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Birth Order Effects and Educational Achievement in the Developing World*

Abstract

Studies on the role of birth order in educational achievement in developing countries have yielded contradictory findings. This study uses unique and novel data on 4,362 siblings living in alternative care families in 54 countries. Results suggest negative birth order effects among biological siblings, implying inferior outcomes for laterborns. A second analysis offers reasons for why previous studies might have found contradictory results. Three sources of heterogeneity are surveyed. Extreme hardship, parental gender preferences, and tutoring between siblings are identified as moderators of birth order effects. The findings can inform development interventions by helping to prioritize individuals in highest need.

JEL Code: I20, J13
Keywords: Birth order, education, child outcomes, developing countries

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1. Introduction

The importance of education for individual prosperity (Hartog and Oosterbeek, 1998; Rosenzweig, 1995) and economic growth (Hanushek and Woessmann, 2015; Mankiw, Romer, and Weil, 1992) is undisputed. However, what determines educational achievement itself? There has been ongoing debate on the influence of individual determinants of educational achievement, such as individual aptitude (Rowe, Vesterdal, and Rodgers, 1998), parental attributes (Desforges and Abouchaar, 2003; Harris, 2008), teacher quality (Darling-Hammond, 2000), and their collective dynamics (Belley and Lochner, 2007; Cameron and Heckman, 2001; Heckman, Lochner, and Todd, 2006). Part of this debate centers around the impact of birth order effects. A rich body of research documents that firstborns in high-income countries tend to fare better across a range of life outcomes, like IQ, height, and all-cause mortality. Studies show that the same holds true for educational achievement. For example, Black, Devereux, and Salvanes (2005) find that secondborns receive on average four months less of education than their first-born siblings.

While the general existence of birth order effects in high-income countries is widely acknowledged, there is substantial debate over *why* birth order effects exist (Barclay and Myrskylä, 2014; Kristensen and Bjerkedal, 2007), and what might explain heterogeneity in findings in low- and middle-income countries (De Haan, Plug, and Rosero, 2014). Some studies with data from low- and middle-income countries demonstrate reversed birth order effects, that is better outcomes for later-born children. For example, evidence from South America (De Haan, Plug, and Rosero, 2014; Emerson and Souza, 2008; Lafortune and Lee, 2014) and Asia (Ejrnæs and Portner, 2004) proposes positive birth order effects, implying better educational outcomes for later-born children. As De Haan, Plug, and Rosero (2014) point out, there is a need for more evidence from low- and middle-income countries.

This study addresses these gaps in the literature by employing novel and unique data. It is the first one to provide evidence from a broad set of low- and middle-income countries across multiple continents. Overall results indicate that birth order effects in low- and middle-income countries are consistent with those in high-income countries. Higher educational achievement for firstborns is identified when estimating the relationship for the full sample. A second analysis of heterogeneity suggests reasons for why previous studies might have found contradictory results. Three sources of heterogeneity are surveyed. Extreme hardship, parental gender preferences, and tutoring between siblings are identified as moderators of birth order effects.

I use a novel dataset covering 26,898 observations of 4,362 biologically related siblings living in long-term alternative care families in 54 countries. The data are provided by a global childcare NGO which places children and young adults in alternative care families. In these families, children live together with their biological siblings, one non-biological mother and up to eight non-biological siblings.[1] Individuals living in these families have parents who passed away or who are no longer able to take care of them. This dataset is particularly valuable as it spans across several continents and permits the observation of family structures where biological and social birth order coexist.

Findings suggest that sibships that have suffered extreme economic or emotional hardship (for instance sexual abuse, domestic violence) show attenuated birth order effects compared to other sibships. This is compatible with previous evidence indicating effect diminishment and reversal for households of low socioeconomic status in high-income countries and reversed birth order effects in low- and middle-income countries. Individual hardship *within* a society seems to be as relevant as differences in development *between* societies. Gender-specific effects are identified for Asia, where the firstborn advantage is significantly smaller for girls, compared to boys, suggesting parental gender preferences. These effects are mainly driven by data from India, a country with a widespread preference for male offspring.

Intra-family comparisons of biologically unrelated children of the same biological birth order provide suggestive evidence that supports the existence of tutoring effects between unrelated siblings. Holding biological birth order constant, I find superior outcomes for older children ranked *higher* in their alternative care family. I propose more tutoring opportunities as a potential explanation. This evidence is only suggestive as large standard errors prevent statements on statistically significant differences between children of the same biological birth order. The finding is consistent with the confluence model – one possible explanation for birth order effects. The confluence model attributes birth order effects to changing dynamics of social interaction within the family; of which tutoring between children is one element.

1. The NGO takes full custody of the children admitted into villages on a long-term basis. The family-like care approach is one type of alternative care. It can be thought of as a hybrid of a foster model and adoption. It emulates a family environment. It will be referred to by the general term of alternative care.

These findings advance the debates on determinants of educational achievement and the formation of human capital in low- and middle-income countries. They also suggest reasons for how and when intra-family differences emerge. Some evidence points to the possible existence of tutoring effects. Larger (alternative care) families could particularly benefit from exploring tutoring as a way to let children grow personally and intellectually. The results can inform policy making and development interventions by helping to prioritize individuals in highest need.

The structure of the remainder of this paper is as follows. First, I will provide an overview of the related literature. I focus on existing theories to explain birth order effects and summarize previous empirical evidence, with a particular focus on low- and middle-income countries. I will then describe the data and the estimation strategy. Subsequently, I will present the results on *classic* birth order effects between biological siblings for the full sample. I will then split the sample by experience of hardship and estimate this relationship again. This will be followed by an analysis on the interaction of gender and firstborn status with a regional split. Subsequently, I will show the results of an analysis comparing biologically unrelated siblings of the same biological birth order. I will conclude by relating results to previous literature, discussing their external as well as internal validity and deriving policy implications.

2. Theory and empirical evidence on birth order effects

This section presents theories to explain birth order effects (section 2.1), empirical evidence in general (section 2.2) and findings from low- and middle-income countries in specific (section 2.2.1). An emphasis will be on studies that used samples similar to this one. Critics have challenged the existence of birth order effects and the methods employed to analyze them. A selection of their objections will be covered as well.

I will conclude that first approaches to elucidate the mixed evidence in low- and middle-income countries exist. A lack of multi-country studies and the ambiguous empirical evidence call for studies that allow to further compare outcomes across countries and elaborate on the direction of birth order effects in low- and middle-income countries (De Haan, Plug, and Rosero, 2014).

2.1. Theories to explain birth order effects

This section presents three main theories that explain why birth order effects surface: (i) resource dilution theory, (ii) confluence theory, and (iii) immunoreactive theory. (i) Resource dilution theory attributes superior outcomes for earlier-born children to the gradual dilution of parental resources with every additional child being born into the family. (ii) Confluence theory posits that within-family social dynamics are an important factor to explain birth order effects. Throughout their lives, firstborns are exposed to an environment of higher average intellectual maturity, compared to later-borns. (iii) Immunoreactive theory attributes these effects to biological causes, namely mothers' biological reactions to the male fetus. It is important to note that these three theories could hold true in parallel: the verification of one will not falsify the other.

(i) Resource dilution theory. Resource dilution theory is based on the assumption that parents' resources, such as attention and financial means, are divided among children living in a household. Hence, they dilute with every additional child.[2] The firstborn will benefit from access to the highest average amount of resources (Blake, 1981; Downey, 2001). This effect is amplified by the fact that investments during early childhood are expected to be more productive than investments later on in life (Cunha and Heckman, 2009). Based on American Time Use Survey data, Price (2008) finds that first-born children experience 20 to 30 minutes of average additional quality time per day compared to secondborns at the same age in similar families due to an equal split of parental time amongst siblings. Also, active discrimination by parents can augment birth order effects (Findings will be presented in the empirical literature review, section 2.2.1). Downey (2001) propose that a strong argument in favor of resource dilution theory is the low likelihood of the null hypothesis being true. It appears unlikely that neither parental resources nor the number of siblings in a household carries any impact on a child's development.

(ii) Confluence theory. The confluence model is based on the conceptualization of the family as an intellectual environment that follows complex dynamics. It has been first described by Zajonc and Markus (1975). The model is based on the assumption that the child's intellectual development is partly driven by the dynamics of its social environment's average intellectual maturity. The authors argue that firstborns benefit, all other things equal, from a household age which is on average higher compared

2. This alludes to Becker and Lewis (1973), who described the quality vs. quantity trade-off that parents are facing regarding their offspring.

to that of younger siblings. Siblings are understood as important peers, and child development is analyzed on the grounds of this peer structure and changes thereof. Moreover, older siblings are expected to benefit from a tutoring effect, namely by reinforcing their skills via teaching them to younger siblings. An important aspect is that this firstborn advantage is dynamic and not a linear function of birth order. As such, it depends on the individual's and their siblings' age. The model suggests a positive association between birth order and achievement from a crossover age of 11 +/-2 onwards (Zajonc and Mullally, 1997; Zajonc and Sulloway, 2007). The crossover age describes the age at which earlier-born siblings start to particularly benefit from tutoring their later-born siblings, resulting in more pronounced negative birth order effects. The authors propose that this also explains conflicting findings in other studies dependent on the respective sample's average age. An additional dimension associated with variation in effect sizes is that of age spacing between siblings (Zajonc, 1976). Confluence theory has received substantial criticism. Galbraith (1982) point out that the model is unable to explain observed birth order effects in French data. For confluence theory to explain birth order effects, spacing would be required to be substantially longer than it is in reality. Furthermore, Galbraith (1982) posit that the model is not able to explain the finding that in France, positive birth order effects (improved outcomes for later siblings) occur in conjunction with negative family size effects (worse outcomes for larger families). Retherford and Sewell (1991) show that the confluence model provides a poor fit if within-family data is used (as opposed to between-family estimation) – a finding seconded by others (Rodgers, 1984; Wichman, Rodgers, and Maccallum, 2006).[3]

(iii) Immunoreactive theory. The final and third type of explanation for birth order effects is based on immunoreactive theory (IMRT) (Gualtieri and Hicks, 1985). Immunoreactive theory hypothesizes that maternal antibody reactions grow stronger with increasing birth order. The authors argue that the male fetus with its particular, *male* genetic attributes causes maternal antibody attacks on the fetal brain. These, in turn, affect male fitness negatively. The reactions are expected to grow stronger for later-born male children with the female body *learning* from the first male fetus and developing stronger anti-body attacks over time. Findings of Kristensen and Bjerkedal (2007) and Barclay (2015) cast doubt on whether biological explanations in general and IMRT-based approaches in specific help to explain birth order effects. In their landmark study, Kristensen and Bjerkedal (2007) show that second-born men whose

3. Retherford and Sewell (1991) are also not able to replicate the findings with a between-family estimation and a representative sample for the United States of America.

biologically older brothers passed away before reaching the age of one resemble firstborns in their achievements. The argument is that the passing of their older brothers renders them biological secondborns but social firstborns.

Apart from theory-specific criticism, birth order research has been subject to general objections that question the validity of employed research methods to study birth order effects. *Spurious association theories* attribute IQ related birth order effects to the analysis of between-family data (Kanazawa, 2012). However, as shown by Sulloway (2007), these theories are unable to provide explanations for various phenomena, such as the observable distinction between biological and functional causes of birth order effects (Kristensen and Bjerkedal, 2007) or the role of age spacing in explaining birth order differences (Buckles and Munnich, 2012). Another objection is based on the observation that the decision to receive a second child is not independent of the outcome of the first pregnancy. This endogenous relationship could serve as an alternative explanation for the firstborn advantage (Ejrnæs and Portner, 2004). However, Bagger et al. (2013) and Black, Devereux, and Salvanes (2010) use instruments to account for endogeneity in fertility decision-making and show that birth order effects are robust to this specification.

In light of the findings by Kristensen and Bjerkedal (2007), I consider two theories as possible explanations for birth order effects in the context of this sample: resource dilution theory and confluence theory.

2.2. Empirical evidence on birth order effects

In the following, I provide a selection of studies that have particular relevance to this one, focusing on studies associating differences in educational achievement with birth order effects. Furthermore, I will summarize findings of studies that employ data that share peculiarities comparable to this sample, namely a non-biological family setting, above average sibship size, and a low- and middle-income country environment. I do not discuss criticism of empirical birth order effects research in-depth. Schooler (1972), Galbraith (1982), and Kanazawa (2012) offer some of the main arguments that have been brought forward by critics.

Ability and educational achievement in biological families. Belmont and Marolla (1973), Black, Devereux, and Salvanes (2011), Calimeris and Peters (2017), and Kristensen and Bjerkedal (2007) explore the relationship between birth order, ability and educational achievement. Black, Devereux, and Salvanes (2011) estimate the IQs of first-born children to be three percent higher than those of second-born children. Confirming evidence has been recognized in regard to negative educational outcomes for higher birth order ranks (Barclay, 2015; Black, Devereux, and Salvanes, 2005; Haan, 2010; Kantarevic and Mechoulan, 2006). This has been established for biological siblings (Black, Devereux, and Salvanes, 2005; Härkönen, 2014) and adoptive sibship groups alike (Barclay, 2015).

Ability and educational achievement in alternative care families. In their study on children growing up with adoptive parents, Björklund, Lindahl, and Plug (2006) argue that both adoptive and biological families carry features that are important for outcomes but that the influence of biological and adoptive parents varies by type of the observed determinant (for instance parental education, gender, income). Beckett et al. (2006) and Lindblad, Hjern, and Vinnerljung (2003) associate positive cognitive development with an earlier child age at adoption. While Hjern, Lindblad, and Vinnerljung (2002) identify substantial differences in psychosocial life outcomes of adopted children compared to non-adopted children, Barclay (2015) can replicate birth order effects in alternative care families living in Sweden. Finally, there is an overlap between adoption studies and studies on peer effects because sibling interactions in large sibship groups are comparable to peer interactions.[4] Scholars have been able to show that the behavior, societal background and educational performance of peers can change individual attainment in both directions (Ammermueller and Pischke, 2009; Sacerdote, 2014). Sacerdote (2011) estimates the influence of peers on par with other important determinants, such as class size (Biddle and Berliner, 2002) or teacher quality (Darling-Hammond, 2000). While most peer research focuses on classmates, similar effects have also been estimated for cohorts living in close-knit settings comparable to SOS Children's Villages (Carrell, Fullerton, and West, 2009).

