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The Fertility Effects of School Entry Decisions

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Abstract. School entry regulations lead to differences in the age when children start school. While previous literature estimated the effects of age at school entry for compliers with school entry regulations, we look at non-compliers, namely those who enter school one year before the official entry date. Based on an instrumental variable approach, the results show that early enrollment increases the number of children by 0.1, whereas we find no significant impact on rates of childlessness.

JEL classification: I21, J24

Keywords: school starting age, early school enrollment, fertility, motherhood, childlessness

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1. Introduction

So far, the literature on the impact of age at school entry analyzed the effect on, for example, educational outcomes, labor market success as well as fertility (e.g. Bedard and Dhuey 2006, Black et al. 2011). To identify causal effects, most studies use instrumental variable or regression discontinuity design methods and exploit school entry regulations. Hence, the estimated effects are measured for compliers of the school entry regulations or are simply reduced form effects.

We contribute to the literature by analyzing the impact of early school enrollment, i.e. for a specific group of non-compliers to the regular school entry regulations, namely those who enter one year before the official entry date. Early enrollment captures a relevant share of school entry decisions. While early enrollment rates are only about 2% in the US (Bassok and Reardon 2013), they are about 14% in China (Zhang et al. 2017) and as high as 20% among West German women born between 1944 and 1970, which builds the sample for our analysis. The analysis of early enrollment completes the picture about school entry decisions and age at school entry effects.

The identification of the impact of early enrollment rests on an IV strategy that exploits regulations on early enrollment, namely exception rules from regular school enrollment. This implies that the compliers to the exception rules are a subgroup of the non-compliers to the regular school entry regulations. To get an overview of potential effects on fertility, we measure the impact on the number of children and childlessness.

2. School Enrollment Regulations

In Germany, schools are regulated at the state level. School entry is determined by cut-off dates. Children turning age 6 before the cut-off date enter school in that year, while children turning age 6 after the cut-off date must wait one more year (cf. Görlitz et al. 2019). Several states allow to deviate from the rule and to enroll early while others do not. The early enrollment exception rules differ between states, over time and apply to children from different birth months. Table 1 displays the month of birth of those children allowed to enroll early by school year and state. The exception rule from regular enrollment and thus the option to enroll early most often applies to children born in the three months following the cut-off date.

Table 1. Birth months allowed to enroll early

School year	BW**	BY	HB	HH	HE	NI	NW	RP	SL	SH
1950	-	-	4 to 6	4 to 6	-	-	-	-	-	-
1951	-	-	4 to 6	4 to 6	6 to 7	-	-	-	-	-
1952	4 to 6	-	4 to 6	4 to 6	6 to 7	-	-	4 to 6	-	-
1953	4 to 6	-	4 to 6	4 to 6	6 to 7	-	-	4 to 6	-	-
1954	4 to 6	-	4 to 6	4 to 6	6 to 7	-	-	4 to 6	-	-
1955	4 to 6	-	4 to 6	4 to 6	6 to 7	4 to 9	-	4 to 6	-	-
1956	4 to 6	-	4 to 6	4 to 6	6 to 7	4 to 9	-	4 to 6	-	4 to 6
1957	4 to 6	-	-	4 to 6	4 to 6	4 to 9	-	4 to 6	-	4 to 6
1958	1 to 3	10 to 12	-	4 to 6	4 to 6	4 to 9	-	4 to 6	-	4 to 6
1959	1 to 3	10 to 12	-	4 to 6	4 to 6	4 to 6	-	4 to 6	-	4 to 6
1960	1 to 3	10 to 12	-	4 to 6	4 to 6	4 to 6	-	4 to 6	-	4 to 6
1961	1 to 3	10 to 12	-	4 to 6	4 to 6	4 to 6	4 to 6	4 to 6	-	4 to 6
1962	1 to 3	-	-	1 to 3	1 to 3	4 to 6	4 to 6	4 to 6	-	4 to 6
1963	1 to 3	-	-	1 to 3	1 to 3	4 to 6	4 to 6	4 to 6	-	4 to 6
1964	1 to 3	-	-	1 to 3	1 to 3	4 to 6	4 to 6	4 to 6	-	1 to 6
1965	1 to 3	-	-	1 to 3	1 to 3	4 to 6	4 to 6	4 to 6	-	1 to 6
1966*	1 to 3 & 7 to 11	-	-	1 to 3	12	4 to 6 & 7 to 9	4 to 6 & 12 to 2	4 to 6 & 12 to 1	-	1 to 6 & 12 to 1
1967	7 to 8	-	7 to 9	-	7 to 9	7 to 9	7 to 9	7 to 9	7 to 9	7 to 10
1968	7 to 8	-	7 to 9	7 to 12	7 to 12	7 to 12	7 to 9	7 to 12	7 to 12	7 to 12
1969	7 to 8	7 to 12	7 to 9	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12
⋮	7 to 8	7 to 12	7 to 9	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12
1974	7 to 8	7 to 12	7 to 9	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12
1975	7 to 8	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12
1976	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12
⋮	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12
1994	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12

