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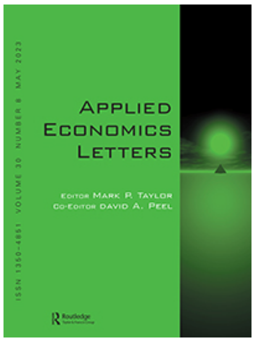

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The fertility effects of school entry decisions

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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 enrolment increases the number of children by 0.1 (which is significant at the 10%-level), whereas we find no significant impact on rates of childlessness.

KEYWORDS
School starting age; early school enrolment; fertility; motherhood; childlessness

JEL CLASSIFICATION
I21; J24

I. Introduction

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

We contribute to the literature by analysing the impact of early school enrolment, 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. Clearly, this group is not representative of all children but not covered in the previous analyses on school entry effects. Early enrolment captures a relevant share of school entry decisions. While early enrolment rates are only about 2% in the US (Bassok and Reardon 2013), they are about 14% in China (Zhang, Zhong, and Zhang 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 enrolment completes the picture about school entry decisions and age at school entry effects.

The identification of the impact of early enrolment rests on an IV strategy that exploits regulations on early enrolment, namely exception rules from regular school enrolment. 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 LATE effects on the number of children and childlessness.

II. School enrolment 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, Penny, and Tamm 2022). Several states allow to deviate from the rule and to enrol early while others do not. The early enrolment 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 enrol early by school year and state. The exception rule from regular enrolment and thus the option to enrol early most often applies to children born in the three months following the cut-off date.

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Table 1. Birth months allowed to enrol 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: * In 1966, 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 enrol early. We assume that the regulations followed arrangements in the other states.

III. 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, Roßbach, and von Maurice 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 analyse 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.

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

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.

[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. Also, the East German cut-off dates for school entry did not differ between regions and over time and early enrolment was generally not allowed.

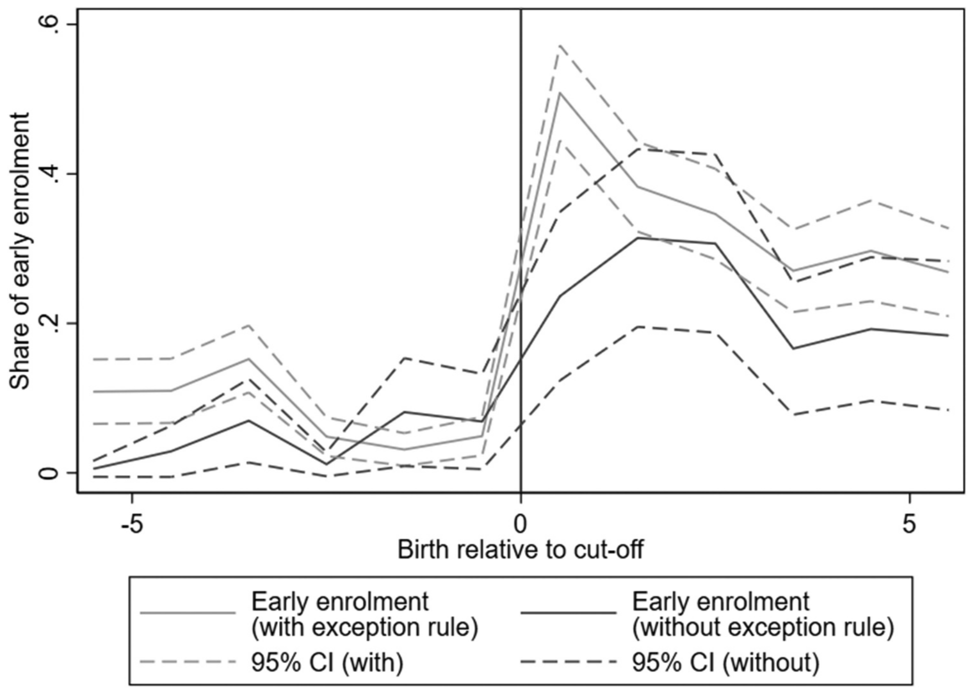

Figure 1. Share of early enrolment by distance to the cut-off and state regulation. Note*: Based on NEPS data. Distance to the cut-off is measured in months.*

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 enrolment exception rule (i.e. non-compliance with the regular enrolment 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 3 shows reduced form and IV estimates for several predetermined characteristics. All predetermined characteristics are balanced and unrelated to early enrolment. This is another important precondition for the validity of the instrument.

The second stage regresses the outcome on predicted early enrolment and the same set of controls included in the first stage and estimates a local average treatment effect (LATE). Robust SEs for the second stage are estimated following Pacini and Windmeijer (2016). As outcome, we use two measures of fertility: the number of children and

Table 2. First-stage estimates.

	Early enrolment
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 enrolment on the instruments. Regressions control for the state, the birth year, the birth month, the distance to the cut-off and state-specificbirth year trends. Robust SEs are shown in parentheses. Significance: * p < 0.10, ** p < 0.05, *** p < 0.01.*

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 enrolment	−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. SEs are shown in parentheses. Significance: * p < 0.10, ** p < 0.05, *** p < 0.01.*

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 enrolment affects fertility.

IV. Results

The bottom part of Table 4 shows regression results of the second stage. We find that early enrolment 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 woman 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 enrolment 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 enrolment dates.

V. Conclusion

This article analyzes the effect of early enrolment 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

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
SD	(0.391)	(1.20)	(2.73)	(0.346)
IV estimate				
Early enrolment	−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 SEs are shown in parentheses and estimated following* Pacini and Windmeijer (2016). *Significance: * p < 0.10, ** p < 0.05, *** p < 0.01.*

effect of early enrolment on the rate of childlessness, whereas we find a positive effect on the number of children of about 0.1 which is significant at the 10%-level. Given that early enrolment 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, Huttunen, and Öckert (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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Disclosure statement

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