Sibship size and spacing. Multiple studies find sibship size to be negatively associated with educational attainment (Black, Devereux, and Salvanes, 2010; Blake, 1981). Rodgers et al. (2000) were the first to show that large families do not imply lower ability per se. Black, Devereux, and Salvanes (2005) found that educational attainment gaps between larger and smaller families disappeared once birth order effects were taken into account. According to the authors, it is fertility decisions of

4. In SOS Children's Villages, children are exposed to biologically unrelated siblings inside their new family's house and other children living in the same village but in separate houses. Both groups form a peer environment.

low socioeconomic status parents that cause mediocre outcomes for larger families, ceteris paribus. However, the same authors found mixed evidence in a later publication (Black, Devereux, and Salvanes, 2010). Other scholars find a reversal (Davis, Cahan, and Bashi, 1977) or total disappearance of birth order effects (Kanazawa, 2012) if family size is considered. Building on confluence theory, Zajonc and Mullally (1997) predict a reversal of effects between first and secondborns at a turnover age of 11 +/- 2 years, and for final life outcomes, a persistent advantage for firstborns and a persistent disadvantage for lastborns, irrespective of sibship size.

Controlling for sibship size, the spacing of siblings continues to provide a potential force influencing birth order effects. Zajonc (1976) predicts varying birth order effects dependent on age spacing of siblings – with a generally positive association of individual outcomes and spacing. Buckles and Munnich (2012) find a positive effect of spacing on older siblings only. The evidence remains mixed as other studies propose a null effect of spacing (Belmont, Stein, and Zybert, 1978; Black, Devereux, and Salvanes, 2010).

2.2.1. Birth order effects in low- and middle-income countries and low-income families in high-income countries

Evidence in low- and middle-income countries is heterogeneous (Mechoulan and Wolff, 2015). Studies from South America (De Haan, Plug, and Rosero, 2014; Emerson and Souza, 2008; Lafortune and Lee, 2014) and Asia (Ejrnæs and Portner, 2004) find positive birth order effects, suggesting better educational outcomes for later-born children. Conversely, Moshoeshoe (2016), Hammitt, Liu, and Tsou (2012) and Calimeris and Peters (2017) find negative birth order effects in Lesotho, Taiwan and Indonesia respectively.

Amongst others, three potential explanations exist for these ambiguous findings: variation in family resources, child labor and parental discrimination/selective investment or a combination thereof. All three factors differ regarding their total and relative levels in low- and middle-income countries compared to high-income countries. Moshoeshoe (2016) proposes family wealth as a determinant of within-country variation of birth order effects in low- and middle-income countries. Lafortune and Lee (2014) find that positive birth order effects are attenuated by increasing family assets in Mexico. In low- and middle-income countries, wealth can be thought of as a proxy for the necessity to send earlier-born children off to work early, potentially leading to their sub-par educational achievement. Where present, child labor effects confirm this hypothesis. Emerson and Souza (2008) attribute positive birth order effects in low- and middle-income countries to higher rates of child labor among earlier-born children. According to Emerson and Souza (2008) and Edmonds (2006), earlier-born children tend to engage more in child labor compared to their younger siblings and receive less education in consequence.

Besides child labor and wealth, variation in parental investments will moderate birth order effects, leading to birth order variation by country and culture. Jayachandran and Kuziemko (2011) show that mothers in India engage in shorter breastfeeding spells if the first-born child is female. The authors offer cultural gender preferences as an explanation. This has been confirmed by Fors and Lindskog (2017), who find negative birth order effects in India and inferior outcomes for first-born girls compared to first-born boys. So do Lafortune and Lee (2014) for South Korea. Ejrnæs and Portner (2004) treat fertility decisions as endogenous and find positive birth order effects on the Philippines. Multiple authors document other forms of discrimination. Mechoulan and Wolff (2015) observe parental discrimination with respect to the allocation of financial resources and gifts. Hotz and Pantano (2015) find weaker sanctioning towards later-born siblings, who do not meet the expectations of their parents. De Haan, Plug, and Rosero (2014) document less parental quality time for earlier-born children in Ecuador.

The first study that has used multi-country data from low- and middle-income countries is that of Tenikue and Verheyden (2010).[5] The authors explore wealth and child labor as potential explanations for birth order patterns. However, their data do not indicate whether any young adults have left the household already. Arguably, this threatens the identification of birth order effects. Moshoeshoe (2016) shows how this factor is likely to bias results.

In high-income countries, multiple studies confirmed that low-income families tend to show the most pronounced positive birth order effects, implying better outcomes for later-born siblings (De Haan, Plug, and Rosero, 2014; Lafortune and Lee, 2014). For families with low income in high-income countries, Bonesrønning and Massih (2011) and Lafortune and Lee (2014) find smaller and reversed birth order effects. In South Korea, the US and Mexico, Lafortune and Lee (2014) document more years of educa-

5. Lafortune and Lee (2014) use a multi-country dataset from one middle-income country (Mexico) and two high-income countries (South Korea and the United States of America).

tion for firstborns in families with higher educated fathers, while the opposite holds true for families with fathers without formal education. Bonesrønning and Massih (2011) find some evidence for more pronounced birth order effects in families with highly educated mothers.

3. Empirical strategy

3.1. Data

The data are provided by SOS Children's Villages, an international NGO. The NGO operates as a federation with national organizations in 133 territories and headquarters in Innsbruck, Austria. Its budget exceeded one billion US Dollars in 2015. Individual donors, corporations as well as governments and other institutions are the main funders. The NGO runs two main childcare programs in addition to a multitude of services along the themes of education, health care, and emergency response.

The two care programs combined serve a total of 553,600 beneficiaries worldwide (SOS Children's Villages International, 2016). The larger program by the number of beneficiaries is the *family strengthening program* with 467,400 beneficiaries. It provides interventions to improve childcare and prevent the breakdown of biological families. The second program, called *family based care* provides care to 86,200 beneficiaries who have lost parental care or whose parents are no longer able to take care of them. Children live in so-called villages. Their educational achievement is the subject of this study.

Before admission, the organization determines a child's need for alternative care by means of a standardized process. Children are admitted on the grounds of four potential reasons for admission: loss of either one or both parents, the inability of caregivers to take care, the referral from another care placement or child abandonment. Table 16 in the appendix displays the share of each reason for admission by region. After a positive admission decision, SOS admits children to a village, where they will become part of a family.

Families typically consist of one caregiver and up to ten children. The vast majority of caregivers is female and working full time for SOS Children's Villages in the functional equivalent of a biological mother. Assignment to a specific family depends on child-mother interaction during an initial trial period. Importantly, biological siblings are never split up between two families. About ten families form one village. Villages provide additional infrastructures such as schools, sports facilities, and the village's head office. Whether children have access to a school on site varies by location. Once children are grown up and self-sustaining, they will move out, and new children enter the family.

Data for this study are obtained from a central program database which provides data for the vast majority of all children living in SOS Children's Villages in low- and middle-income countries. Data are collected at village level monthly. A committee of social workers, head of the village and other representatives of the respective national organization is responsible for the collection of data, and for tracking educational achievement. Commonly, data collection is paper-based with subsequent data entry into a computer. Alternative care mothers can provide input, but a committee makes the final decision on performance.[6]

The data provide the following information on all individuals: A codified surname and first name, an individual's gender and date of birth, their reason and date of admission. Besides, detailed reason for admission is available for some *reasons for admission.* The database offers information on the house, village, and home country of an individual. Educational performance is tracked on a scale from one to four, where four is a good outcome. The variable will be described in more detail in the next section. Appendix section A provides the exact wording. According to related literature, it will be referred to by *educational achievement.* For caregivers, full names are available. The study is based on panel data obtained from collection cycles from September 2014 through September 2016. For this timespan, data is retrieved at the end of each quarter. Applying all exclusion restrictions results in 26,898 observations, from 4,362 individuals, living in 54 countries. The motivation to use multiple observations per person is that the primary independent variable of interest (biological birth order) is time-invariant and secondly, that multiple outcome observations increase statistical power.

All figures presented in the following refer to the sample after application of exclusion restrictions. Appendix table 14 provides a detailed overview of the number of observations per country, and grading distributions within countries after application of exclusion restrictions. The average age of children in the sample is 12 with a standard deviation of 3.5 years. The final sample contains a slightly higher percentage of female children (52 percent). On average, children have been admitted at the age of 6.4 with a standard deviation of 3.1 years. The highest number of observations included in the sample is Asian (17,577), followed by children from Latin America (5,121) and Africa (4,200).

6. Not all villages can offer a full committee. In these cases, a social worker will carry out data collection and data entry.

The average number of children analyzed per biological sibship is 2.4 (SD = 0.7). The equivalent figure for alternative care sibships is 9.5 (SD = 2.2). On average, children have spent 46 percent of their life in SOS care.[7] Further descriptive statistics for first-, second-, and thirdborns with a split by region can be found in appendix tables 8, 9, 10 respectively. Unfortunately, the data do not provide further parental background information, that goes beyond the child's reason for admission. Parental information such as employment status or age would be desirable.

Table 1: Descriptive statistics for children by birth order rank

	Firstborns		Secondborns		Third- or higherborns		Full sample	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Outcome variable:								
Educational achievement	3.02	0.73	3.02	0.72	3.07	0.71	3.03	0.73
Individual characteristics:								
Age	13.65	3.17	11.16	3.12	9.75	2.76	12.02	3.46
Age at entry	7.77	3.06	5.54	2.75	4.54	2.46	6.35	3.13
Gender = female	0.56	0.50	0.48	0.50	0.51	0.50	0.52	0.50
No. bio. siblings	2.30	0.57	2.30	0.57	3.22	0.42	2.44	0.66
No. all siblings	9.50	2.17	9.50	2.17	9.61	2.18	9.52	2.17
Lifeshare spent in SOS care	0.42	0.22	0.49	0.24	0.52	0.25	0.46	0.23
Reason for admission:								
Abandonment	0.13	0.34	0.14	0.35	0.13	0.34	0.14	0.34
Death of parents	0.63	0.48	0.63	0.48	0.63	0.48	0.63	0.48
Referral	0.02	0.14	0.02	0.13	0.02	0.13	0.02	0.14
Inability caregiver	0.22	0.41	0.21	0.41	0.22	0.41	0.21	0.41
Observations	11,693		11,693		2,871		26,898	

Notes: Data describes final sample after application of sampling restrictions (see appendix); Variable definitions: Age at entry = age at which the child has been admitted; Gender = Variable that is one for girls and zero for boys; No. siblings bio. only = number of biological siblings; No. all siblings = number of all siblings in alternative care family; Lifeshare spent in SOS care = Number of years in SOS alternative care divided by age; Referral = referral from another care placement; Inability caregiver = inability of caregiver to take care of child.

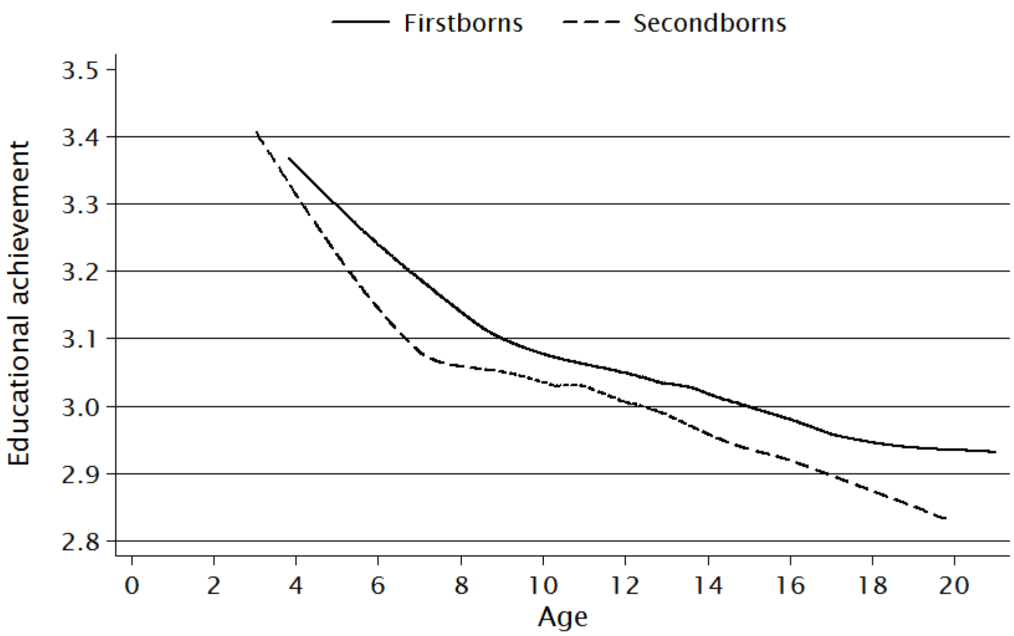
Siblings are assigned to biological sibships based on the codified identifier that the database operator assigned per surname per household. The accuracy of the matching of identified sibships is assured through several quality checks. First, the date of entry and reason for admission must be identical across all siblings. If both variables are not identical across the sibship, all those sibships are excluded, who either carry the same surname as their caregiver or that show contradicting reasons for admission within a sibship. Individuals who share a surname with their caregiver are excluded because abandoned children and those who were referred from another care placement

7. The percentage figure refers to time since admission to any village divided by age.

are sometimes given the name of their primary SOS caregiver. This leads to a shared surname amongst non-biological siblings. The process for the exclusion of all cases of contradicting reasons for admission is further detailed in appendix section B.

Figure 1 displays the central relationship of interest analyzed in this paper. The figure shows the average educational achievement of children based on age and split by birth order rank. Firstborns show consistently higher average educational achievement by age than secondborns.

Figure 1: Lowess smoothing of educational achievement vs. age for first- and secondborns



Notes: **Dependent variable:** average educational achievement by age; Lowess smoothing.

