTERNET	Access to internet	0=not available, 1=available
MHS	Mother's highest school leaving qualification	MHS=1 HS
MRS		MRS=1 RS
MGYM		MGYM=1 GYM
MSTUD		MSTUD=1 University
VHS	Father's highest school leaving qualification	VHS=1 HS
VRS		VRS=1 RS
VGYM		VGYM=1 GYM
VSTUD		VSTUD=1 University
MKIBEKLN	Care received from mother in ages 0-3	total hours per day per child
MKIBEKIG	Care received from mother in ages 4-6	
MKIBEGS	Care received from mother in ages 7-10	
VKIBEKLN	Care received from father in ages 0-3	
VKIBEKIG	Care received from father in ages 4-6	
VKIBEGS	Care received from father in ages 7-10	
BERM	Mother's labour force participation	total hours per day

As the variables MKIBEKLN, VKIBEKLN etc. are based on intertemporal data, there have been a lot of drop outs. Thus the variables mentioned in Tab. 1 are only completely available for 148 children. In detail:

There are 2659 children in GSOEP born between 84 and 89.

Of these, 767 stem from sample A and B (which started in 84).

Of these, 579 attend HS, RS or GYM.

Of these, for 196 children mother's time use is complete and plausible.

Of these, for 169 children father's time use is complete and plausible.

Of these, for 148 children the variables ENGEL, KZAHL99 and BERM are completely available.

Table 2 shows the descriptive statistics for the remaining 148 children. 36 % of them attend HS, 28 % attend RS and 36 % attend GYM.

**Table 2 Descriptive statistics (N=148 children)**

Variable	Mean	Std. Dev.	Variable	Mean	Std. Dev.	Mean per day in each year
SEX	0.55	0.5	VHS	0.45	0.5	
KZAHL99	2	0.97	VRS	0.2	0.4	
ENGEL	0.21	0.1	VGYM	0.05	0.23	
IMG	0.22	0.42	VSTUD	0.13	0.34	
PC	0.46	0.5	MKIBEKLN	10.7	7.2	2.68
INTERNET	0.28	0.45	MKIBEKIGA	7.9	5.45	2.63
MHS	0.41	0.49	MKIBEKGS	8.9	5.8	2.23
MRS	0.31	0.46	VKIBEKLN	2.2	2.33	0.55
MGYM	0.09	0.29	VKIBEKIGA	1.7	1.7	0.57
MSTUD	0.05	0.21	VKIBEKGS	2.6	2.1	0.65
			BERM	32.2	35.3	3.22

#### 4. Estimation method

To carry out this investigation, the following stochastic model was chosen. Let  $y$  be an (abstract) metric measure for pupils' performance at primary school. Let  $x$  be a vector of variables which possibly influence performance  $y$  such as those variables in section 3. Let  $b$  be a vector of coefficients. Assume a linear relationship between  $y$  and  $x$ :

$$(1) \quad y = b^T \cdot x + \varepsilon.$$

$\varepsilon$  is a random term, which is assumed to follow a standard normal distribution. Let be  $x^{(i)}$  the vector of the values the variables take for pupil  $i$ . Define:

$$(2) \quad y_i = b^T \cdot x^{(i)} + \varepsilon_i.$$

Teachers' recommendations are mainly based on childrens' performance at primary school.

Thus two numbers  $A$  and  $B$  ( $A < B$ ) are introduced with the following properties:

- (3) If  $y_i < A$  then HS will be attended.  
 If  $A < y_i < B$  then RS will be attended.  
 If  $B < y_i$  then GYM will be attended.

Given these assumptions, A, B, and b can be estimated using a maximum likelihood approach:

$$(4) \quad \prod_{i \in \text{HS}} \text{Pr ob}(y_i < A) \cdot \prod_{i \in \text{RS}} \text{Pr ob}(A < y_i < B) \cdot \prod_{i \in \text{GYM}} \text{Pr ob}(B < y_i) \xrightarrow{A, B, b} \max!$$

## 5. Estimation results

Table 3 gives the estimated results for A, B and the coefficients b using all 21 variables described in section 3. Many of these will turn out to be insignificant. To see which variables are insignificant is, however, interesting in itself.

