Parenting, Birth Order and School Achievement

V. Joseph Hotz — Duke University
Juan Pantano — UCLA

Extended Abstract
September 21, 2007

1 Introduction and Motivation

Interest on the effects of birth order on human capital accumulation has been reinvigorated after the publication of Black, Devereux & Salvanes (2005) (BDS, from now on) who find large and robust effects of birth order on educational attainment with Scandinavian data. However, despite the convincing results, the underlying causal mechanisms generating this finding remain somewhat unknown. Indeed, BDS acknowledge:

"...One important issue remains unresolved: what is causing the birth order effects we observe in the data? Our findings are consistent with optimal stopping being a small part of the explanation. Also, the large birth order effects found for highly educated mothers, allied with the weak evidence for family size effects, suggest that financial constraints may not be that important. Although a number of other theories (including time constraints, endowment effects, and parental preferences) have been proposed in the literature, we are quite limited in our ability to distinguish between these models...."

In thinking about children's behavior it is important to remember that parents can resort to a variety a mechanisms to influence it. In particular, they can limit or grant access to important sources of utility for children. This paper advances two channels that have not been previously considered in the generating process for birth order effects in educational outcomes: we consider differential discipline schemes arising from a) the dynamics of a parental reputation mechanism and/or b) the changing constraints in the technology of punishment.

In particular, we hypothesize that altruistic parents have incentives to invest in reputation by committing to tough parenting with the earlier born in the hope of inducing their (paternalistic) preferred school effort levels by the later born.[1] Alternatively, the technology of punishment available to parents might change as children grow up . This may happen because the earlier born who was once handled alone, now interacts with later born siblings, changing the relative costs of alternative punishment schemes.

The literature on birth order effects in education in not minor. Zajonc (1976), Olneck & Bills (1979), Blake (1981), Hauser & Sewell (1985), Behrman & Taubman (1986), among others, found mixed results that provide support for a variety of birth order theories ranging from the "no-one-to-teach-hypothesis" to the theory of differential genetic endowments. However, with the strong birth order effects found in Behrman & Taubman (1986) and, more recently,

[1] See Hao, Hotz & Jin (2007) who find evidence for this hypothesis when examining birth order effects in teeangers' risky behaviors. A key insight of this paper is that birth order effects arise endogenously as the result of parent-child interactions in the reputation game as parents play tough on older children in an attempt to build a reputation that disciplines the youngest ones.

in Black, Devereux & Salvanes (2005), the literature seems to be settling on the issue of existence and moving towards consideration and sophisticated testing of alternative mechanisms. Indeed, Price (2007) finds empirical support in time use data for a modern version of dilution theory: at leas for limited time the earlier born don't have to share the available stock of parental input with other siblings whereas the later born usually enjoy more limited parental time input as parents are not able to match the increased demand for their time.[2]

2 The Data

We exploit data from the Children of NLSY79 female respondents (NLSY-C). In particular, we are able to observe the whole fertility history of NLSY79 females. So we can potentially observe all of their children. Crucially, many of these females have 2 or more children so we are able to explore birth order effects in such families. Due to limited sample sizes, however, we limit most of our analysis to families that have between 2 and 4 children.

TV watching and, more recently, video gaming are time intensive activities that usually crow-out, at least partially, the time that should be used for homework or study. Indeed, there exist a vast literature in psychology documenting the detrimental effects of TV watching on school performance. Therefore TV viewing and videogaming are natural places to look for parental discipline schemes given that children value these activities highly and parents are able to enforce and monitor restrictions on access.

Useful for our purposes, the NLSY-C has includes some detailed information on this issue. The specific question is the following. How often do(es) your parent(s)...limit the amount of time you can spend watching TV or playing videogames? Allowed answers were: a) Never, b) Rarely, c) Sometimes and d) Often.

On the other hand the NLSY-C does not have systematic information on grades except for a specific supplemental school survey fielded in 1995-96 about school years 1994-95. However, the NLSY-C includes a self- report about how the mother thinks each of her children is doing in school. The specific question is: Is your child one of the best students in class, above the middle, in the middle, below the middle, or near the bottom of the class? Note that while these self-reports can be validated with the supplemental schooling survey, it can be argued that it is the mother's subjective belief what really matters.

3 Preliminary Empirical Findings

Table 1 shows that there exists a clear association between school performance (as perceived by the mother) and birth order. Indeed, while 33% of first born are considered "one of the best in the class" only 20% of the 6th born reach such recognition. On the other hand, only 2% of first born are considered "near the bottom of the class", while 7.5% of 6th born are classified in such manner by their mothers.

[2] See Lindert (1977) for a related approach.

Table 1: Mother´s Evaluation of Child´s Academic Standing by Birth Order

	Birth Order of Child						
	1	2	3	4	5	6	Total
One of the best students in the class	33.2	30.9	28.0	25.3	25.5	20.4	31.0
Above the middle	24.9	24.3	24.5	23.1	20.0	21.5	24.5
In the middle	34.4	36.5	38.0	39.5	42.9	45.2	36.1
Below the middle	5.7	6.3	7.3	8.8	8.7	5.4	6.3
Near the bottom of the class	1.9	2.0	2.1	3.4	2.9	7.5	2.1
Total	100	100	100	100	100	100	100

More formally, I follow BDS (2005) and explore, birth order effects in academic standing by estimating the following linear model for the probability of being considered one of the best students in the class.

$$\text{BestStudent}_i = \sum_k \alpha_k \text{ Birth Order}_{ki} + X_i\beta + \varepsilon_i \quad (1)$$

where X_i includes controls for family size, child's age and year and Birth Order_{ki} is a dummy variable = 1 when respondent i is the k^{th} child born in the the family, and = 0 otherwise.