3.2. Models

Estimation of baseline model. In the *baseline model*, educational achievement is regressed on a biological birth order vector and a set of controls. A pooled OLS estimation approach is used with biological sibship dummies and controls for individual, biological sibship and alternative care family features as shown in baseline equation 1. (Results based on cross section estimations are presented in the appendix.)

$$Edu_{i,j,k,t} = \beta_0 + \beta_1 BIRTHORDER_i + \gamma_j + \delta_t + \beta_2 X_i + \beta_3 XT_{i,t} + \rho_1 AltCareFam_{k,t} + \varepsilon_{i,t} \tag{1}$$

The dependent variable $Edu_{i,j,k,t}$ is the educational achievement of child i in sibship j in alternative care family k at time t. The variable can take on four possible values from 1 to 4, where 4 is good. The grading scheme uses the four values to indicate poor, below average, satisfactory and outstanding performance respectively. The appendix section A presents the exact wording of all four values.

The birth order vector $BIRTHORDER_i$ contains the variables of interest and includes birth order dummies for all birth order ranks but the first one, which is omitted. For sibships of three siblings, this vector contains dummies for being second-born and being third-born. For estimations of biological families of more than three members, this includes dummies for being second-born and being third-born or of higher rank.

γ_j is a biological sibship dummy for sibship j that is time-invariant and captures unobserved biological family characteristics. To account for potential grading trends over time, I introduce time dummies, denoted by δ_t for each quarter. The vector X_i accounts for an individual's time-invariant attributes: gender and reason for admission, while $XT_{i,t}$ denotes time-variant attributes: age and relative lifeshare spent inside SOS care. Age is coded with a vector of dummies containing one dummy for each possible age from 3 through 21. Lifeshare spent in SOS is calculated as the number of years in SOS alternative care divided by age. Finally, the $AltCareFam_{k,t}$ variable denotes the number of children in an individual's alternative care family, both biologically related and unrelated. The baseline model will be estimated for all biological sibship groups of $N < 5$ members. An alternative specification will estimate it for sibship pairs of $N = 2$. Standard errors are clustered on the level of the individual in all models to account for the serial correlation of errors within an individual over time.

In addition to the baseline model, I estimate two derivative models to study heterogeneity in birth order effects. The first model divides the full sample by experience of economic or emotional hardship. The second model introduces a gender interaction effect and divides the sample by region. In a third derivative model, I estimate a factorial family model that predicts the relationship between biologically unrelated siblings.

Estimation of hardship model. The hardship model is based on the baseline model equation (1). I split the sample by experience of extreme hardship. The main question to answer is whether birth order effects persist for children who have suffered extreme hardship. While all children in this sample have suffered some form of hardship, some children have experienced extreme hardship. I assess this experience of extreme hardship based on the *detailed reason for admission* that has been provided for the majority of children upon admission.[8] The list of all detailed reasons for admission is presented in appendix table 17.

Two dummies indicate extreme economic and extreme emotional hardship respectively. Experience of extreme hardship is coded as 0 by default in both cases.[9] If the detailed reason of admission is indicative of either type of hardship, the respective hardship dummy (economic or emotional) is coded as 1. For the model, the sample is first divided into children who have experienced extreme hardship during their childhood and those who have not according to the detailed reason for admission. The group without extreme hardship experience is divided into children whose parents passed away and all others. For the group with extreme hardship experience, I run three models. The first model includes all children with emotional hardship experience. The second model includes all children with economic hardship experience. The third model includes all children with either of the two types of experience. Importantly, children can have suffered both economic and emotional hardship.

Estimation of gender split model. The gender split model is based on the baseline model equation (1). It additionally interacts gender with being first-born. I estimate it for the full sample and by region. The regional breakdown is motivated by previous literature finding a strong preference for male offspring in Asia in general and India in

8. The general reason for admission groups are mutually exclusive, that is children will belong to either of six groups. The detailed reasons are not. There can be multiple detailed reasons for admission.

9. The default coding of 0 is based on the hypothesis that a missing *detailed reason for admission* value indicates that another reason for admission other than the stated one is not given. One might argue that a missing value is a missing assessment rather than the absence of hardship. In appendix table 25 an alternative coding that codes all missing values as missing and drops these observations is presented.

specific.

Estimation of the factorial family model. The third derivative model is used to study educational achievement differences of biologically unrelated siblings, who are living together in alternative care families. Specifically, I investigate whether it matters to be the first, second or third oldest child of a specific biological birth order rank in an alternative care family. This is coded via tuples that identify a children's position in their biological and alternative care family.

I identify all potential positions of an individual within both its initial, biological and its new, alternative care family with the tuple (b,a). The first tuple entry (b) is equivalent to an individual's biological birth order rank. This biological birth order rank reflects an individual's position in its initial, biological family before admission to alternative care. All biologically first-born children in the sample are assigned (1,a), all secondborns are assigned (2,a), and all individuals with biological birth order rank three or higher are assigned (3,a). The second tuple entry (a) reflects an individual's relative position in an alternative care family, given its biological birth order rank. There are multiple biologically firstborns in an alternative care family, as there are multiple secondborns, and so forth. Tuple entry (a) denotes the rank of an individual *within* their alternative care family, *within* the group of children of the same biological birth order rank. Hence, the oldest biologically firstborn in an alternative care family is assigned rank 1, resulting in the tuple (1,1). The second oldest biologically firstborn is assigned rank (1,2). All biologically firstborns who are younger than the second oldest biologically firstborn are assigned rank (1,3).

Assume that there is a small alternative care family with four children {X,x,Y,y}. Within this family, {X,x} and {Y,y} form two biological sibships. The age structure of {X,x,Y,y} in years is assumed to be {20,15,10,5} respectively. X will be assigned tuple (1,1) for being biologically firstborn and being the oldest firstborn in its alternative care family. Individual x is assigned (2,1) for being a biological secondborn but being the oldest one in its alternative care family. Y is assigned tuple (1,2), and y is assigned (2,2). As both tuple values (b) and (a) can take on values from 1 to 3 only, this leads to 9 potential factorial combinations ranging from (1,1) to (3,3). Indicator vector $DTUPLE_{i,t}$ contains one dummy for each of these combinations as shown in equation 2.

$$DTUPLE_i = BioBirthorderRank_i * AlternativeCareFamilyRank_{i,t} \quad (2)$$

This indicator vector substitutes the former birth order vector in the baseline model equation 1, resulting in model equation 3. Importantly, I still control for age and employ biological sibship dummies. This implies that β_1 absorbs only the effect of relative rank within an alternative care family.

$$Edu_{i,j,k,t} = \beta_0 + \beta_1 DTUPLE_{i,t} + \gamma_j + \delta_t + \beta_2 X_i + \beta_3 XT_{i,t} + \rho_1 AltCareFam_{k,t} + \varepsilon_{i,t} \quad (3)$$

4. Results

4.1. Results of the baseline model: Birth order effects between biological siblings

Table 2 shows this study's baseline results. The estimates suggest the existence of negative birth order effects, implying lower educational achievement of secondborns and laterborns. Educational achievement is regressed on biological birth order, a set of controls and biological sibship dummies with a pooled OLS model. Standard errors are clustered at the level of the individual.

The minimum control model is shown in column (1). It estimates birth order effects with a gender dummy, time dummies, and age dummies only. Its estimate of birth order effects is only significant at the 10 percent level. Column (2) shows the baseline model results with full controls. The effect size in this baseline model indicates a decrease in achievement of 2.4 percent from first- to secondborns.[10] Column (3) replicates this for sibling pairs and excludes all sibships of more than two siblings. Being second-born is further associated with a slightly higher achievement compared to being later-born. However, this difference is not statistically significant at the five percent level in itself.

Across all models, age is negatively associated with educational achievement. The age dummies are not presented for the sake of brevity.[11] Female children outperform male children, ceteris paribus. The results impute no association of the number of non-biological siblings in alternative care families with educational achievement per se. The reason for admission is not found to influence later educational achievement in the overall sample. The insignificance of the reason for admission dummies is expected as the reason for admission rarely varies between siblings.[12] There is no statistically significant evidence at the five percent level for the association between the percentage of one's lifetime spent in SOS alternative care and educational achievement.

10. This figure is calculated by the effect size of -0.079 and the baseline of 3.2 in average educational achievement (This baseline value of 3.2 applies to the youngest children at the age of three and is lower for older individuals. It is calculated by dividing the effect size by the baseline value.)

11. Figure 1 presents the negative relationship between age and education.

12. Due to the employment of sibship dummies, the *reason for admission* dummies only capture within-sibship variance.

Table 2: Baseline model: birth order effects between biological siblings

	(1) Baseline model with minimum controls	(2) Baseline model with full controls	(3) Limited baseline model: sibling pairs full controls
Secondborn	-0.051*	-0.079***	-0.096***
	(0.027)	(0.021)	(0.026)
Thirdborn or higher	-0.005	-0.091**	
	(0.040)	(0.041)	
Gender = female	0.104***	0.138***	0.119***
	(0.024)	(0.020)	(0.023)
No. all siblings		-0.003	-0.000
		(0.003)	(0.003)
Lifeshare spent in SOS care		0.158*	0.183*
		(0.090)	(0.111)
Abandonment		0.087	0.139*
		(0.060)	(0.072)
Death of parents		0.103*	0.014
		(0.059)	(0.069)
Referral		-0.034	0.033
		(0.115)	(0.148)
Constant	3.433***	3.233***	3.206***
	(0.131)	(0.158)	(0.185)
Sibship dummies		✓	✓
Time dummies	✓	✓	✓
Age dummies	✓	✓	✓
Observations	26,898	26,898	17,644
$Adj.R^2$	0.016	0.66	0.70
Clusters	4362	4362	2963
Standard errors clustered at individual level	Yes	Yes	Yes

Notes: **Dependent variable:** Educational achievement; **Baseline group:** firstborn male children; Sibship dummies; Minimum controls defined as control for sibship dummies, quarter dummies and age dummies only; Robust standard errors in parentheses are clustered at individual level; ***/**/* indicate significance at the 1%/5%/10% level.

4.2. Hardship model and gender split model: Sources of heterogeneity in birth order effects

4.2.1. Results of the hardship model

Table 3 shows the baseline model results split by the experience of hardship. I find no birth order effects for sibships, who experienced extreme emotional or economic hardship before admission, irrespective of whether their parents passed away or not. Within the subsample without hardship experience, I find birth order effects in both subsamples. Birth order effects are robust and of comparable magnitude for individuals who have experienced parental death (column (1)) and those who have been admitted on other grounds than parental death (column (2)).

I do not find significant birth order effects for the groups with hardship experience (columns (3) through (5)) with the exception of thirdborns who have suffered from emotional hardship. The general absence of birth order effects persists when splitting the model into subregions, as displayed in appendix table 24.

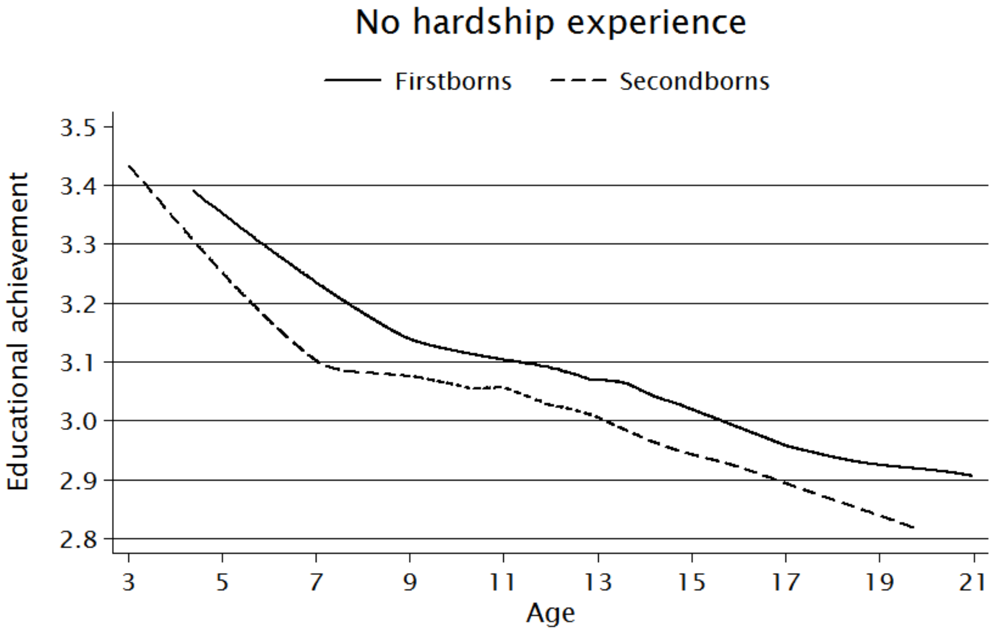
The heterogeneity in birth order effects based on hardship is also supported by the descriptive data displayed in Lowess graphs in figure 2. Both figures display the educational achievement of first- and secondborns by age. Birth order effects are more evident in this depiction of raw data for those siblings who have not suffered extreme hardship (top graph) than it is for children who have suffered hardship (bottom graph).