**Table 3 Estimation results I** (Sample size N=148)

Variable	Coefficient	$\alpha^5$	Variable	Coefficient	$\alpha$
A	0.404		VHS	-0.74	0.07
B	1.005		VRS	0.08	0.87
SEX	-0.016	0.95	VGYM	-0.627	0.29
KZAHL99	-0.087	0.52	VSTUD	1.54	0.03
ENGEL	-0.4	0.72	MKIBEKLN	0.054	0.027
IMG	-0.14	0.68	MKIBEKIGA	-0.015	0.67
PC	0.025	0.94	MKIBEKS	0.002	0.95
INTERNET	-0.25	0.5	VKIBEKLN	-0.016	0.79
MHS	1.058	0.03	VKIBEKIGA	-0.0066	0.95
MRS	1.3	0.02	VKIBEKS	0.013	0.87
MGYM	1.925	0.0008	BERM	-0.0006	0.87
MSTUD	7.56	0.9996			

Table 3 shows that neither the child's sex nor the number of his brothers and sisters has an significant influence on his success at school. Instruments such as the presence of PC and INTERNET turn out be meaningless as well. IMG and ENGEL are, perhaps surprisingly, insignificant. The reason might be that the parents' education variables cover the effects of living in an immigrant household and being member of a family with lower income.

(Multicollinearity: Immigrants seldom have German school qualifications. Low school qualifications lead on average to low incomes). In general, the variables indicating parents' education turn out to be significant. Sometimes, however, they have an unexpected, but insignificant sign. This might be due to the low number of cases. Among the parents' time use variables only, mother's child care hours during the small child period turn out to be significant. Note that BERM is insignificant too. It seems that mother's working hours are not so important, what matters is the time devoted to the infant.

Fathers' child care times are insignificant as well. Looking back to Table 2, we see that the reason cannot be that their mean or their variance is too small. How the difference in fathers' and mothers' time use occurs might be explained must be left for further research.

The results in Table 3 provide the reason for an improved second estimation. The variables SEX, KZAHL99, PC, INTERNET, ENGEL, BERM, IMG, VKIBEKLN, VKIBEKIGA, VKIBEKLS are deleted because they are insignificant and might even more be disturbing because of multicollinearity as outlined above. The variables giving information on the parents' education are combined to yield more reliable coefficients. The same will be done with mothers' time use. As fewer variables are considered, the number of drop outs decreases and hence the sample size increases. We thus define:

$$\begin{aligned}
 (5) \quad MABI &= 1 && \text{if} && MSTUD=1 \text{ or } MGYM=1 ; && \text{else } MABI=0; \\
 VABI &= 1 && \text{if} && VSTUD=1 \text{ or } VGYM=1; && \text{else } VABI=0; \\
 MKIBE &= MKIBEKLN + MKIBEKIGA + MKIBEKLS;
 \end{aligned}$$

Using these 3 variables gives the results shown in Table 4.

**Table 4 Estimation results II** (Sample Size N=196<sup>6</sup>, Pseudo-R<sup>2</sup> = 12,4 %)

Variable	Coefficient	$\alpha$
A	0.244	
B	0.805	
MABI	1.14	0.0001
VABI	1.05	0.0001
MKIBE	0.01375	0.0117

It can be seen that deleting and recombining variables leads to convincing levels of significance. The coefficients can be easily interpreted. A stands for the HS-RS threshold, B stands for the RS-GYM threshold. The difference is  $B - A = 0.561$ . This corresponds almost exactly to the difference in marks (i.e.=0.5 , see section 2). Thus we can straightforwardly transform the coefficient estimates into marks.

According to this, parents' education levels predominate for childrens' success at school. Adding 1.14 and 1.05 yields about 2.2, and this makes the difference between a sufficient performance and a good one.

The mean of the variable MKIBE is 27.5. Multiplying this mean by the coefficient 0.01375 yields 0.378. So we can say that, on average, marks are improved by 0.4 by domestic child care. This is less than the effect due to parents' education but nevertheless it is not negligible.

If we use the metaphor that childrens' success at primary school is partly produced by their families, we could say that it is produced by capital (i.e. parents' human capital) and labour (i.e. parents' child care times). The results of this investigation show that this production is rather capital-intensive.

