How Families Produce Inequality

Sibling Configuration and the Allocation of Resources Among Siblings

Thesis submitted in partial fulfillment of the requirements

for the degree of Doctor of Philosophy

by

Magdalena Osmanowski

Faculty of Sociology

Bielefeld University

First Supervisor: Prof. Dr. Martin Diewald

Second Supervisor: Jun. Prof. Dr. Reinhard Schunk

Bielefeld, May 27, 2015

Printed on non-ageing paper (DIN ISO 9706)

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1 INTRODUCTION

Sociological research on social inequalities has traditionally identified the family as a key factor in explaining disparities between individuals. Families are the first and one of the main environmental influences to which children are exposed and therefore have an important impact on a child's life chances. Depending on the amount and variety of a family's resources, the children might move up or down the social ladder or stay at the same level as their parents. Yet when discussing the role of family background on individual outcomes, social scientists tend to assume, perhaps only implicitly, that all children within the same family are treated equally by their parents. Families are characterized according to their equality and solidarity principles, assuming no differences among the members, particularly the children. Therefore, in the majority of cases, research based on these assumptions focuses on differences between, rather than within, families (Conley, Pfeiffer, & Velez, 2007).

Studies of intergenerational processes mainly involve correlation analyses, either between parents and their children or between siblings. These analyses have shown that, regarding certain outcome variables, siblings who grow up in the same family, and therefore within the same environment, are as different from each other as are two children who were not raised by the same parents (Plomin & Daniels, 1987). But why is it that siblings who live in the same household and share the same family environment differ in terms of their success in life? Researchers have proposed many explanations, the first certainly being genetics. On average, full siblings (who are not identical twins) share on average 50 percent of their genes (see, for example, Dunn & Plomin, 1991; Roves, 2002), which results in similarities but also considerable dissimilarities. Because this percentage

is only a mean value, the resemblance might vary upward or downward for each individual pair of siblings. A debate on the effects of environmental factors is also ongoing,[1] particularly with regard to the major influence of the family on children's development. Such effects become notable when parents treat their children unequally because the experience of each child within the same family will differ.

Contrary to the strong social norms dictating that parents should treat all their children equally, research has shown that the majority of parents tend to favor one child over the others (Suitor, Gilligan, & Pillemer, 2013). As a result, children take different developmental paths, which may lead to divergent outcomes. The differential treatment of children might be the result of a child's individual endowments or the family context but also of sibling characteristics (McHale, Updegraff, Jackson-Newsom, Tucker, & Crouter, 2000). Based on these characteristics, parents decide – consciously or unconsciously – how much they want to invest in each individual child. This kind of parental action, in particular the distribution of resources among siblings (Downey, 2001), is therefore one of the main mechanisms explaining the differences in siblings' outcomes. However, there is a gap in the literature when it comes to mechanistic explanations for differences between or among siblings. Rather, the emphasis tends to be on the relationship between child and sibling characteristics and its effect on children's outcomes. Mechanisms to explain these correlations are seldom specified and even less often analyzed empirically. In this dissertation, the focus is laid on one of these mechanisms: the allocation of resources among siblings or, to be more precise, the frequency with which they are exposed to cognitively stimulating activities.[2] These factors have been shown to influence children's skill development, which in turn has an effect on outcomes later in life such as school grades or income (e.g., Cunha & Heckman, 2008; Hackman, Farah, & Meaney, 2010; Hsin, 2006).

[1] See the next section for more on the relationship between nature and nurture.

[2] For more on parental resources, see Section 2.1.

Parents decide how they distribute their resources among their offspring based on particular sibling characteristics. Until now the most prominent variable studied has been the number of siblings, but the effect of birth order has often been examined as well. In contrast, the sex composition of siblings has been much less a part of such analyses, and birth spacing between siblings has been somewhat neglected in the literature. These sibship characteristics might influence parents in terms of how they allocate their time among their children. Therefore, in addition to between-family analyses, in which children from different families are compared with one another, within-family heterogeneity needs to be considered as well because much of the overall inequality is found between children who have the same parents and who come from the same household (Martin, 2006; McLanahan & Percheski, 2008; see also the literature on sibling correlations, for example, regarding income, see Björklund, Jäntti, & Solon, 2005; Mazumder, 2008).

Since the mother is usually the parent who stays at home and cares for the children when they are very young, whereas the father tends to be the breadwinner for the family (Walter & Künzler, 2002), the focus here will be on the time a mother spends with her children,[3] specifically the frequency of with which she engages in cognitively stimulating activities with them.