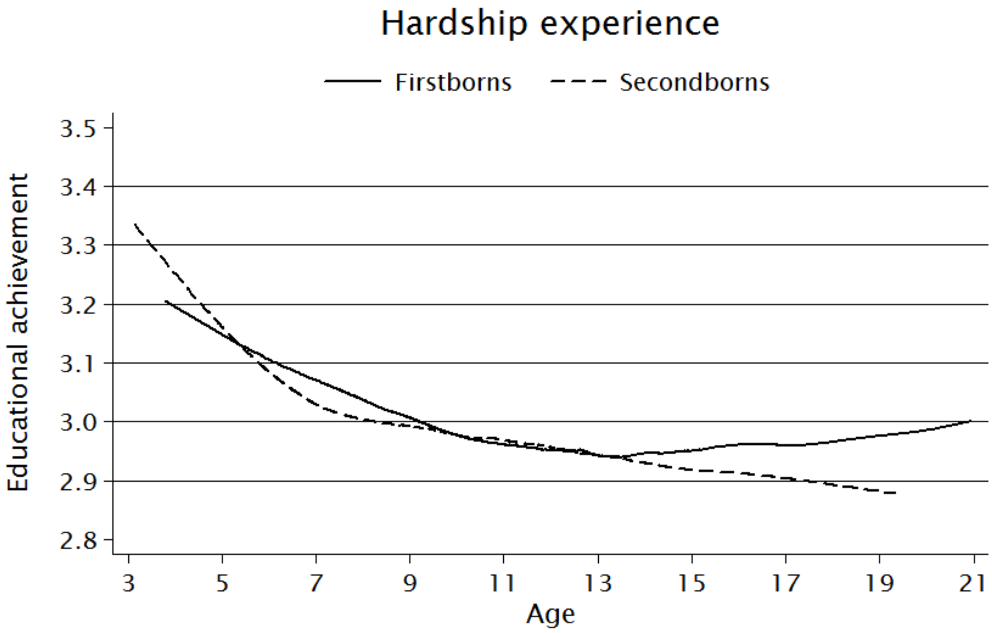
Table 3: Hardship model: baseline model split by experience of hardship

	No extreme hardship		Extreme hardship		
	(1)	(2)	(3)	(4)	(5)
	Parental death	Other reasons	Financial	Emotional	Financial and emotional
Secondborn	-0.091***	-0.091**	0.012	-0.075	-0.030
	(0.032)	(0.046)	(0.052)	(0.050)	(0.037)
Thirdborn or higher	-0.148**	-0.019	0.073	-0.179**	-0.063
	(0.061)	(0.083)	(0.108)	(0.088)	(0.071)
Gender	0.092***	0.107***	0.125**	0.255***	0.216***
	(0.030)	(0.038)	(0.056)	(0.048)	(0.038)
No. all siblings	-0.003	-0.007	0.006	-0.005	-0.002
	(0.004)	(0.007)	(0.006)	(0.007)	(0.005)
Lifeshare spent in SOS care	0.004	0.463**	0.275	-0.210	0.065
	(0.132)	(0.181)	(0.242)	(0.247)	(0.183)
Constant	3.807***	3.053***	1.679**	3.888***	3.588***
	(0.338)	(0.256)	(0.692)	(0.325)	(0.324)
Sibship dummies, time dummies, age dummies	✓	✓	✓	✓	✓
Reason for admission dummies	✓	✓	✓	✓	✓
Observations	13,273	5,665	3,701	4,642	7,960
$Adj.R^2$	0.68	0.71	0.75	0.67	0.70
Clusters	2000	965	601	855	1404
Standard errors clustered at individual level	Yes	Yes	Yes	Yes	Yes

Notes: **Dependent variable:** educational achievement; **Baseline group:** firstborn male children; Sibship dummies; Robust standard errors in parentheses are clustered at individual level; ***/**/* indicate significance at the 1%/5%/10% level.

Figure 2: Children without and with hardship experience: Lowess smoothing of educational achievement vs. age for first- and secondborns





Dependent variable: average educational achievement by age; Top graph: individuals without experience of extreme hardship only; Bottom graph: individuals with experience of personal hardship only; Lowess smoothing.

4.2.2. Results of the gender split model

Table 4 reports the results of a gender-specific birth order effect estimation. Based on the baseline estimation, I introduce an additional dummy interacting birth order and gender. The reference group is being a male secondborn. I find that the achievement gap between firstborns and secondborns is attenuated for girls (see column (1) of table 4). The regional split shows that Asia drives the moderate global effect (see table 4, columns (2) through (4)). First-born girls in Asia exhibit a mitigation of their *firstborn advantage*. Within Asia, this mitigation is entirely attributable to India and Nepal, as shown in the appendix table 26. In India and Nepal, the full firstborn advantage is revoked for women.

Table 4: Gender split model: baseline model with gender interaction term

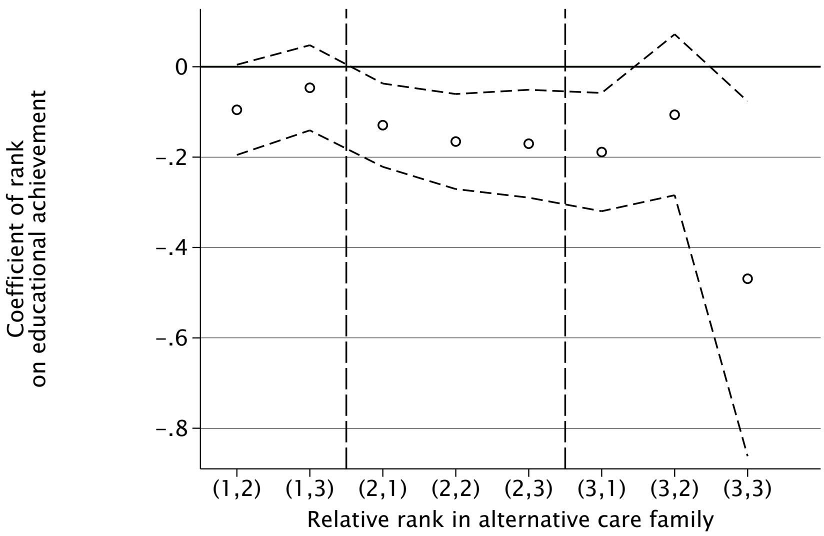
	(1) Full sample	(2) Africa	(3) Latin America	(4) Asia
Firstborn=1	0.121***	0.010	0.111*	0.144***
	(0.026)	(0.069)	(0.062)	(0.032)
Gender = female=1	0.174***	0.144**	0.240***	0.152***
	(0.025)	(0.062)	(0.053)	(0.031)
Firstborn=1 X Gender = female=1	-0.086***	-0.128	-0.053	-0.098**
	(0.033)	(0.082)	(0.077)	(0.041)
Thirdborn	-0.016	-0.025	-0.066	0.006
	(0.028)	(0.072)	(0.064)	(0.035)
Constant	3.405***	3.593***	3.658***	2.165***
	(0.273)	(0.409)	(0.359)	(0.686)
Sibship dummies, time dummies, age dummies	✓	✓	✓	✓
Reason for admission dummies and lifeshare spent in SOS	✓	✓	✓	✓
Observations	26,898	4,200	5,121	17,577
$Adj.R^2$	0.66	0.68	0.56	0.66
Clusters	4362	706	915	2741
Standard errors clustered at individual level	Yes	Yes	Yes	Yes

Notes: **Dependent variable:** educational achievement; **Baseline group:** secondborn male children; Sibship dummies; Robust standard errors in parentheses are clustered at individual level; ***/**/* indicate significance at the 1%/5%/10% level.

4.2.3. Results of the factorial family model

I assess differences between children of the same biological birth order based on their relative rank in their alternative care family via a pooled OLS model. Figure 3 summarizes the results. The figure shows the coefficients of the indicator vector describing the relative position within a non-biological alternative care family. The shown data are for sibships without the experience of extreme hardship only (This omission is based on the insight that this group does not show birth order effects). Appendix table 5 presents the estimates shown in figure 3 and for the full sample, including individuals with hardship experience (The effects are smaller if one includes these children). I do not find differences that are statistically significant at the 5 percent level between children who are of the same biological rank but differ in their alternative care family rank. While large standard errors, also due to splitting the sample into nine subgroups, prevent effect estimation of differences within the biological birth order rank groups, figure 3 reveals a pattern which hints at the fact that relative alternative care family rank might play a role in educational achievement.

Figure 3: Factorial family model: On the importance of the relative rank in the alternative care family



Notes: **Dependent variable:** educational achievement; **Baseline group:** male children of alternative care family relative rank (1,1); Alternative care family relative rank: Holding biological birth order rank position constant, position in alternative care family based on age. (1,1) is the oldest biological firstborn of an alternative care family, (1,2) is the second oldest biological firstborn and so forth; Alternative care family dummies; Robust standard errors are clustered at individual level; Lines indicate 95 percent confidence interval.

The omitted baseline group is composed of firstborns, who are the oldest firstborn in their alternative care family (assigned tuple (1,1)). Controlling for age, they are expected to perform better than the second oldest biologically firstborn (1,2). However, this effect is only statistically significant at the 10 percent level. Biologically firstborns are expected to perform better than any of the secondborns. Estimates indicate that biological secondborns benefit from ranking higher in their alternative care family, too. Compared to the baseline firstborn, the penalty for being the oldest secondborn is smaller than the one of the third oldest secondborn. Again, the difference between biologically secondborns is not statistically significant. The lowest performing children are those with a biological birth order rank of three or higher, who also come third or later in their alternative care family amongst children of the same biological birth order (3,3). This relationship holds true although the youngest children tend to show the highest achievement.

5. Robustness checks and validity

5.1. Robustness checks

The main birth order results predicting negative birth order effects as shown in table 2 are robust to different choices of dummies on country or family level and the removal of all dummies (see appendix table 21). I find more pronounced effects for Latin America and Asia when splitting the baseline model by region (see appendix table 18). As shown in the regional breakdown, results are not driven by an individual country alone (see appendix tables 19 and 20). The baseline model specification is also robust to the estimation of single periods as shown in appendix tables 22 and 23. For the hardship model, results are also robust to a split by region (see appendix table 24). Furthermore, I estimate the hardship model in a specification that excludes all individuals with missing information regarding their *detailed reason for admission.* The main finding with respect to the absence of birth order effects amongst children who have experienced hardship remains unaffected by definition. Birth order effects for individuals without hardship experience remain partially unaffected (see appendix table 25).[13]

13. This is likely be driven by a loss of observations. Particularly children who have lost both parents often have no information regarding the detailed reason for admission. This is expected as the loss of two parents justifies an admission without further explanation of experience of hardship.

5.2. Internal and external validity

Internal validity. The endogeneity of fertility decision making poses a challenge to birth order research in general, whenever it is not possible to instrument for fertility decisions. However, the robustness of birth order effects in light of endogeneity has already been shown by Bagger et al. (2013) and Black, Devereux, and Salvanes (2010). Moreover, the results of this study also hold true for different sibship size subsets, such as sibling pairs (see column three of table 2). The factorial family model shown in table 3 remains unaffected as well, since alternative care siblings' features are statistically independent of biological parents' fertility decisions.

I match siblings based on a codified last name. This method could bias birth order effects downwards. It might exclude *real* biological siblings for example due to differently spelled names and hence differently codified last names. These false negative cases would reduce the sample size. Bias would arise if false negative cases exhibited birth order effects that were systematically different from correctly identified sibships. For this to hold true, one would need to assume an unlikely association between false rejection of a sibship and their (unmeasured) birth order effect size. Meanwhile, the opposite scenario of a false positive scenario is more likely and expected to downward bias the effects: children who by chance carry the same last name are not expected to exhibit any birth order effects and will downward bias the estimation. I use quality control checks to exclude these cases. These are described in appendix section B.

A final bias threatening internal validity could arise from non-random patterns in reporting of achievement data. For a considerable share of all children, achievement data has not been reported. These individuals have not been included in this analysis. For results to be unbiased, one needs to assume that a lack of reporting is independent from a child's performance *relative* to its siblings. This assumption seems to be reasonable, in particular as the provision of educational achievement data varies rather at village than at individual level.

External validity. The external validity of this study depends on whether this sample can be considered representative of its underlying population or, alternatively, whether deviations from population averages will bias results. Björklund, Lindahl, and Plug (2004) provide a framework to assess the external validity of studies that employ data from adoptive settings. While this study's setting is different from an adoptive context, it shares important characteristics: non-biological caregivers, non-biological siblings and a change of the care context from the child's perspective. Björklund, Lindahl, and Plug (2004) argue that three assumptions need to hold true to work with adoption data and to extrapolate findings to biological sibships: (i) Children need to be as good as randomly assigned to their adoptive families, (ii) they need to be adopted early on in their lives and one needs to assume that (iii) studies on adoptive child-parent relationships can be extrapolated to biological child-parent relationships (This last assumption is based on the hypothesis of non-differential treatment of adoptees by adoptive parents as well as the general similarity of individuals in adoptive settings vs. non-adoptive settings concerning unobserved traits). I discuss whether the assumptions (i) through (iii) are met by this study in appendix section E.4. I conclude that the sample's traits can downward bias effect sizes but will not lead to a reversal in the effect sign.

6. Discussion

Baseline model, gender model, and hardship model. This study is the first one to deliver cross-continental evidence for birth order effects on educational achievement in low- and middle-income countries. I propose individual hardship and parental gender preference as two explanations for previously documented heterogeneity in findings. This within-sample heterogeneity relates the findings to the mixed-picture found in previous studies using data from low- and middle-income countries. The effect size for the baseline model is comparable to previous research. For example, Black, Devereux, and Salvanes (2011) document IQ differences of around 3 points between firstborns and secondborns.

Children who have been exposed to higher degrees of adversity prior to admission to a village show mitigated and potentially reversed birth order effects. A lack of resources in the case of economic hardship and the presence of adversity in the case of emotional hardship provide two explanations.[14] The relevance of hardship experience, and thereby absence of parental resources, ties in with previous literature documenting the role of parental education in high-income countries (Lafortune and Lee, 2014). This finding supports the resource dilution hypothesis by showing that the absence of

14. The absence of child labor within alternative care is expected to dampen effects partially. Previous studies show that the existence of child labor typically disfavors earlier born children. The parental anticipation of earlier born children engaging in child labor in the future can create this disadvantage already previous to the oldest sibling engaging in child labor. The absence of child labor in villages is hence expected to disperse this effect partially compared to settings with child labor.

parental resources can lead to a mitigation of birth order effects.

The second source of heterogeneity is that of cultural gender preferences. A birth order effect model with gender interaction, as shown in Table 4, recommends gender as a far-reaching determinant concerning the development of differences between children based on birth order. The disproportionately high share of female children amongst abandoned children in Asia supports the hypothesis of a male preference.[15] Less pronounced birth order effects for female children accord with studies in countries with a preference for male offspring (Jayachandran and Kuziemko, 2011; Fors and Lindskog, 2017).

Factorial family model. This study provides novel insight into interactions of children within non-biological families. The factorial family model suggests that besides birth order, children benefit from having younger siblings in their biologically unrelated family. In this sample's setting, later- and last-born children receive more tutoring opportunities than they would in their biological families. This alludes to existing explanations that propose tutoring opportunities as one driver of the advantageous intellectual development of firstborns (Zajonc, 2001; Zajonc, Markus, and Markus, 1979; Zajonc and Markus, 1975). The estimates in table 3 imply a sizable advantage for being in a higher alternative care family rank if biologically later-born. The pattern is only suggestive as the standard errors do not allow to make statements on statistically significant differences. However, I argue that the most likely reason for this pattern is the interaction between children within their alternative care families, with tutoring as a suggested mechanism, as proposed in confluence theory. Eskreis-Winkler, Fishbach, and Duckworth (n.d., in press) show that troubled children, who are asked to motivate others, benefit from mentoring. In a randomized trial setting, the motivation of struggling children to do homework increased more than those of troubled peers that received expert advise. The authors propose that it is a higher self-confidence that leads to higher accomplishment.