Tables 2a and 2b show the results of estimating the model in (1) for all families and the for families with 2, 3 or 4 children. All birth order coefficients are relative to the first born which is the omitted category. As can be seen in Table 2a there exist strong birth order effects in all families.

Table 2a: Effect of Birth Order on the Probability of Being One of the Best Students. OLS

	All Families[a]	2-child Families	3-child Families	4-child Families
Second Child	-0.028**	-0.021	-0.041**	-0.02
	[0.010]	[0.014]	[0.016]	[0.025]
Third Child	-0.054**		0.049***	0.073***
	[0.014]		[0.018]	[0.026]
Fourth Child	-0.089**			0.094***
	[0.026]			[0.029]
Observations	11532	4809	4433	2290

Standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

All regressions include indicators for child's age and year. [a] This specification includes family size indicators. Linear Probability Models. Dependent Variable =1 if Mother thinks child is one of the best students in the class, =0 otherwise.

Moreover, when we estimate (1) controlling for family fixed effects the birth order results hold robust. See Table 2b below.

Table 2b: Effect of Birth Order on the Probability of Being One of the Best Students. Family Fixed Effects

	All Families[a]	2-child Families	3-child Families	4-child Families
Second Child	-0.028***	-0.022*	-0.043***	-0.016
	[0.009]	[0.012]	[0.014]	[0.022]
Third Child	-0.047***		-0.047***	-0.052**
	[0.013]		[0.016]	[0.024]
Fourth Child	-0.056**			-0.056**
	[0.024]			[0.028]
Observations	11532	4809	4433	2290

Standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

All regressions include indicators for child's age and year. [a] This specification includes family size indicators. Linear Probability Models. Dependent Variable =1 if Mother thinks child is one of the best students in the class, =0 otherwise.

Next we explore at a descriptive level whether birth order effects arise because of differential parental treatment. We ask whether the data shows any sign of differential parental toughness by birth order. We estimate ordered probit models for our categorical variable on the likelihood of getting TV time limited by parents[3]

$$\text{Limit TV time}_i = \begin{cases} \text{Never} & \text{if} & & \text{Limit}_i^* & < \mu_0 \\ \text{Rarely} & \text{if} & \mu_0 < & \text{Limit}_i^* & < \mu_1 \\ \text{Sometimes} & \text{if} & \mu_1 < & \text{Limit}_i^* & < \mu_2 \\ \text{Often} & \text{if} & \mu_2 < & \text{Limit}_i^* & \end{cases} \tag{2}$$

where

$$\text{Limit}_i^* = \sum_k \gamma_k \text{Birth Order}_{ki} + \delta X_i + \varepsilon \tag{3}$$

Table 3a shows estimates from this order probit model for parental toughness.

[3] OLS and Fixed Effects estimates for models with dichotomous versions of the same dependent varible generate the same pattern of birth order effects.

Table 3b: Effect of Birth Order on the Probability of Having TV time Limited
(Ordered Probit with Family Random Effects)

	All Families[a]	2-child Families	3-child Families	4-child Families
Second Child	-0.154***	-0.177***	-0.089	-0.230**
	[0.034]	[0.046]	[0.060]	[0.107]
Third Child	-0.219***		-0.149**	-0.333***
	[0.050]		[0.068]	[0.113]
Fourth Child	-0.295***			-0.414***
	[0.088]			[0.128]
Observations	6684	2911	2518	1255

Standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Categorical Dependent Variable with 4 categories: Never, Rarely, Often, Always. All models include indicators for child's age and year. [a] This specification includes family size indicators.

Table 3a: Effect of Birth Order on the Probability of Having TV time Limited
(Ordered Probit)

	All Families[a]	2-child Families	3-child Families	4-child Families
Second Child	-0.138***	-0.151***	-0.088	-0.221**
	[0.031]	[0.041]	[0.055]	[0.098]
Third Child	-0.216***		-0.168***	-0.303***
	[0.043]		[0.058]	[0.097]
Fourth Child	-0.306***			-0.392***
	[0.075]			[0.103]
Observations	6684	2911	2518	1255

Standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Categorical Dependent Variable with 4 categories: Never, Rarely, Often, Always. All models include indicators for child's age and year. [a] This specification includes family size indicators.

As can be seen in the table, the likelihood of frequent TV limitations declines with birth order. First born tend to face stricter disciplinary standards (i.e. parents tend to be more tough/severe on them regarding TV time) . Similarly, parents seem to be increasingly lenient with later born.

Table 3b shows family random effects estimates of the same ordered model in (2).

The results are, again, strikingly similar. They support the existence of differential disciplinary schemes which are strongly linked to birth order. In ongoing work, we make an effort to account for other theories of birth order (i.e dilution) that can add to the effects arising from differential birth order discipline. Moreover, we test whether birth order effects arise from a parental reputation mechanism or they merely reflect changes in the relative costs of implementing, enforcing and monitoring a given disciplinary scheme at different times.

References

[1] Behrman & Taubman (1986) "Birth Order, Schooling & Earnings" JoLE

[2] Blake (1981) "Family size and the quality of children " Demography

[3] Hao, Hotz & Jin (2007) “Games that Parents and Adolescents Play: Risky Behavior, Parental Reputation and Strategic Transfers” , Economic Journal.

[4] Hauser & Sewell (1985) "Birth Order and Educational Attainment in Full Sibships"

[5] Kessler(1991) "Birth Order, Family Size & Achievement: Family Structure and Wage Determination", JoLE

[6] Lindert (1977) "Sibling Position and Achievement" JHR

[7] Olneck & Bills (1979) "Family Configuration and Achievement: Effects of Birth Order and Family Size in a sample of Brothers", Social Psychology Review

[8] Price (2007) "Parent-Child Quality Time: Does Birth Order Matter?" forthcoming JHR