

The Quantity-Quality Tradeoff and Birth Order in Kyrgyzstan

Human Capital Formation

Preliminary Version

Leo Gärtner, Maya Moritz, Julius Schölkopf

October 28, 2020

Life in Kyrgyzstan Conference (2020)

Session 2.5: Intra-household Decisions and Demographics

Introduction

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Introduction

Policy discussions about family planning policies as viable vehicles for human capital development (Knodel et al., 1990)

1. Does increased family size and higher birth order lead to lower education levels? (Becker & Tomes, 1976; Bharadwaj et al., 2018)
2. Does lower average spacing between births reduce this trade-off? (Booth & Kee, 2009)
3. Is share of total income devoted to education the main channel for this trade-off? (De Haan, 2010)

What we do and what we find

- **Research Question:** Does family size influence educational outcomes in Kyrgyzstan?
- **Method:** Using the presence of twins and same sex children as instruments for potentially endogenous number of and average space between children explaining educational outcomes and share of income spent on education
- **Data:** Life in Kyrgyzstan multi-topic longitudinal survey of households and individuals data for 2011
- **Result:** Evidence that there is no trade-off between child quantity and child quality among Kyrgyz households

Descriptive Data Analysis

Data Description

	Sample 1 Finished Education			Sample 2 Attending School		
	N	Mean	St. Dev.	N	Mean	St. Dev.
Number of children in family	2060	2.6368	1.299	1892	3.4291	1.2694
Child age (in 2011 in years)	2060	26.4058	7.5179	1892	12.3641	3.0854
Female	2060	0.3165	0.4652	1892	0.4841	0.4998
Child's education	2060	11.4257	2.3885			
Logarithmic Expenditure Share				1892	-3.8608	0.9509
Household head's education	2026	10.7724	2.8919	1848	11.3679	2.1968
Mother's education	1446	10.7918	2.4774	1700	11.2447	2.0315
Father's education	1455	11.0591	2.5128	1639	11.2953	2.1290
Twins	2060	0.0131	0.1137	1892	0.0126	0.1119
Average space (in months)	1601	55.6226	36.2575	1794	50.0774	27.4156
City	2060	0.3485	0.4766	1892	0.2822	0.4502

Table 1: Descriptive statistics for all children with completed education in sample 1 as well as children still attending school in sample 2 by 2011 (LiK 2011 Data).

Educational Expenditures

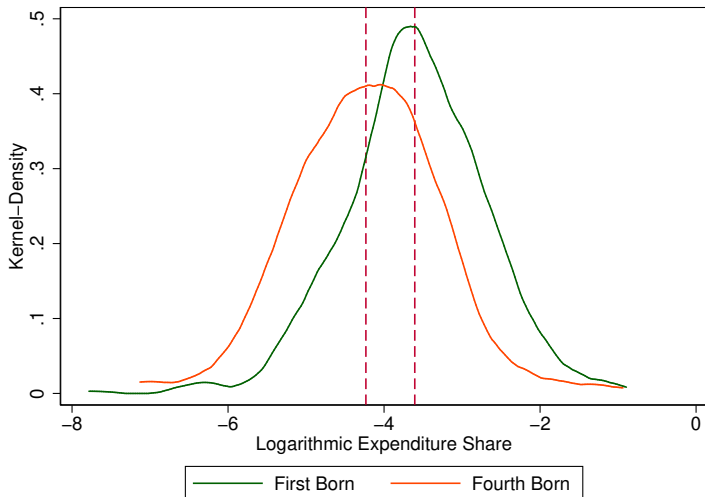


Figure 1: Kernel-Density estimate for logarithmic expenditure share for schooling

Methodology and Results

Effect of family size or birth order on educational years

$$educyears_i = \beta_0 + \beta_1 nchild_i + \beta_2 order_i + \mathbf{x}_i' \phi + u_i \quad (1)$$

- $educyears_i$: years of education for person i
- $nchild_i$: number of children in person i 's family
- $order_i$: Dummies for second-, third-, fourth-, fifth- or sixth-born child
- Vector of controls \mathbf{x}_i : education years of each parent, age, living in a city and gender