The interaction between biologically unrelated siblings is expected to benefit older siblings disproportionately. Exclusion of other potential influences suggests this mechanism. Prenatal factors and postnatal differences in biological parental resource dilution cannot account for the observed patterns. Biological parents can discriminate

15. In the overall sample, 52 percent of all children are female. The equivalent figure for abandoned children is 52 percent as well. In Asia, 53 percent of all children are female, whereas 56 percent of all abandoned children are female.

between their *own* children before admission but are not in a position to intervene in the period following admission. Selection-based explanations would imply that the parents of older biological sibship groups are systematically different from those of younger ones. I find the relative share of *lifetime spent inside SOS Children's Villages' care* to be statistically insignificant at the five percent level.[16] If older cohorts differed systematically, the share of a child's life spent inside SOS care should capture this effect. So should age control variables.

Discriminatory behavior by the alternative care mother is highly unlikely, too. Theoretically, deliberate discriminatory behavior could induce these differences. If alternative care mothers were actively discriminating in favor of the respective oldest firstborn of a sibship cohort, the relative lifeshare spent inside alternative care should capture this effect. However, it is insignificant throughout all models. Another factor rendering this unlikely is the admission process itself. The alternative care mother is experiencing a *flow* of children over time as younger siblings enter the family while older siblings leave it. The oldest sibling of an alternative care family hence used to be amongst its youngest. The *social* role of being alternative care family firstborn is consequently temporary and developing over time. If being older was beneficial per se, one would find age to have a positive sign and effect on grades – as opposed to its current negative sign. And, if having more siblings was beneficial, one would find the variable reflecting the number of total alternative care family siblings to be significant.

Policy implications. This study provides insight into the educational achievement of vulnerable children in low- and middle-income countries who are without parental care or at risk of losing it. This group is the target of many local and global development programs and policies.

Results carry particular significance for families living in a context which is comparable to the one of SOS Children's Villages. This applies for example to children living with relatives or non-kin families (foster care, youth facilities, and boarding schools) and young asylum seekers/unaccompanied minors who are living in group homes. The suggested interaction between biologically unrelated siblings via tutoring requires acknowledgment by policymakers. Eskreis-Winkler, Fishbach, and Duckworth (n.d., in press) documents the effectiveness of such tutoring interventions.

16. Definition of lifeshare spent in SOS care: Lifetime share spent inside a village divided by the age of an individual.

Acknowledging sources of relative achievement differences within families is important for two reasons. First, building on this and other studies, policymakers will be able to better identify family members in highest need for intervention. Secondly, knowledge about the mechanics at work can inform the type of necessary intervention.

7. Conclusion

This study contributes to the debate on the formation of human capital and determinants of educational achievement in low- and middle-income countries. It does so by drawing from a dataset from three continents. The findings suggest strong heterogeneity in human capital formation, with economic and emotional hardship, parental gender preferences and sibling interaction as mediating factors.

This study also contributes to the on-going theoretical dispute on the relevance of tutoring effects to explain birth order effects. The results can inform policy interventions by identifying the most vulnerable members of families and describing the drivers of the development of within-family differences. Tutoring is pointed out as a potentially under-appreciated mediator of personal growth. While these findings advance the discussion, more multi-country evidence is needed to understand the mediators of birth order effects more profoundly.

References

Ammermueller, Andreas, and Jörn-Steffen Pischke. 2009. "Peer effects in European primary schools: evidence from PIRLS." *Journal of Labor Economics* 27 (3): 315–348.

Bagger, Jesper, Javier A. Birchenall, Hani Mansour, and Sergio Urzúa. 2013. "Education, Birth Order, and Family Size." *IZA Discussion Paper Series* 7454.

Barclay, Kieron J. 2015. "Birth order and educational attainment: Evidence from fully adopted sibling groups." *Intelligence* 48:109–122.

Barclay, Kieron J., and Mikko Myrskylä. 2014. "Birth order and physical fitness in early adulthood: Evidence from Swedish military conscription data." *Social Science and Medicine* 123:141–148.

Becker, Gary S., and H. Gregg Lewis. 1973. "On the Interaction between the Quantity and Quality of Children." *Journal of Political Economy* 81 (2 (Part 2: New Economic Approaches to Fertility)): S279–S288.

Beckett, Celia, Barbara Maughan, Michael Rutter, Jenny Castle, Emma Colvert, Christine Groothues, Jana Kreppner, Suzanne Stevens, Thomas G. O'Connor, and Edmund J. S. Sonuga-barke. 2006. "Do the Effects of Early Severe Deprivation on Cognition Persist Into Early Adolescence? Findings From the English and Romanian Adoptees Study." *Child Development* 77 (3): 696–711.

Belley, Philippe, and Lance Lochner. 2007. "The Changing Role of Family Income and Ability in Determining Educational Achievement." *Journal of Human Capital* 1 (1): 37–89.

Belmont, Lillian, and Francis A. Marolla. 1973. "Birth Order, Family Size, and Intelligence." *Science* 182 (117): 1096–1101.

Belmont, Lillian, Zena Stein, and Patricia Zybert. 1978. "Child spacing and birth order: effect on intellectual ability in two-child families." *Science* 202 (4371): 995–996.

Biddle, Bruce J., and David C. Berliner. 2002. "Small class size and its effects." *Educational Leadership* 59 (5): 12–23.

Björklund, Anders, Mikael Lindahl, and Erik Plug. 2004. "Intergenerational Effects in Sweden : What Can We Learn from Adoption Data?" *IZA Discussion Paper Series* 1194.

Björklund, Anders, Mikael Lindahl, and Erik Plug. 2006. "The Origins of Intergenerational Associations: Lessons from Swedish Adoption Data." *The Quarterly Journal of Economics* 121 (3): 999–1028.

Black, Sandra E., Paul J. Devereux, and Kjell G. Salvanes. 2005. "The More the Merrier? The Effect of Family Size and Birth Order on Children's Education." *The Quarterly Journal of Economics* 120 (2): 669–700.

———. 2010. "Small Family, Smart Family?: Family Size and the IQ Scores of Young Men." *The Journal of Human Resources* 45 (1): 33–58.

———. 2011. "Older and wiser? Birth order and IQ of young men." *CESifo Economic Studies* 57 (1): 103–120.

Blake, Judith. 1981. "Family Size and the Quality of Children." *Demography* 18 (4): 421–442.

Bonesrønning, Hans, and Sofia Sandgren Massih. 2011. "Birth order effects on young students' academic achievement." *Journal of Socio-Economics* 40 (6): 824–832.

Buckles, Kasey S., and Elizabeth L. Munnich. 2012. "Birth Spacing and Sibling Outcomes." *The Journal of Human Resources* 47 (3): 613–642.

Calimeris, Lauren, and Christina Peters. 2017. "Food for thought: the birth order effect and resource allocation in Indonesia." *Applied Economics* 49 (54): 1–12.

Cameron, Stephen V., and James J. Heckman. 2001. "The Dynamics of Educational Attainment for Black, Hispanic, and White Males." *Journal of Political Economy* 109 (3): 455–499.

Carrell, Scott E., Richard L. Fullerton, and James E. West. 2009. "Does Your Cohort Matter? Measuring Peer Effects in College Achievement." *Journal of Labor Economics* 27 (3): 439–464.

Cunha, F., and James J. Heckman. 2009. "The Economics and Psychology of Inequality and Human Development." *Journal of the European Economic Association* 7 (2-3): 320–364.

Darling-Hammond, Linda. 2000. "Teacher Quality and Student Achievement: A Review of State Policy Evidence Previous Research." *Education* 8 (1): 1–44.

Davis, Daniel J., Sorel Cahan Cahan, and Joseph Bashi. 1977. "Birth order and intellectual development: the confluence model in the light of cross-cultural evidence." *Science* 196 (4297): 1470–14722.

De Haan, Monique, Erik Plug, and Jose Rosero. 2014. "Birth Order and Human Capital Development: Evidence from Ecuador." *The Journal of Human Resources* 49 (2): 359–392.

Desforges, Charles, and Alberto Abouchaar. 2003. *The impact of parental involvement , parental support and family education on pupil achievements and adjustment: A literature review.* Vol. 433. Nottingham: DfES publications.

Downey, Douglas B. 2001. "Number of Siblings and Intellectual Development: The Resource Dilution Explanation." *American Psychologist* 56 (6/7): 497–504.

Edmonds, Eric V. 2006. "Understanding in child labor sibling differences." *Journal of Population Economics* 19 (2006): 795–821.

Ejrnæs, Mette, and Claus C. Portner. 2004. "Birth Order and the Intrahousehold Allocation of Time." *Review of Economics and Statistics* 86 (4): 1008–1019.

Emerson, Patrick M., and André Portela Souza. 2008. "Birth Order, Child Labor, and School Attendance in Brazil." *World Development* 36 (9): 1647–1664.

Eskreis-Winkler, Lauren, Ayelet Fishbach, and Angela Duckworth. n.d. "Dear Abby: Should I Give Advice or Receive it?" *Psychological Science* in press.

Fors, Heather Congdon, and Annika Lindskog. 2017. "Within-Family Inequalities in Human Capital Accumulation in India: Birth Order and Gender Effects." *University of Gothenburg - Working Paper in Economics* 700.

Galbraith, Richard C. 1982. "Sibling spacing and intellectual development: A closer look at the confluence models." *Developmental Psychology* 18 (2): 151–173.

Gualtieri, Thomas, and Robert E. Hicks. 1985. "An immunoreactive theory of selective male affliction." *Behavioral and Brain Sciences* 8 (3): 427–441.

Haan, M *de.* 2010. "Birth order, family size and educational attainment." *Economics of Education Review* 29 (4): 576–588.

Hammitt, James, Jin-Tan Liu, and Meng-Wen Tsou. 2012. "The intergenerational transmission of education: Evidence from Taiwanese adoptions." *Economics Letters* 115 (1): 134–136.

Hanushek, Eric A., and Ludger Woessmann. 2015. *The Knowledge Capital of Nations: Education and the Economics of Growth.* Cambridge, MA: CES ifo Book Series, The MIT Press.

Härkönen, Juho. 2014. "Birth order effects on educational attainment and educational transitions in West Germany." *European Sociological Review* 30 (2): 166–179.

Harris, Alma. 2008. "Do parents know they matter? Engaging all parents in learning." *Educational Research* 5 (3): 37–41.

Hartog, Joop, and Hessel Oosterbeek. 1998. "Health, wealth and happiness: why pursue a higher education?" *Economics of Education Review* 17 (3): 245–256.

Heckman, James J., Lance J. Lochner, and Petra E. Todd. 2006. "Earnings Functions, Rates of Return and Treatment Effects: The Mincer Equation and Beyond." Chap. 7 in *Handbook of the Economics of Education,* edited by Eric A. Hanushek and Finis Welch, 1:307–458. St. Louis, MO: Elsevier.

Hjern, Anders, Frank Lindblad, and Bo Vinnerljung. 2002. "Suicide, psychiatric illness, and social maladjustment in intercountry adoptees in Sweden: a cohort study." *The Lancet* 360 (9331): 443–448.

Hotz, V Joseph, and Juan Pantano. 2015. "Strategic Parenting, Birth Order and School Performance." *Journal of Population Economics* 28 (4): 911–936.

Jayachandran, Seema, and Ilyana Kuziemko. 2011. "Why Do Mothers Breastfeed Girls Less than Boys? Evidence and Implications for Child Health in India." *The Quarterly Journal of Economics* 126 (3): 1485–1538.

Kanazawa, Satoshi. 2012. "Intelligence, Birth Order, and Family Size." *Personality and Social Psychology Bulletin* 38 (9): 1157–1164.

Kantarevic, Jasmin, and Stéphane Mechoulan. 2006. "Birth Order , Educational Attainment , and Earnings: An Investigation Using the PSID." *The Journal of Human Resources* 41 (4): 755–777.

Kristensen, Petter, and Tor Bjerkedal. 2007. "Explaining the relation between birth order and intelligence." *Science* 316 (5832): 1717.

Lafortune, Jeanne, and Soohyung Lee. 2014. "All for One? Family Size and Children's Educational Distribution Under Credit Constraints." *American Economic Review: Papers and Proceedings* 104 (5): 365–369.

Lindblad, Frank, Anders Hjern, and Bo Vinnerljung. 2003. "Intercountry Adopted Children as Young Adults – A Swedish Cohort Study." *American Journal of Orthopopsychiatry* 73 (2): 190–202.

Mankiw, Gregory, David Romer, and David N Weil. 1992. "A Contribution to the Empirics of Economic Growth." *The Quarterly Journal of Economics* 107 (2): 407–437.

Mechoulan, Stéphane, and François Charles Wolff. 2015. "Intra-household allocation of family resources and birth order: evidence from France using siblings data." *Journal of Population Economics* 28 (4): 937–964.

Moshoeshoe, Ramaele. 2016. "Birth Order Effects on Educational Attainment and Child Labour: Evidence from Lesotho." *ERSA Working Paper* 621.

Price, Joseph. 2008. "Parent-Child Quality Time: Does Birth Order Matter?" *The Journal of Human Resources* 43 (1): 240–265.

Retherford, Robert D., and William H. Sewell. 1991. "Birth Order and Intelligence: Further Tests of the Confluence Model." *American Sociological Review* 56 (2): 141–158.

Rodgers, Joseph Lee. 1984. "Confluence Effects: Not Here, Not Now!" *Developmental Psychology* 20 (2): 321–31.

Rodgers, Joseph Lee, Hobart Cleveland, Edwin *van den* Oord, and David C. Rowe. 2000. "Resolving the debate over birth order, family size, and intelligence." *The American Psychologist* 55 (6): 599–612.