Notes: *) Several states changed the start of the school year leading to two cohorts starting within one year. **) From 1976 onwards, Baden-Württemberg (BW) left open the range of birth months allowed to enroll early. We assume that the regulations followed arrangements in the other states.

3. Data and method

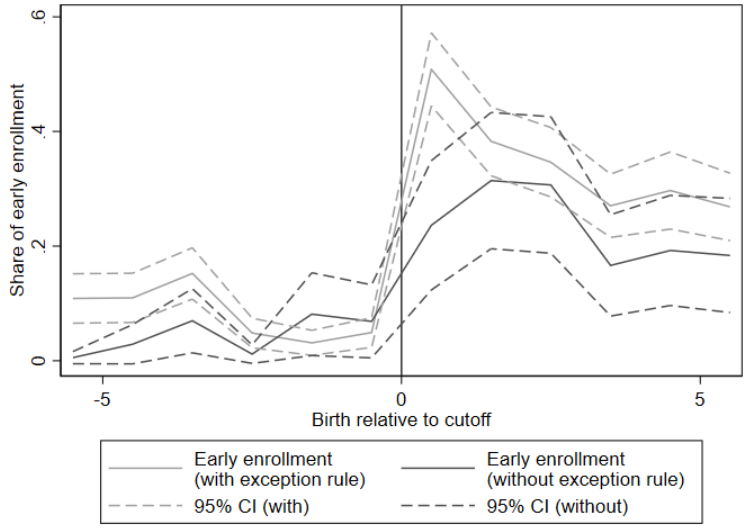
We use two data sets and a two-sample two-stage least squares IV estimator for the analysis. Data from the adult cohort of the National Educational Panel Study (doi:10.5157/NEPS:SC6:8.0.0) is used for the first stage. NEPS includes information on the educational background, e.g. the date of school entry, of individuals born between 1944 and 1986 (Blossfeld et al. 2011). The date of birth and the state-specific regulation allow to determine the date when children should have entered school. If reported school entry took place at least 8 months before that date, we define a child as early enrolled. Because we want to analyze completed fertility, the analysis sample is restricted to women born between 1944 and 1970 from West Germany.[1] The NEPS sample for the first stage estimation comprises 4 448 women.

For the second stage we use data from the Mikrozensus waves 2008, 2012 and 2016. The data comprises information on the number of children ever born to a woman. The sample for the second stage estimation comprises more than 290 000 women.

[1] East Germany (including Berlin) is dropped from the analysis because during the time those women were in school the East and West German schooling systems differed considerably.

Figure 1 shows the share of children with early enrollment by distance to the cut-off separately for states with and without exception rules. Interestingly, the share of early enrollment is not zero in states without exception rules. Yet, the share is clearly higher in states with exception rules allowing early enrollment, especially for children born in the first and second month after the cut-off. For those born further away from the cut-off early enrollment rates decrease and differences between states with and without exception rules become smaller.

Figure 1. Share of early enrollment by distance to the cut-off and state regulation



Note: Based on NEPS data. Distance to the cut-off is measured in months.

Our first stage estimation takes this pattern into account. We use four instruments. These are dummies indicating a birthday in the first (second/third/any further) month after the cut-off and falling under an exception rule. As controls we further include dummies for the state, the birth year, the birth month, and the distance to the cut-off as well as state specific birth year trends.

First stage results are shown in Table 2. Two of the four instruments are significant at the 1%-level and a third instrument at the 10%-level. Compliance with the early enrollment exception rule (i.e. non-compliance with the regular enrollment regulation) is highest for those born in the first month after the cut-off and basically zero for those born more than three months after the cut-off. The F-statistic for the joint significance of the instruments is 12.12, indicating no weak instrument problem (Staiger and Stock 1997).