OLS-Estimation: Effect of Family Size on Child's Education

	(1)	(2)	(3)	(4)	(5)
Number of Children	-0.133*** (0.0508)	-0.0743 (0.0531)	-0.0777 (0.0562)	-0.0790 (0.0554)	-0.116** (0.0486)
Mother's education		0.197*** (0.0351)	0.198*** (0.0350)	0.179*** (0.0343)	
Father's education		0.210*** (0.0357)	0.210*** (0.0359)	0.195*** (0.0347)	
Household head's education					0.233*** (0.0248)
Second-born			-0.0142 (0.130)	-0.0142 (0.129)	-0.0526 (0.110)
Third-born			0.166 (0.197)	0.135 (0.195)	0.0643 (0.175)
Fourth-born			-0.0581 (0.253)	0.00122 (0.246)	0.0375 (0.242)
Fifth-born			-0.299 (0.441)	-0.159 (0.517)	0.0844 (0.601)
Sixth-born			-0.787*** (0.220)	-0.275 (0.254)	-0.793*** (0.202)
Observations	2,054	1,348	1,348	1,348	2,020
Adj. R-squared	0.0668	0.1969	0.1946	0.2142	0.1299

Table 2: Regressions include a constant, age and gender dummies. (4) includes dummies for ethnicity and living in a city. Standard Errors clustered on the household level in parantheses.

Methodology: OLS-Estimation (II)

Effect of family size and birth order on education expenditures

$$\log(\text{EducExpend}_i) = \beta_0 + \beta_1 nchild_i + \beta_2 order_i + \mathbf{x}'_i \phi + u_i \quad (2)$$

- $\log(\text{EducExpend}_i)$: logarithmic share of income spend on education of child i

$$\text{EducExpend}_i = \frac{\text{Yearly Investment into Education}_i}{12 \cdot \text{Total Monthly Income}_i}$$

- $order_i$: Dummies for second-, third-, fourth-, fifth- or sixth-born child

Effect of average space and birth order on education expenditures

$$\log(\text{EducExpend}_i) = \beta_0 + \beta_1 AvSpace_i + \beta_2 order_i + \mathbf{x}'_i \phi + u_i \quad (3)$$

- $AvSpace_i$: Average space between the kids in the family

OLS-Estimation: Family Size and Education Expenditures

	(1)	(2)	(3)	(4)	(5)
Number of children	-0.146*** (0.0282)	-0.0950*** (0.0337)	-0.0179 (0.0367)	-0.140*** (0.0285)	-0.0684** (0.0321)
Mother's education		0.0353* (0.0184)	0.0290 (0.0182)		
Father's education		-0.0026 (0.0156)	-0.0040 (0.0157)		
Household head's education				0.0164 (0.0131)	0.0124 (0.0132)
Second-born			-0.151*** (0.0415)		-0.160*** (0.0402)
Third-born			-0.333*** (0.0610)		-0.308*** (0.0576)
Fourth-born			-0.488*** (0.0860)		-0.461*** (0.0816)
Fifth-born			-0.700*** (0.193)		-0.585*** (0.184)
Sixth-born			-0.929** (0.454)		-0.704** (0.348)
Observations	1,875	1,592	1,592	1,831	1,831
Adj. R-squared	0.043	0.029	0.054	0.044	0.063

Table 3: Models include a constant, dummies for age and gender of the child. Standard Errors clustered on the household level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