Rosenzweig, Mark R. 1995. "Why are there returns to schooling?" *American Economic Review* 85 (2): 153–158.

Rowe, David C., Wendy J. Vesterdal, and Joseph L. Rodgers. 1998. "Herrnstein's syllogism: genetic and shared environmental influences on IQ, education, and income." *Intelligence* 26 (4): 405–423.

Sacerdote, Bruce. 2011. "Peer Effects in Education: How Might They Work, How Big Are They and How Much Do We Know Thus Far?" Chap. 4 in *Handbook of the Economics of Education,* edited by Eric A. Hanushek, Stephen Machin, and Ludger Woessmann, 3:249–277. St. Louis, MO: Elsevier.

———. 2014. "Experimental and Quasi-Experimental Analysis of Peer Effects: Two Steps Forward?" *Annual Review of Economics* 6 (1): 253–272.

Schooler, Carmi. 1972. "Birth order effects: Not here, not now!" *Psychological Bulletin* 78 (3): 161–175.

SOS Children's Villages International. 2016. *International Annual Report 2015.* Vienna, Austria. Accessed September 4, 2018. https://issuu.com/soschildrensvillagesinternational/docs/sos%7B%5C_%7Dchildrens%7B%5C_%7Dvillages%7B%5C_%7Dinternationa.

Sulloway, Frank J. 2007. “Birth Order and Intelligence.” *Science* 316 (5832): 1711–1712.

Tenikue, Michel, and Bertrand Verheyden. 2010. “Birth order and schooling: Theory and evidence from twelve Sub-Saharan countries.” *Journal of African Economies* 19 (4): 459–495.

Wichman, Aaron L., Joseph Lee Rodgers, and Robert C. Maccallum. 2006. “A Multilevel Approach to the Relationship Between Birth Order and Intelligence.” *Personality and Social Psychology Bulletin* 32 (1): 117–127.

York, Travis T., Charles Gibson, and Susan Rankin. 2015. “Defining and Measuring Academic Success.” *Practical Assessment, Research & Evaluation* 20 (5): 1–20.

Zajonc, Robert B. 1976. “Family configuration and intelligence.” *Science* 192 (4236): 227–236.

———. 2001. “The family Dynamics of Intellectual Development.” *American Psychologist* 56 (6/7): 490–496.

Zajonc, Robert B., and Gregory B. Markus. 1975. “Birth order and intellectual development.” *Psychological Review* 82 (1): 74–88.

Zajonc, Robert B., Hazel Markus, and Gregory B. Markus. 1979. “The Birth Order Puzzle.” *Journal of Personality and Social Psychology* 37 (8): 1325–1341.

Zajonc, Robert B., and Patricia R. Mullally. 1997. “Birth order: Reconciling conflicting effects.” *American Psychologist* 52 (7): 685–699.

Zajonc, Robert B., and Frank J. Sulloway. 2007. “The confluence model: birth order as a within-family or between-family dynamic?” *Personality & Social Psychology Bulletin* 33 (9): 1187–94.

A. Coding of variables

Educational achievement scale

In the database, the main outcome variable is named educational performance. To align with the terminology used in the previous literature, I use the term educational achievement, when referring to educational outcomes in this study. This is done because the description of the raw data fits the definition of educational achievement by York, Gibson, and Rankin (2015).

The scale is reversed from the original scaling in the raw data to offer a more intuitive interpretation.

4 = Outstanding performance=Child is learning very well, and progressing as expected by caregivers, teachers, and other leaders.

3 = Satisfactory performance=Child is learning well, but caregivers, teachers, or other leaders have a few concerns about progress.

2 = Below average performance=Child is learning and progressing poorly or is falling behind.

1 =Poor performance=Child has serious problems with learning.

Note: The scale for South America consists of five instead of only four potential outcomes. The two highest ones are merged based on their wording. Their joint share among all remaining four outcomes is comparable to the other two continents.

B. Sampling restrictions

General sampling restrictions. Applying all of the following sampling restrictions reduces the sample size of 53,907 individuals to 4,362 individuals, which I then observe over time. Besides, four countries are excluded.

On country-level, I exclude all countries that show double-peaked grading patterns in educational achievement, that is distributions with the two most common grades being separated by another grade. Local, cultural understanding of grading is expected to be different from the rest of the sample. China, Costa Rica, Ecuador, and Honduras have grading curves with two peaks. For example, China has 67 percent of individuals ranked on the highest and best grade, 5 percent ranked on the second highest grade and then again 17 percent on the third highest grade and 12 percent on the lowest grade (sample average is 25, 54, 19, 2 percent respectively). This informs the notion that in these countries, all lower grades are rather considered to be a punishment than grading on a continuous curve. Baseline model results are not reported but robust to including these countries.[17]

On alternative care family level, I exclude SOS families with either more than 15 or less than two alternative care siblings. The reason for doing so is to find a compromise between including the largest number of *regular families* and excluding so-called Youth Facilities, which are run by SOS but do not operate a traditional alternative care family model.

On biological sibship level, I only include sibships with less than five members. I run alternative specifications for sibship groups with two members. This is done to prevent false identification of non-biological siblings that have been assigned a *placeholder* name that is not the name of the primary caregiver.

On an individual level, I drop a full biological sibship if one of its individuals is bound by any of the following individual-level restrictions. I use a wide age frame of three to 21 years to assure inclusion of all individuals who are receiving schooling. I exclude only children as they are out of focus for birth order analysis. Also, all multiple birth siblings (for example twins) are omitted for the reason that their development is expected to be different from single-birth children with the same birth order rank

17. The baseline model run on those countries only shows significant birth order effects for thirdborns, but not for secondborns.

(see Barclay (2015)). I exclude all observations with missing education or age data within the sibship as both are key for all models. To assure accurate identification of biological firstborns, all individuals with siblings outside of SOS Children's Villages care are omitted.

Process for the exclusion of individuals based on conflicting reasons for admission within a sibship. I conduct a quality check on all children who have contradicting reason for admission. If individuals of a sibship differ concerning their reason for admission, this can be a sign of false positive identification on the grounds of a shared surname within an alternative care family. A conflict is assumed in two cases. The first case is given if at least one sibling of an identified sibship is registered as a half-orphan without mother and another sibling of the same sibship is registered as a half-orphan without a father. As both reasons cannot hold true in parallel, all individuals for which this case applies are excluded. The second case is given if the following sequence of events is given. The earliest admitted child of a sibship enters a village on the grounds of loss of both parents. Later, siblings with the same name enter the same family due to loss of only one parent. These statements cannot hold true in parallel in this specific sequence and thus are excluded.

C. Auxiliary tables

Table 5 displays the factorial family model estimation results. The last specification in column 3 is used for the graph in figure 3 in the main part of this essay.

Table 5: Factorial family model: Relative rank in alternative care family and educational achievement

	(1) Minimum control	(2) Baseline controls	(3) Baseline controls no hardship only
(1,2) Bio. Rank 1, AC Family Relative Rank 2	-0.056 (0.041)	-0.047 (0.041)	-0.095* (0.051)
(1,3) Bio. Rank 1, AC Family Relative Rank 3	-0.052 (0.039)	-0.050 (0.038)	-0.046 (0.048)
(2,1) Bio. Rank 2, AC Family Relative Rank 1	-0.110*** (0.039)	-0.103*** (0.039)	-0.129*** (0.047)
(2,2) Bio. Rank 2, AC Family Relative Rank 2	-0.151*** (0.044)	-0.146*** (0.043)	-0.165*** (0.054)
(2,3) Bio. Rank 2, AC Family Relative Rank 3	-0.154*** (0.050)	-0.145*** (0.050)	-0.170*** (0.061)
(3,1) Bio. Rank 3, AC Family Relative Rank 1	-0.150*** (0.055)	-0.152*** (0.055)	-0.189*** (0.067)
(3,2) Bio. Rank 3, AC Family Relative Rank 2	-0.089 (0.068)	-0.079 (0.069)	-0.106 (0.091)
(3,3) Bio. Rank 3, AC Family Relative Rank 3	-0.379** (0.178)	-0.437** (0.192)	-0.469** (0.200)
Time dummies	✓	✓	✓
Age dummies	✓	✓	✓
Sibship dummies	✓	✓	✓
Baseline model controls		✓	✓
Reason for admission dummies		✓	✓
Observations	26,898	26,898	18,938
Adj.R^2	0.65	0.66	0.67
Clusters	4362	4362	2958
Standard errors clustered at individual level	Yes	Yes	Yes

Notes: **Dependent variable:** educational achievement; **Baseline group:** male children of alternative care family relative rank (1,1); Alternative care family relative rank: given the biological birth order rank, position in alternative care family based on age. (1,1) is the oldest biological firstborn of an alternative care family, (1,2) is the second oldest biological firstborn et cetera; Sibship dummies = biological sibship dummies; Minimum controls defined as the control for sibship dummies, quarter dummies, and age dummies only; Robust standard errors in parentheses are clustered at individual level; ***/**/* indicate significance at the 1%/5%/10% level.

D. Descriptive statistics

The vast majority of children (90 percent) is between seven and 18 years old. The largest age group are the 11 to 13-year-olds (compare table 6). Table 7 presents a cross tabulation of biological birth order and the relative alternative care family rank within the biological birth order. The fact that there are many cases of biologically firstborns falling into the last category (3) of alternative care family rank is attributable to singletons. The relative position within a family is coded before I exclude children that, eg do not have any biological siblings in SOS care.

D.1. Age distribution and birth order ranks statistics

Table 6: Number of observations by age

	Overview N	Rel. share in percent	Cum. share in percent
3	28	0.1	0.1
4	196	0.7	0.8
5	412	1.5	2.4
6	744	2.8	5.1
7	1,225	4.6	9.7
8	1,787	6.6	16.3
9	2,304	8.6	24.9
10	2,667	9.9	34.8
11	2,832	10.5	45.3
12	2,817	10.5	55.8
13	2,806	10.4	66.2
14	2,487	9.2	75.5
15	1,968	7.3	82.8
16	1,626	6.0	88.9
17	1,263	4.7	93.5
18	884	3.3	96.8
19	511	1.9	98.7
20	273	1.0	99.7
21	68	0.3	100.0
Observations	26,898		

Table 7: Overview birth order ranks
and relative alternative care family ranks

	Relative alternative care family rank within biological birth order			
	1	2	3	Total
Biological birth order				
1	1,821	2,139	7,733	11,693
2	5,180	4,288	2,225	11,693
3	2,823	659	30	3,512
Observations	9,824	7,086	9,988	26,898

D.2. Descriptive statistics by birth order rank and region

Table 8: Descriptive statistics for first-born children

	Attributes of firstborns			
	Africa mean	Latin America mean	Asia mean	Full sample mean
Age at entry	7.69	7.95	7.73	6.35
Age	13.36	14.50	13.49	12.02
Educational achievement	3.08	2.65	3.11	3.03
Gender = female	0.52	0.50	0.58	0.52
No. bio. siblings	2.22	2.40	2.29	2.44
No. all siblings	8.99	7.60	10.15	9.52

Notes: Share of women is statistically different from 50 percent in Asia only (at 5 percent level).

Table 9: Descriptive statistics for second-born children

	Attributes of secondborns			
	Africa mean	Latin America mean	Asia mean	Full sample mean
Age at entry	5.25	5.60	5.59	6.35
Age	10.67	12.00	11.04	12.02
Educational achievement	3.12	2.72	3.07	3.03
Gender = female	0.50	0.47	0.48	0.52
No. bio. siblings	2.22	2.40	2.29	2.44
No. all siblings	8.99	7.60	10.15	9.52

Notes: Share of women is statistically different from 50 percent in Asia and Latin-America only (at 5 percent level).

Table 10: Descriptive statistics for third- and later-born children

	Attributes of thirdborns or higher			
	Africa mean	Latin America mean	Asia mean	Full sample mean
Age at entry	7.69	7.95	7.73	6.35
Age	13.36	14.50	13.49	12.02
Educational achievement	3.08	2.65	3.11	3.03
Gender = female	0.52	0.50	0.58	0.52
No. bio. siblings	2.22	2.40	2.29	2.44
No. all siblings	8.99	7.60	10.15	9.52

Notes: Share of women is statistically different from 50 percent in Africa only (at 5 percent level).

Table 11: Descriptive statistics comparison by region

	Comparsion Africa (1) vs. Latin America (2)			Comparsion Africa (1) vs. Asia (2)			Comparsion Latin America (1) vs. Asia (2)		
	Mean (1)	Mean (2)	Diff.	Mean (1)	Mean (2)	Diff.	Mean (1)	Mean (2)	Diff.
Personal characteristics:									
Gender = female	0.50	0.48	0.02	0.50	0.53	-0.02**	0.48	0.53	-0.04***
Age at entry	6.22	6.36	-0.14	6.22	6.37	-0.15**	6.36	6.37	-0.01
Age	11.75	12.65	-0.90***	11.75	11.91	-0.16**	12.65	11.91	0.74***
Family characteristics:									
No. bio. siblings	2.31	2.56	-0.25***	2.31	2.44	-0.13***	2.56	2.44	0.12***
No. all siblings	9.03	7.66	1.37***	9.03	10.17	-1.15***	7.66	10.17	-2.52***
Reason for admission (in percent):									
Death of parents	0.75	0.32	0.42***	0.75	0.69	0.06***	0.32	0.69	-0.37***
Inability caregiver	0.21	0.38	-0.18***	0.21	0.17	0.04***	0.38	0.17	0.22***
Abandonment	0.05	0.25	-0.21***	0.05	0.12	-0.08***	0.25	0.12	0.13***
Hardship experience (in percent):									
Emotional hardship experience	0.12	0.49	-0.37***	0.12	0.09	0.03***	0.49	0.09	0.40***
Financial hardship experience	0.00	0.00	0.00	0.00	0.21	-0.21***	0.00	0.21	-0.21***

D.3. Descriptive statistics by reason for admission

Table 12: Descriptive statistics for children by experience of hardship

	No hardship prior to admission		Hardship prior to admission		Full sample	
	Mean	SD	Mean	SD	Mean	SD
Outcome variable:						
Educational achievement	3.05	0.72	2.98	0.74	3.03	0.73
Age	12.08	3.46	11.86	3.44	12.02	3.46
Age at entry	6.40	3.13	6.21	3.14	6.35	3.13
Gender	0.51	0.50	0.53	0.50	0.52	0.50
No. bio. siblings	2.43	0.65	2.47	0.69	2.44	0.66
No. all siblings	9.62	2.15	9.27	2.22	9.52	2.17
Lifeshare spent in SOS care	0.46	0.23	0.47	0.24	0.46	0.23
Reason for admission:						
Abandonment	0.11	0.31	0.21	0.41	0.14	0.34
Death of parents	0.70	0.46	0.46	0.50	0.63	0.48
Referral	0.02	0.13	0.02	0.15	0.02	0.14
Inability caregiver	0.18	0.38	0.31	0.46	0.21	0.41
Share of regions:						
Share Africa	0.20	0.40	0.06	0.24	0.16	0.36
Share Latin America	0.14	0.34	0.31	0.46	0.19	0.39
Share Asia	0.67	0.47	0.62	0.48	0.65	0.48
Observations	18,938		7,960		26,898	

Notes: Data describes final sample after application of sampling restrictions.