The aim of this dissertation is to investigate one mechanism in particular that explains the relationship between sibling characteristics and a child's outcome – that is, parents' allocation of resources, namely cognitively stimulating activities, between or among siblings. For this purpose differences not only between families but also, when possible, within families, are analyzed and not only one but all the sibship characteristics mentioned above are included. Therefore, the following questions are posed:

[3] Certainly the role of the father has recently been changing. Fathers are developing a greater understanding of family life and childcare in particular, as evidenced in the literature by the designation "Neue Väter" (new fathers). See also Seiffge-Krenke (2009) or Meuser (2012) for a description of changes in fatherhood during the last few decades. However, many fathers still prefer the more traditional role; in 2005, the proportion of these "Neue Väter" in Germany was approximately 20 percent (Cyprian, 2005). Although fathers' involvement in childcare has been found to have a big influence on a child's development (Seiffge-Krenke, 2009), detailed information about the amount of time fathers spend with their children is not available in the data used in this dissertation.

1. What effect on the allocation of resources (i.e., the frequency with which parents engage in activities with their children) does the number of siblings have for preschool children in Germany? Does a larger number of siblings always have a negative effect, as is usually predicted, or might countervailing processes result in a positive effect in terms of the time a mother spends with her children?

2. How influential is the age gap between siblings, and is it the age gap per se that matters or rather the ages of the children and therefore their institutional involvements? Can mothers combine activities better when children are close in age, or do these children instead compete against each other for maternal resources?

3. Does having brothers hurt more than having sisters with respect to the amount of time spent with the mother? Again, do same-sex siblings profit from a combination of activities or are they rivals for time with their mother? Or is this particular sibship characteristic no longer an issue nowadays?

4. Does a child's gender operate in combination with birth order or number of siblings in terms of allocation of resources? How are these three sibship characteristics related to one another?

1.1 Relevance of Sibling Analysis for the Investigation of Inequalities

That parents influence their children's life outcomes is an undeniable conclusion of multidisciplinary research. This relationship has been investigated by not only social scientists but also behavioral geneticists and biologists, and debates concerning the exact basis for this result reflect two points of view: genetics and environment, or, in other words, "nature and nurture"[4] (Conley, 2011; Galton, 1876; Plomin & Daniels, 1987). Researchers do agree, however, that nature and

[4] In her "nurture assumption", Harris (2002, 2011) argues for a differentiation between the terms nurture and environment, which is "the strongly held belief that parents are the most important part of the child's environment" (Harris, 2002: 4).

nurture play important roles both independently and to a great extent in combination with each other.[5,6] This conclusion has been confirmed by empirical results, which reveal that although biological siblings (also fraternal twins) share on average 50 percent of their genes and identical twins even 100 percent, and they grow up in the same family (Dunn & Plomin, 1991) and share the same environment, their life outcomes turn out to be different in many respects. Results of studies on the transmission of inequality that focus on similarities between siblings tend to differ in terms of certain outcomes such as educational attainment and success in the labor market (Black, Devereux, & Salvanes, 2004; Conley & Glauber, 2005a). Correlation analyses of sibling outcomes indicate that correlation coefficients for siblings and even twins are not as high as might be expected; for example, Dunn and Plomin (1991) report that the correlation between siblings' personalities is roughly 0.15 and is not more than 0.5 for identical twins. Thus, even children who are genetically identical do not have identical personalities. The effects of a child's social environment seem to counteract those of heredity.

Certainly the family plays a decisive role in that they provide the earliest and most influential environment for their children. Very young children are not yet in contact with other socializing agents such as teachers and fellow pupils. As mentioned above, the homogeneous influence of the family on all its members is still the most prominent view in social science research. Similarly, the classic and still dominant theories concerning social mobility fail to differentiate between individual family members, continuing to assume that siblings' outcomes should implicitly be almost identical[7] despite their inability to reconcile the reports of low correlations between siblings' characteristics. Actually, they ignore the children's

[5] For more on the interplay between genes and the environment, see the literature on epigenetics. For example, Meloni (2014) offers diverse definitions as well as a good review of the most important developments in epigenetics. For a biological approach, see also Baccarelli (2014), and for an explicit integration into sociology of genotype-environment interactions (G × E) and its methodological difficulties, see Seabrook and Avison (2010). In addition, Landecker and Panofsky (2013) reviewed the literature on epigenetics of socioeconomic status and discuss the role of epigenetics in empirical as well as theoretical sociological research.

[6] Behavioral geneticists have long debated the approach to disentangling both effects (see Rende, Plomin, and Vandenberg (1990) and Diewald (2008) for a summary and discussion), but until now no definite solution has been found (Conley, 2011).

[7] See Chapter 2 for a discussion of these theories.

individuality by treating all the children within one family as a single entity.[8] The main conclusion of such research is that it is the parents who either give or do not give their children the kinds of advantages that will improve their future outcomes, such as cultural capital, money, or other resources; the children's individual characteristics are thus disregarded.