## 6. Conclusions

This investigation has shown that family and household conditions play an important part in childrens' success at primary school. Essentially parents' human capital and their efforts in caring for the children improve primary school marks. Germany's educational misery cannot be overcome by only looking at the efficiency of kindergartens, schools and universities.

Plans to remedy the problem must include family<sup>7</sup> and social policies.

Moreover, in the author's opinion, what is needed is an analysis of the present situation that uses methods of the New Political Economy. In the following, an attempt is made to give a preliminary outline for such an analysis.

Suppose there are two groups of parents. Group A with higher education levels and group B with lower education levels.

Group B parents' should have an objective interest in improving the public educational system. The improvement should be able to compensate differences in the home production of human capital.

Group A parents' interests are ambiguous in a variety of respects:

High education leads to high wages and salaries. So they are interested in labour force participation and hence interested in an excellent public educational system.

However, an average or bad standard of public education improves the relative performance of their children, because group A is better at compensating for deficits in school education than Group B, as this investigation shows. But producing good marks also involves time, and this goes against group A's interest in labour force participation.

Why not then send the children to private schools? These are rare in Germany. Obviously German schools – according to PISA slightly below the OECD average - are not bad enough to make parents willing to pay fees. Additionally, being educated must not necessarily mean that parents are wealthy enough to pay for childrens' education.

Lobbying for schools takes time. Parents, especially young parents, are short of time, because children and professional career demand a lot of energy. Generally speaking, it will be better to invest the scarce time available in one's own children and not in political activities. If children are older and the parents' career is established, then improvements in the educational system will no longer help their own children. Now there is little interest in lobbying.

Decisions about German kindergartens, schools and universities are made in the towns and the states, not far away in Brusselles. So it should be relatively easy to bring about improvements in this field. Promoting these improvements should be the task of group A. They have the contacts to the local and state politicians, they have the eloquence to convince them, they have the experience from profession, travel and the media to know that things cannot stay as they are. However, there seem to be two main obstacles:

1. Demography: The majority of people are not parents of school age children. Therefore group A and group B at least would have to form an alliance.
2. Ambiguity of interests, especially for group A, as shown above.

Analysing Germany's educational misery in a framework of the New Political Economy thus suggests the following:

- I. Group A parents should become aware of the ambiguity of their interests and resolve it.
- II: For demographic reasons, at least an alliance with Group B parents (and with grandparents) is needed.

III. Therefore improvements must take account of the interests of group A and group B, i.e.: the absolute performance of group A children must be improved, as must the relative performance of group B children.

The econometric part of this investigation has shown that investing time in one's own children will not be without success. It further showed that human capital can be passed on. In the author's opinion, the first gives the parents the right to require improvements in public education. The second gives them the responsibility to take action to bring about improvements, for it should be remembered that the current adults' good education has been given to them by society mainly free of charge.

## References

*Etzold, S.* (2001): Illusion der Gleichheit. Die ZEIT Nr. 47/2001, p. 44.

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<sup>1</sup> Compare here [[www.pisa.oecd.org/knowledge/chap6/a.htm](http://www.pisa.oecd.org/knowledge/chap6/a.htm)]

<sup>2</sup> Unlike PISA and other assessments which must rely on actual remembered family data. Compare here Etzold (2001).

<sup>3</sup> Besides these three main types there are comprehensive schools that integrate HS, RS and GYM and a large variety of special schools ("Förderschule") dedicated to the promotion of pupils with various kinds of handicaps.

<sup>4</sup> Marks awarded are from 1 (best) to 6 (worst).

<sup>5</sup> Probability of making an error when rejecting the hypothesis that the coefficient is 0.

<sup>6</sup> There are many drop outs. The variable EDUK is available for 579 children, the variable MKIBE only for 196 children as described in section 3. To avoid selection bias, the correlation between the non-availability of time use data and parents' education had to be tested. A Probit procedure with MABI and VABI as independent variables showed, however, that these variables were insignificant in explaining drop outs (MABI- $\alpha$ =0.75; VABI- $\alpha$ =0.29).

<sup>7</sup> Compare here Ott (2002).