D.4. Distribution of educational achievement by region and country

Table 13: Distribution of of educational achievement by region

Educational achievement	Asia	Latin America	Africa	Full sample
1	275	130	87	492
	(1.6)	(2.5)	(2.1)	(1.8)
2	2,706	1,942	562	5,210
	(15.4)	(37.9)	(13.4)	(19.4)
3	9,497	2,339	2,368	14,204
	(54.0)	(45.7)	(56.4)	(52.8)
4	5,099	710	1,183	6,992
	(29.0)	(13.9)	(28.2)	(26.0)
Observations	17,577	5,121	4,200	26,898

Notes: Column percentages in parantheses.

Table 14: Educational achievement distribution by country (I/II)

Country	Educational achievement distribution by country					Number of observations by country		
	1	2	3	4	Total	N	Rel. share	Cum. Share
			in percent				in percent	
Angola	0.00	20.00	60.00	20.00	100.00	70	0.26	0.26
Argentina	1.32	36.84	51.32	10.53	100.00	76	0.28	0.54
Bangladesh	0.69	6.39	73.19	19.72	100.00	720	2.68	3.22
Benin	8.13	30.08	44.72	17.07	100.00	123	0.46	3.68
Bolivia	3.34	35.72	43.61	17.33	100.00	1,408	5.23	8.91
Botswana	0.00	24.24	12.12	63.64	100.00	33	0.12	9.03
Cambodia	0.32	12.77	33.55	53.35	100.00	1,237	4.60	13.63
Centr. Afr. Rep.	10.00	40.00	50.00	0.00	100.00	90	0.33	13.97
Chad	0.00	0.00	100.00	0.00	100.00	18	0.07	14.03
Chile	0.00	39.06	55.79	5.15	100.00	233	0.87	14.90
Colombia	4.25	52.75	39.75	3.25	100.00	400	1.49	16.39
Congo, Dem. Rep.	0.00	8.75	68.75	22.50	100.00	160	0.59	16.98
Cote d'Ivoire	11.11	36.11	25.00	27.78	100.00	36	0.13	17.12
Dominican Rep.	2.91	49.82	38.91	8.36	100.00	275	1.02	18.14
El Salvador	0.82	21.31	37.70	40.16	100.00	122	0.45	18.59
Equat. Guinea	0.00	0.00	26.03	73.97	100.00	146	0.54	19.14
Ethiopia	0.00	0.88	40.98	58.14	100.00	571	2.12	21.26
Gambia	0.00	78.57	21.43	0.00	100.00	14	0.05	21.31
Guatemala	4.35	33.15	48.37	14.13	100.00	184	0.68	21.99
Guinea	7.37	1.05	53.68	37.89	100.00	95	0.35	22.35
Haiti	3.70	14.81	70.37	11.11	100.00	135	0.50	22.85
India	1.55	15.58	58.43	24.44	100.00	7,811	29.04	51.89
Indonesia	0.00	0.00	65.22	34.78	100.00	46	0.17	52.06
Jamaica	23.38	48.05	23.38	5.19	100.00	77	0.29	52.35
Kenya	4.92	6.56	65.57	22.95	100.00	183	0.68	53.03
Laos	1.66	12.31	60.51	25.52	100.00	1,869	6.95	59.97
Liberia	12.50	33.33	42.50	11.67	100.00	360	1.34	61.31
Malawi	0.00	22.73	27.27	50.00	100.00	88	0.33	61.64

Table 15: Educational achievement distribution by country (II/II)

Country	Educational achievement distribution by country					Number of observations by country		
	1	2	3	4	Total	N	Rel. share	Cum. share
	in percent						in percent	
Mexico	1.58	72.33	26.09	0.00	100.00	253	0.94	62.58
Namibia	0.00	17.78	40.00	42.22	100.00	45	0.17	62.75
Nepal	1.01	14.58	43.78	40.64	100.00	2,675	9.94	72.69
Nicaragua	2.37	28.46	37.15	32.02	100.00	253	0.94	73.63
Niger	0.00	50.00	50.00	0.00	100.00	20	0.07	73.71
Nigeria	0.00	0.00	93.33	6.67	100.00	45	0.17	73.88
Palestine	0.00	15.38	46.15	38.46	100.00	13	0.05	73.92
Panama	4.40	61.54	34.07	0.00	100.00	182	0.68	74.60
Paraguay	0.60	30.35	46.59	22.46	100.00	837	3.11	77.71
Peru	0.32	30.81	62.24	6.64	100.00	633	2.35	80.07
Philippines	0.00	6.16	61.85	31.99	100.00	422	1.57	81.63
Senegal	0.85	14.41	84.75	0.00	100.00	118	0.44	82.07
Sierra Leone	0.00	3.90	89.22	6.88	100.00	436	1.62	83.69
Somalia	0.00	0.00	78.95	21.05	100.00	19	0.07	83.76
Somaliland	0.00	4.60	81.03	14.37	100.00	174	0.65	84.41
South Africa	4.35	4.35	43.48	47.83	100.00	23	0.09	84.50
Sri Lanka	0.92	14.96	52.82	31.30	100.00	869	3.23	87.73
Swaziland	0.18	14.86	44.57	40.40	100.00	552	2.05	89.78
Thailand	0.00	5.98	68.41	25.61	100.00	535	1.99	91.77
Togo	0.00	15.14	41.08	43.78	100.00	185	0.69	92.46
Venezuela	0.00	25.00	75.00	0.00	100.00	40	0.15	92.61
Vietnam	5.67	34.24	41.13	18.95	100.00	1,393	5.18	97.78
Zambia	0.00	13.07	71.68	15.25	100.00	505	1.88	99.66
Zanzibar	0.00	42.86	57.14	0.00	100.00	70	0.26	99.92
Zimbabwe	0.00	19.05	61.90	19.05	100.00	21	0.08	100.00
Total	1.83	19.37	52.81	25.99	100.00	26,898	100.00	

D.5. Distribution of reason for admission by region

Table 16: Share of children by reason for admission

Reason for admission	Reason for admission by region Africa in percent of column	Latin America in percent of column	Asia in percent of column	Full sample in percent of column
Abandoned	0.20	0.25	0.21	0.21
Caregivers unable to care for child	0.17	0.01	0.18	0.15
Death of both parents / no responsible caregiver	0.21	0.38	0.17	0.21
Death of father and mother unable to care for a child	0.38	0.06	0.31	0.27
Death of mother and father unable to care for a child	0.05	0.25	0.12	0.14
Referred from another care placement	0.00	0.04	0.02	0.02

Table 17: Share of children by detailed reason for admission

Detailed reason for admission	Detailed reason for admission by region			
	Africa in percent of column	Latin America in percent of column	Asia in percent of column	Full sample in percent of column
Emotional hardship:				
Alcohol or drug use of parents	0.16	0.37	0.11	0.19
Caregivers unwilling to care for child	0.61	0.00	0.00	0.04
Child rights violation (physical, sexual, emotional, neglect)	0.23	0.75	0.14	0.34
War or natural disasters or emergencies	0.07	0.00	0.00	0.01
Harmful cultural practices	0.01	0.00	0.10	0.07
Economic hardship:				
Severely economically underresourced households	0.00	0.00	0.75	0.46
Other reasons:				
Other	0.00	0.00	0.01	0.00
Born out of wedlock	0.00	0.00	0.02	0.01
Caregiver in conflict with law or in prison	0.01	0.01	0.03	0.02
Caregiver unable to care for child (disability, illness)	0.10	0.09	0.16	0.13
Family in crisis situation	0.00	0.11	0.00	0.04
No information	0.04	0.00	0.01	0.01
Parents separated or divorced	0.00	0.00	0.12	0.07

Notes: Columns do not add up to 100 percent as some children have multiple reasons as entries. Individuals with any hardship experience only.

E. Robustness checks

Tables 18, 19, and 20 show baseline model estimates for different sub-regions. I find that the general effect is driven by countries in Latin America and Asia. In Asia, both main regions display birth order effects. In Latin America, observed birth order effects are driven by one main region.

E.1. Baseline model estimation for individual regions

Table 18: Baseline model estimation for individual regions

	(1) Baseline model full sample	(2) Baseline model Africa only	(3) Baseline model Latin America only	(4) Baseline model Asia only
Secondborn	-0.079***	0.054	-0.099**	-0.095***
	(0.021)	(0.057)	(0.049)	(0.025)
Thirdborn or higher	-0.091**	0.018	-0.181*	-0.093*
	(0.041)	(0.097)	(0.104)	(0.049)
Gender = female	0.138***	0.088*	0.218***	0.114***
	(0.020)	(0.048)	(0.043)	(0.025)
No. all siblings	-0.003	-0.004	-0.002	-0.003
	(0.003)	(0.006)	(0.010)	(0.003)
Lifeshare spent in SOS care	0.158*	-0.236	0.109	0.206*
	(0.090)	(0.179)	(0.245)	(0.108)
Abandonment	0.087	-0.006	0.124	0.082
	(0.060)	(0.106)	(0.137)	(0.069)
Death of parents	0.103*	-0.022	0.404***	0.070
	(0.059)	(0.122)	(0.150)	(0.071)
Referral	-0.034	0.000	0.245	-0.124
	(0.115)	(.)	(0.213)	(0.132)
Constant	3.515***	3.547***	3.829***	2.302***
	(0.281)	(0.434)	(0.383)	(0.704)
Sibship dummies, time dummies, age dummies	✓	✓	✓	✓
Observations	26,898	4,200	5,121	17,577
Adj.R^2	0.66	0.68	0.56	0.66
Clusters	4362	706	915	2741
Standard errors clustered at individual level	Yes	Yes	Yes	Yes

Notes: **Dependent variable:** educational achievement; **Baseline group:** firstborn male children; Sibship dummies; Robust standard errors in parentheses are clustered at individual level; ***/**/* indicate significance at the 1%/5%/10% level.

Table 19: Baseline model estimation with Asia in 2 subgroups

	(1) Baseline model Asia only	(2) Baseline model Asia group 1 only	(3) Baseline model Asia group 2 only
Secondborn	-0.095***	-0.092***	-0.101***
	(0.025)	(0.034)	(0.036)
Thirdborn or higher	-0.093*	-0.043	-0.201***
	(0.049)	(0.063)	(0.073)
Gender = female	0.114***	0.064*	0.172***
	(0.025)	(0.034)	(0.034)
No. all siblings	-0.003	-0.002	-0.007**
	(0.003)	(0.004)	(0.004)
Lifeshare spent in SOS care	0.206*	0.223	0.273
	(0.108)	(0.138)	(0.172)
Abandonment	0.082	-0.015	0.146**
	(0.069)	(0.104)	(0.070)
Death of parents	0.070	-0.020	0.198*
	(0.071)	(0.098)	(0.107)
Referral	-0.124	-0.177	-0.080
	(0.132)	(0.164)	(0.150)
Constant	2.302***	4.023***	2.158***
	(0.704)	(0.438)	(0.657)
Sibship dummies, time dummies, age dummies	✓	✓	✓
Observations	17,577	10,486	7,091
$Adj.R^2$	0.66	0.63	0.72
Clusters	2741	1679	1062
Standard errors clustered at individual level	Yes	Yes	Yes

Notes: **Dependent variable:** educational achievement; **Baseline group:** firstborn male children; Sibship dummies; Groups based on cultural cluster – Group 1: India, Nepal. Group 2: Bangladesh, Cambodia, Indonesia, Laos, Philippines, Sri Lanka, Thailand, Vietnam; Robust standard errors in parentheses are clustered at individual level; ***/**/* indicate significance at the 1%/5%/10% level.

Table 20: Baseline model with Latin America in 3 subgroups

	(1) Baseline model Latin America only	(2) Baseline model Latin America group 1 only	(3) Baseline model Latin America group 2 only	(4) Baseline model Latin America group 3 only
Secondborn	-0.099**	-0.009	-0.208***	-0.057
	(0.049)	(0.074)	(0.080)	(0.090)
Thirdborn or higher	-0.181*	-0.246*	-0.043	-0.296
	(0.104)	(0.147)	(0.172)	(0.230)
Gender = female	0.218***	0.176***	0.201***	0.284***
	(0.043)	(0.068)	(0.069)	(0.076)
No. all siblings	-0.002	-0.007	0.013	-0.029
	(0.010)	(0.015)	(0.017)	(0.029)
Lifeshare spent in SOS care	0.109	0.670	0.147	-0.476
	(0.245)	(0.427)	(0.399)	(0.290)
Abandonment	0.124	0.331*	0.334	-0.192
	(0.137)	(0.193)	(0.284)	(0.203)
Death of parents	0.404***	0.392**	0.394	0.082
	(0.150)	(0.199)	(0.304)	(0.232)
Referral	0.245	0.372*	1.502***	-0.510***
	(0.213)	(0.194)	(0.392)	(0.187)
Constant	3.829***	3.134***	2.914***	4.739***
	(0.383)	(0.468)	(0.648)	(0.394)
Sibship dummies, time dummies, age dummies	✓	✓	✓	✓
Observations	5,121	2,350	1,764	994
$Adj.R^2$	0.56	0.51	0.62	0.67
Clusters	915	391	327	184
Standard errors clustered at individual level	Yes	Yes	Yes	Yes

Notes: **Dependent variable:** educational achievement; **Baseline group:** firstborn male children; Sibship dummies; Groups based on cultural cluster – Group 1: Argentina, Chile, Bolivia, Peru; Group 2: Brazil, Colombia, Dominican Republic, Haiti, Jamaica, Paraguay, Venezuela; Group 3: El Salvador, Guatemala, Mexico, Nicaragua, Panama; Robust standard errors in parentheses are clustered at individual level; ***/**/* indicate significance at the 1%/5%/10% level.