OLS-Estimation: Average Space and Education Expenditures

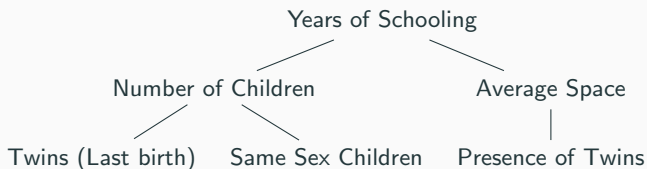
	(1)	(2)	(3)	(4)	(5)
Average Space (Months)	0.00124	0.000638	-0.000478	0.00120	0.000638
	(0.00104)	(0.00113)	(0.00109)	(0.00104)	(0.00102)
Mother's education		0.0462**	0.0164		
		(0.0185)	(0.0194)		
Father's education		-0.000795	-0.0159		
		(0.0163)	(0.0169)		
Household head's education				0.0205	0.00996
				(0.0142)	(0.0142)
Second-born			-0.159***		-0.174***
			(0.0381)		(0.0364)
Third-born			-0.355***		-0.371***
			(0.0526)		(0.0499)
Fourth-born			-0.533***		-0.573***
			(0.0764)		(0.0727)
Fifth-born			-0.805***		-0.754***
			(0.177)		(0.172)
Observations	1,777	1,540	1,540	1,734	1,734
Adj. R-squared	0.0103	0.0079	0.0701	0.0023	0.481

Table 4: Models include a constant, dummies for age and gender of the child. Standard Errors clustered on the household level in parentheses. Interpretation model (1): 2 Years average space implies approx. an increase in the share $EducExpend_i$ of 3 % c.p.

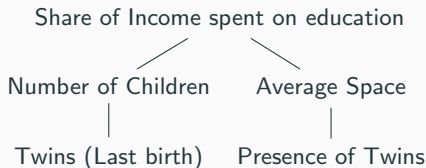
Methodology: Explaining Child-Quality using IVs

Problem: Number of children and the average space are correlated with unobservable characteristics not included in our model \Rightarrow OLS biased

Years of Schooling as the dependent variable



Share of Income spent on education as the dependent variable



For the first-born child in a household or different family sizes, we estimate the structural equation (4) using 2SLS

$$educyears_i = \beta_0 + \beta_1 \cdot nchild_i + \mathbf{x}_i' \phi + u_i \quad (4)$$

$$nchild_i = \gamma_0 + \gamma_1 Z + \mathbf{x}_i' \alpha + e_i \quad (5)$$

1. Relevance: Instrument must be correlated with the endogenous explanatory variables conditional on controls
2. Exogeneity: Instrument is uncorrelated with u_i (Angrist & Evans, 1998; Angrist et al., 2010; De Haan, 2010; Sudha, 1997)
 - Twinning is uncorrelated with factors that may determine family size or education years
 - Random gender component, sex mix preferences

IV-Estimation: Effect of Family Size on Education Years

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS		IV Twins Last Birth		IV Same Sex	
	(Parents)	(Head)	(Parents)	(Head)	(Parents)	(Head)
Number of Children	-0.145** (0.0612)	-0.159*** (0.0483)	0.402 (0.317)	0.292 (0.280)	0.967 (2.427)	0.0120 (1.214)
Mother education	0.185*** (0.0475)		0.175*** (0.0500)		0.280*** (0.0900)	
Father education	0.207*** (0.0434)		0.223*** (0.0476)		0.350** (0.173)	
Head's education		0.211*** (0.0231)		0.193*** (0.0265)		0.307*** (0.0620)
Coefficient on First Stage			2.227*** (0.47)	2.549*** (0.482)	0.082 (0.089)	0.136* (0.077)
F-Statistic			22.43	28.42	0.85	3.24
Prob > F			0.000	0.000	0.358	0.072
Observations	795	1,260	795	1,260	589	798

Table 5: Effect of family size on education years of first-born children using OLS and IV. All regressions include dummy variables for gender and parental (Parents) or household head (Head) education. SStandard Errors clustered on the household level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

IV-Estimation: Effect of Average Space on Education Years

	(1)	(2)	(3)
	Three	Four	Five
	Children	Children	Children
Average Space (in months)	-0.0037 (0.0158)	-0.167 (0.170)	0.0327 (0.0410)
Father education	0.153** (0.0607)	0.398 (0.262)	-0.0130 (0.0756)
Mother education	0.172*** (0.0534)	0.214 (0.193)	0.0318 (0.145)
Coefficient on First Stage	-39.663*** (3.7201)	-6.156** (2.5079)	-13.972*** (4.4872)
F-Statistic First Stage	113.67	6.03	9.7
Prob > F	0.0000	0.0152	0.0030
Observations	387	311	106