Table 2. First stage estimates

	Early enrollment
Sample average	
1st month after cut-off * exception rule	0.2969***
	(0.0592)
2nd month after cut-off * exception rule	0.1080*
	(0.0553)
3rd month after cut-off * exception rule	0.1357***
	(0.0510)
More than 3 months after cut-off * exception rule	-0.0147
	(0.0332)
F test of excluded instruments	12.12
Observations	4,448

*Notes: Based on NEPS data, the table provides estimates of early enrollment on the instruments. Regressions control for the state, birth year, birth month, distance to the cut-off and state specific birth year trends. Standard errors are shown in parentheses. Significance: * p < 0.10, ** p < 0.05, *** p < 0.01.*

Table 3 shows reduced form and IV estimates for several predetermined characteristics. All predetermined characteristics are balanced and unrelated to early enrollment. This is another important precondition for the validity of the instrument.

Table 3. Balancing of predetermined characteristics

	Own mother with college degree (y/n)	Own mother's age at birth	Own mother foreign born (y/n)	Number of older siblings
IV estimate				
Early enrollment	-0.0007	0.4750	-0.0216	0.2461
	(0.0228)	(1.9443)	(0.0637)	(0.5163)
Reduced form estimate				
1st month after cut-off * exception rule	0.0117	0.2045	-0.0075	0.0889
	(0.0077)	(0.6362)	(0.0207)	(0.1452)
2nd month after cut-off * exception rule	-0.0176	0.3618	-0.0103	0.027
	(0.0178)	(0.8278)	(0.0293)	(0.2690)
3rd month after cut-off * exception rule	-0.0097	-0.2364	0.0101	0.0482
	(0.0162)	(0.7222)	(0.0149)	(0.1841)
More than 3 months after cut-off * exception rule	0.0088	0.2158	0.0011	0.0419
	(0.0105)	(0.4107)	(0.0232)	(0.1378)
Observations	4,284	4,309	4,398	4,093

*Note: Based on NEPS data, the table provides IV and reduced form estimates of the instruments for the outcomes listed in the first row. Standard errors are shown in parentheses. Significance: * p < 0.10, ** p < 0.05, *** p < 0.01.*

The second stage regresses the outcome on predicted early enrollment and the same set of controls included in the first stage. Robust standard errors for the second stage are estimated following Pacini and Windmeijer (2016). As outcome we use two measures of fertility: the number of children and a dummy for childlessness. Sample means are shown in the first row of Table 4. In addition, we also look at educational outcomes (years of education and a dummy for having a college degree), because these might represent mechanisms how early enrollment affects fertility.

5. Results

The bottom part of Table 4 shows regression results of the second stage. We find that early enrollment has no significant impact on rates of childlessness. If anything, childlessness decreases. On average the number of children increases by about 0.1 child per women if she was enrolled early. This estimate is statistically significant at the 10%-level. To assess the magnitude of this estimate, note that in Germany (completed) cohort fertility was 1.75 for women born around 1945, dropped to 1.60 for women born 20 years later and further to 1.55 for women born around 1975 (Statistisches Bundesamt 2019). Thus, the estimate is roughly similar to a half of the fertility drop observed for women born 30 years apart.

One way how early enrollment might affect fertility is by changing educational outcomes. To test, whether education is an actual mechanism, Table 4 also shows results using years of education and a dummy for having a college degree as outcomes. Both point estimates are insignificant and close to zero. Accordingly, the fertility effects are unlikely to be the result of differences in education between women enrolling early and those sticking to regular enrollment dates.

Table 4. Sample means and two-sample IV-estimates

	Childlessness (y/n)	Number of children	Years of education	College degree (y/n)
Sample mean	0.189	1.65	13.20	0.139
Std. dev	(0.391)	(1.20)	(2.73)	(0.346)
IV estimate				
Early enrollment	-0.0217	0.1022*	-0.0115	-0.0037
	(0.0176)	(0.0569)	(0.1224)	(0.0153)
Observations	290,205	290,205	289,692	289,692

*Note: Based on Mikrozensus data, the table provides second stage IV estimates for the outcomes listed in the first row. Robust standard errors are shown in parentheses and estimated following Pacini and Windmeijer (2016). Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

6. Conclusion

This paper analyzes the effect of early enrollment on the number of children and childlessness for women born between 1944 and 1970. In doing so, we use a two-sample two-stage least squares IV estimator. Our results indicate no significant effect of early enrollment on the rate of childlessness, whereas we find a significant positive effect on the number of children of about 0.1. Given that early enrollment means that children are younger by one year when entering school, we can compare these findings with the literature on school entry age. Similar to our results, McCrary and Royer (2011) do not find any impact on childlessness for the US. Yet, our findings contrast with Fredriksson et al. (2021), who find school entry age effects on the age at birth, but no impact on the number of children based on Finnish data.

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