E.2. Alternative specifications for baseline model

Table 21: Baseline estimation with different types of dummies

	(1) Sibship dummies	(2) Family dummies	(3) Village dummies	(4) Country dummies	(5) No dummies
Secondborn	-0.079***	-0.065***	-0.065***	-0.046*	-0.065**
	(0.021)	(0.020)	(0.024)	(0.026)	(0.027)
Thirdborn or higher	-0.091**	-0.054	-0.043	-0.002	-0.032
	(0.041)	(0.037)	(0.036)	(0.039)	(0.040)
Gender = female	0.138***	0.118***	0.106***	0.101***	0.104***
	(0.020)	(0.020)	(0.021)	(0.022)	(0.023)
No. all siblings	-0.003	0.004	0.014***	0.014***	0.029***
	(0.003)	(0.004)	(0.005)	(0.005)	(0.005)
Lifeshare spent in SOS care	0.158*	0.015	-0.001	0.072	0.086*
	(0.090)	(0.061)	(0.052)	(0.052)	(0.052)
Constant	3.233***	3.667***	2.431***	3.182***	3.092***
	(0.158)	(0.287)	(0.325)	(0.232)	(0.138)
Time dummies, age dummies	✓	✓	✓	✓	✓
Reason for admission dummies	✓	✓	✓	✓	✓
Sibship dummies	✓				
Family dummies		✓			
Village dummies			✓		
Country dummies				✓	
Observations	26,898	26,898	26,898	26,898	26,898
$Adj.R^2$	0.66	0.55	0.28	0.13	0.041
Clusters	4362	4362	4362	4362	4362
Standard errors clustered at individual level	Yes				
Standard errors clustered at family level		Yes			
Standard errors clustered at village level			Yes		Yes
Standard errors clustered at country level				Yes	

Notes: **Dependent variable:** educational achievement; **Baseline group:** firstborn male children; Robust standard errors in parentheses are clustered at individual level; ***/**/* indicate significance at the 1%/5%/10% level.

Table 22: Baseline estimation for each quarter (I/II)

	(1) 2014Q3	(2) 2014Q4	(3) 2015Q1	(4) 2015Q2	(5) 2015Q3
Secondborn	-0.107*	-0.137***	-0.155***	-0.101***	-0.066*
	(0.058)	(0.040)	(0.040)	(0.038)	(0.036)
Thirdborn or higher	-0.122	-0.153*	-0.218***	-0.180**	-0.085
	(0.113)	(0.082)	(0.081)	(0.075)	(0.068)
Gender = female	0.127***	0.146***	0.143***	0.128***	0.155***
	(0.046)	(0.034)	(0.032)	(0.030)	(0.030)
No. all siblings	1.005	0.296**	-0.101	0.434	0.445
	(0.760)	(0.116)	(0.284)	(0.304)	(0.305)
Lifeshare spent in SOS care	0.351	0.221	0.235	0.096	0.066
	(0.285)	(0.189)	(0.171)	(0.166)	(0.152)
Abandonment	0.194	0.001	0.022	0.175*	0.129
	(0.162)	(0.146)	(0.125)	(0.098)	(0.099)
Death of parents	0.254*	0.154	0.100	0.090	0.104
	(0.143)	(0.115)	(0.105)	(0.096)	(0.090)
Referral	-0.197	-0.070	-0.133	-0.084	-0.123
	(0.257)	(0.211)	(0.185)	(0.184)	(0.176)
Constant	-5.806	0.653	3.994	-0.498	-1.130
	(6.349)	(1.417)	(2.838)	(2.852)	(2.889)
Sibship dummies, time dummies, age dummies	✓	✓	✓	✓	✓
Observations	1,074	2,213	2,397	2,651	2,765
$Adj.R^2$	0.55	0.48	0.49	0.49	0.48
Clusters	1074	2213	2397	2651	2765
SEs clustered at individual Level	Yes	Yes	Yes	Yes	Yes

Notes: **Dependent variable:** educational achievement; **Baseline group:** firstborn male children; Robust standard errors in parentheses are clustered at individual level; ***/**/* indicate significance at the 1%/5%/10% level.

Table 23: Baseline estimation for each quarter (II/II)

	(1) 2015Q4	(2) 2016Q1	(3) 2016Q2	(4) 2016Q3	(5) 2016Q4
Secondborn	-0.065**	-0.088***	-0.060*	-0.053*	-0.082**
	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
Thirdborn or higher	-0.082	-0.120*	-0.023	-0.033	-0.097
	(0.063)	(0.064)	(0.065)	(0.066)	(0.064)
Gender = female	0.113***	0.144***	0.161***	0.118***	0.135***
	(0.028)	(0.028)	(0.029)	(0.029)	(0.028)
No. all siblings	0.876	0.917	0.151	-0.053	0.869
	(0.568)	(0.598)	(0.162)	(0.302)	(0.574)
Lifeshare spent in SOS care	0.012	0.082	0.184	0.245*	0.045
	(0.137)	(0.134)	(0.129)	(0.128)	(0.152)
Abandonment	0.115	0.078	0.088	0.158	0.135
	(0.105)	(0.111)	(0.101)	(0.102)	(0.111)
Death of parents	0.132	0.112	0.071	0.077	0.145
	(0.090)	(0.091)	(0.087)	(0.084)	(0.091)
Referral	0.015	0.019	0.005	0.103	0.049
	(0.197)	(0.196)	(0.179)	(0.196)	(0.199)
Constant	-4.334	-4.767	2.365**	4.048	-3.922
	(4.910)	(5.216)	(1.197)	(2.588)	(4.988)
Sibship dummies, time dummies, age dummies	✓	✓	✓	✓	✓
Observations	3,090	3,124	3,186	3,318	3,080
$Adj.R^2$	0.50	0.49	0.49	0.47	0.49
Clusters	3090	3124	3186	3318	3080
SEs clustered at individual level	Yes	Yes	Yes	Yes	Yes

Notes: **Dependent variable:** educational achievement; **Baseline group:** firstborn male children; Robust standard errors in parentheses are clustered at individual level; ***/**/* indicate significance at the 1%/5%/10% level.

E.3. Robustness checks of hardship and gender split model

Table 24: Hardship model estimation for individual regions

	Extreme hardship experience only			
	(1)	(2)	(3)	(4)
	Full sample	Africa only	Latin America only	Asia only
Secondborn	-0.030	-0.198	-0.081	0.001
	(0.037)	(0.147)	(0.065)	(0.046)
Thirdborn or higher	-0.063	-0.355	-0.303**	0.046
	(0.071)	(0.251)	(0.128)	(0.088)
Gender = female	0.216***	0.103	0.334***	0.127***
	(0.038)	(0.113)	(0.064)	(0.046)
No. all siblings	-0.002	-0.026	-0.008	0.002
	(0.005)	(0.031)	(0.013)	(0.004)
Lifeshare spent in SOS care	0.065	0.298	-0.154	0.052
	(0.183)	(0.551)	(0.314)	(0.233)
Constant	3.588***	3.727***	4.098***	2.033***
	(0.324)	(0.663)	(0.408)	(0.713)
Sibship dummies, time dummies, age dummies	✓	✓	✓	✓
Reason for admission dummies	✓	✓	✓	✓
Observations	7,960	500	2,507	4,953
$Adj.R^2$	0.70	0.59	0.61	0.74
Clusters	1404	113	493	798
Standard errors clustered at individual level	Yes	Yes	Yes	Yes

Notes: **Dependent variable:** educational achievement; **Baseline group:** firstborn male children; Individuals with experience of personal hardship only; Sibship dummies; Robust standard errors in parentheses are clustered at individual level; ***/**/* indicate significance at the 1%/5%/10% level.

Table 25: Hardship model: different coding of hardship experience

	No extreme hardship		Extreme hardship		
	(1)	(2)	(3)	(4)	(5)
	Parental death	Other reasons	Economic	Emotional	Financial and emotional
Secondborn	-0.087	-0.091**	0.012	-0.075	-0.030
	(0.063)	(0.046)	(0.052)	(0.050)	(0.037)
Thirdborn or higher	-0.178	-0.019	0.073	-0.179**	-0.063
	(0.117)	(0.083)	(0.108)	(0.088)	(0.071)
Gender = female	0.160***	0.107***	0.125**	0.255***	0.216***
	(0.056)	(0.038)	(0.056)	(0.048)	(0.038)
No. all siblings	0.014	-0.007	0.006	-0.005	-0.002
	(0.009)	(0.007)	(0.006)	(0.007)	(0.005)
Lifeshare spent in SOS care	0.188	0.463**	0.275	-0.210	0.065
	(0.304)	(0.181)	(0.242)	(0.247)	(0.183)
Constant	3.421***	3.053***	1.679**	3.888***	3.588***
	(0.429)	(0.256)	(0.692)	(0.325)	(0.324)
Sibship dummies, time dummies, age dummies	✓	✓	✓	✓	✓
Reason for admission dummies	✓	✓	✓	✓	✓
Observations	4,179	5,664	3,701	4,642	7,960
$Adj.R^2$	0.71	0.71	0.75	0.67	0.70
Clusters	637	964	601	855	1404
Standard errors clustered at individual level	Yes	Yes	Yes	Yes	Yes

Notes: **Dependent variable:** educational achievement; **Baseline group:** firstborn male children; Sibship dummies; Robust standard errors in parentheses are clustered at individual level; ***/**/* indicate significance at the 1%/5%/10% level.

Table 26: Gender split model: Asia only baseline model with gender interaction term: interacting gender with being first-born

	(1) Asia	(2) Nepal and India	(3) Rest of Asia
Firstborn=1	0.144***	0.209***	0.037
	(0.032)	(0.043)	(0.046)
Gender = female=1	0.152***	0.147***	0.129***
	(0.031)	(0.042)	(0.044)
Firstborn=1 X Gender = female=1	-0.098**	-0.220***	0.101*
	(0.041)	(0.054)	(0.060)
Thirdborn	0.006	0.035	-0.048
	(0.035)	(0.046)	(0.051)
No. all siblings	-0.003	-0.002	-0.007**
	(0.003)	(0.004)	(0.004)
Lifeshare spent in SOS care	0.208*	0.247*	0.258
	(0.107)	(0.137)	(0.166)
Abandonment	0.080	-0.017	0.147**
	(0.069)	(0.103)	(0.071)
Death of parents	0.070	-0.021	0.191*
	(0.071)	(0.098)	(0.107)
Referral	-0.116	-0.151	-0.087
	(0.132)	(0.165)	(0.160)
Constant	2.165***	3.888***	2.041***
	(0.686)	(0.393)	(0.669)
Sibship dummies, time dummies, age dummies	✓	✓	✓
Observations	17,577	10,486	7,091
$Adj.R^2$	0.66	0.63	0.72
Clusters	2741	1679	1062
Standard errors clustered at individual level	Yes	Yes	Yes

Notes: **Dependent variable:** educational achievement; **Baseline group:** secondborn male children; Sibship dummies; Asia only; Robust standard errors in parentheses are clustered at individual level; ***/**/* indicate significance at the 1%/5%/10% level.

E.4. Validity of extrapolation of findings

Björklund, Lindahl, and Plug (2004) argue that in order to extrapolate findings from adoption data to the general population, the following needs to hold: (i) Children need to be as good as randomly assigned to their adoptive families, (ii) they need to be adopted early on in their lives and one needs to assume that (iii) studies on adoptive child-parent relationships can be extrapolated to biological child-parent relationships. In the following section, I discuss whether the assumptions made by Björklund, Lindahl, and Plug (2004) hold in this setting.

(i) Children are not randomly selected into families. Consequently, SOS Children's Villages parents' attributes are not expected to be statistically independent of those of their children. Rather, children and parents have a say in whom they are paired up with and have a trial period of living together. The data do not allow to reject the hypothesis, that the sorting of children and caregivers will moderate birth order effects. However, the rotation of children in and out of the family makes it unlikely that a selection induced by caregiver behavior occurs at this level.

(ii) An additional threat to external validity stems from a comparatively high age of admission. However, the baseline estimation does not suggest that the relative share of life spent in SOS Children's Villages' acts as a significant driver of educational achievement at the five percent level.[18] It is hence not expected that treatment in SOS Children's Villages leads to a reversal in birth order effects per se.[19]

(iii) Björklund, Lindahl, and Plug (2004) assert that adoptive children and their parents, as well as their relationships, shall not carry unobservable traits that lead to bias and consequently systematic deviation from what one would expect in biological settings. Generally, the sample is selected insofar as individuals are expected to disproportionately be of underprivileged socio-economic background, relative to the average population. However, first, this group is of particular interest to policymakers as it is often a target of policy interventions. Furthermore, within-sample differences based on hardship experience are still expected to provide valuable insight. The gender and culture-specific effects found in India support the belief that the sample confirms to

18. If it did, this would imply that longer exposure to biological parents changed later educational achievement.

19. One hypothesis that I cannot reject is that of heterogeneous opposing effects that cancel out. While some children might benefit from an early admission, others might suffer, resulting in a zero net effect.

general cultural patterns found in respective populations. Concerning parental influence, SOS parents are not expected to discriminate between siblings of different birth order actively. As described in-depth in the discussion part, non-biological caregivers are exposed to a *rotation* of children rendering discrimination very unlikely. Exposure to non-discriminatory parents can downward-bias effect sizes compared to biological settings but will not lead to a reversal in signs. Concerning family composition, sample families are of above average size compared to average biological and adoptive families. Growing up in large families is likely to dampen birth order effects, as Härkönen (2014), as well as Zajonc and Sulloway (2007), find. However, considering the consistent insignificance of the alternative care sibship size variable, I conclude that family sizing is not expected to moderate educational achievement in this setting.

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