Table 6: Effect of the average spacing between births on education years. Results from IV estimation with twin birth instrument. All models include dummies for the age, order and the gender of the children. Standard Errors clustered on the household level in parentheses.
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

IV-Estimation: Effect of Family Size on Expenditures

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS		IV Twins Last Birth		IV Same Sex	
	(Parents)	(Head)	(Parents)	(Head)	(Parents)	(Head)
Number of Children	0.0131 (0.0366)	-0.0493 (0.0321)	-0.173 (0.129)	-0.204* (0.123)	-2.523 (2.647)	-2.674 (2.800)
Mother's education	0.0138 (0.0190)		0.0027 (0.0158)		-0.175 (0.204)	
Father's education	-0.0153 (0.0163)		-0.0125 (0.0123)		0.0359 (0.0701)	
Head's education		-0.0071 (0.0140)		-0.0088 (0.0103)		-0.0261 (0.0476)
First-Stage			1.057*** (0.179)	1.11*** (0.175)	0.071 (0.072)	0.066 (0.067)
F-Statistic			34.57	40.16	0.99	0.96
Prob > F			0.000	0.000	0.319	0.3262
Observations	1,592	1,831	1,592	1,831	1,540	1,734

Table 7: Effect of family size on share of total income spent for education of first-born children using OLS and IV. All regressions include dummy variables for gender and age as well as parental (Parents) or household head (Head) education years. Robust standard errors in parentheses. Standard Errors clustered on the household level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

IV-Estimation: Effect of Average Space on Expenditures

	(1)	(2)	(3)	(4)	(5)	(6)
	Three child family		Four child family		Five child family	
	Parents	Head	Parents	Head	Parents	Head
Average Space	0.0081 (0.0370)	0.0096 (0.0367)	0.0029 (0.0195)	0.0090 (0.0163)	0.0756 (0.0498)	0.0792* (0.0425)
First Stage	-18.728*** (7.177)	-18.278* (7.452)	-12.895*** (3.214)	-14.823*** (3.242)	-8.698 (6.719)	-9.762 (7.352)
F-Statistic	6.81	6.02	16.09	20.90	1.68	1.76
Prob > F	0.009	0.0147	0.000	0.000	0.1989	0.1873
Observations	487	544	481	519	216	232

Table 8: Instrumenting twin births for the effect of average spacing between consecutive births on the logarithmic education expenditure share. In all regressions, controls for parental education as well as dummies for age, birth order and gender are included. Standard Errors clustered on the household level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

1. Years of Completed Education

- OLS: negative effect of family size
- Twins at last birth and sex mix of the first two children as instrumental variables: number of children has no statistically significant effect on the first-born.

2. Education Expenditure Share

- OLS: negative relationship between family size and educational expenditures, no statistically significant effect of average space
- Presence of twins as IV: no statistically significant effect of average space
- Additional child does not decrease the per child spending when looking at first-borns

3. No effect of family size and average space on either finished education or educational spending, as in De Haan (2010)

Discussion and Conclusion

- Data limitations due to small sample size
 - Survey of 3,000 households leading 2060 persons with finished education and 1892 children still attending school
- Selection Bias
 - Subsample of offspring who have completed their education only persons living in their parents household \Rightarrow downward bias?
 - Urban population potentially overrepresented and females underrepresented in first sample (according to World Bank Data)
- Weak identification problem (e.g Stock & Yogo, 2005)
 - Gender mix instrument generally weak
 - Twin instrument relatively strong

- Contribution to research on Kyrgyzstan
- Evidence that there is no trade-off between child quantity and child quality among Kyrgyzstanian households
 - Parental education important for educational outcomes but the influence diminishes with growing family size
 - Future research: due to low overall education or alternative channels, e.g. network effects, remittances?
- Equality between genders in education
 - Future research: employment effects and limitations on available sectors for women (e.g. Mansfield et al., 2015)

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