These established assumptions have been consistently challenged not only by correlation studies but also by studies on siblings and inequality (Behrman, Pollak, & Taubman, 1982; Conley & Glauber, 2005a; Hertwig, Davis, & Sulloway, 2002). Despite the diversity and breadth of this growing field of research, its main message can be summarized in a few words: children within the same family are not treated the same by their parents nor do they perceive themselves as being treated the same. For example, based on a review of the literature, Harris (2011) concluded that "growing up in the same home does not make children more alike" (Harris, 2011: 32). In this context, Plomin and Daniels (1987) introduced the variable of shared versus nonshared familial environments. They noted that shared environments had no effect on sibling outcome differences but in contrast led to sibling similarities, whereas nonshared environments were experienced unequally by siblings and consequently led to developmental differences between them (see also Dunn & Plomin, 1991). Although this distinction between shared and nonshared environments may be theoretically compelling, such studies present methodological problems or rather data restrictions that cannot be lifted owing to moral issues.[9] Parents' differential treatment of their children is certainly one factor in a nonshared familial environment, however (Boisvert & Wright, 2008).

The fact that siblings reach different educational levels, hold different positions in the workplace, have different incomes, or even exhibit different health behaviors can certainly be explained by familial processes to a large extent. Investigations of

[8] Nevertheless, there is also research on families that treats mothers and fathers as the entity "parents", without further differentiating between their individual characteristics (e.g., Bauer & Gang, 2000; Behrman, Pollak, & Taubman, 1986).

[9] Conley (2011) has published a commentary critical of the paper by Plomin and Daniels (1987) in which he discusses whether their methodological ideas for disentangling the causes of social outcomes in shared and unshared environments are feasible.

siblings and, more generally, of sibship characteristics seek to learn what factors, aside from genetics, lead to different outcomes among siblings.

1.2 The German Case

1.2.1 Research in Germany

Most of the empirical research concerning the effects of sibling configuration on the distribution of development-stimulating resources or the relationship between children's outcomes and the amount of resources they receive comes from the United States. Although some data also come from Asia and other European countries, this field of research has rarely been active in Germany. Even if German studies have been carried out, most of the reports cited in the literature were generated in America (e.g. Boll, Ferring, & Filipp, 2005; Kasten, 2007; Pinquart & Silbereisen, 2009). In Germany, the research has been focused mainly on relationships among siblings, including rivalry (Bauer & Gang, 2000), and on differential parental treatment or parental favoritism (Boll, Ferring, & Filipp, 2001; Kasten, 2007). Most of these studies do not include original analyses but instead deal with the topic theoretically; the studies that do include empirical analyses involve older siblings, a more commonly selected age group; for example, Bauer and Gang (2000) examined the relationship between sibling rivalry and education based on respondents who were 17 to 46 years of age. Nevertheless, some studies have focused on sibling characteristics (not empirically: Kasten, 2001; empirically: Schulze & Preisendörfer, 2013).

This dissertation cites studies that focus on at least one aspect of the relationship between sibling constellations and cognitively stimulating activities in general in Section 2.1 and on the effects of different sibling constellations on parental allocation of resources or children's outcomes in the sections covering empirical results (Chapters 4 to 7, respectively).

1.2.2 German Statistics

Although mothers devote unequal amounts of resources to their children for reasons that should apply to almost all mothers no matter what the national context, there may be reasons attributable to other factors such as differences in cultures and social norms, institutional settings and levels of institutional involvement, and family policies. Compared with other countries, Germany has certain characteristics that must be considered in order to interpret and better understand the results of studies carried out in Germany as well as to allow comparisons of statistical results reported from other countries. Therefore, to provide insights into the population being analyzed here, statistics that pertain to important (family) characteristics in Germany are presented below and include the demographic relationship between number of siblings and maternal characteristics, birth spacing, preschool, and childcare arrangements. In addition, some of these statistics are compared with American statistics to illustrate the structural differences between the two countries. Although comparisons with countries other than the United States would certainly reveal interesting differences, the majority of empirical studies were carried out in America and almost all the empirical studies cited in the following chapter are based on U.S. data.

With respect to Germany, information about families was obtained from the Federal Statistical Office of Germany (Statistisches Bundesamt), the World Family Map (Child Trends, 2014), which summarize statistics from 49 countries from all over the world on various indicators of family well-being, as well as the Organization for Economic Co-operation and Development (OECD) with information on at least its 34 member countries. Because the statistics reported on the World Family Map are derived from different sources, the years of a study for a single indicator may differ for different countries or may change for different indicators for a single country.[10] Similarly, the OECD retrieves information from different data sources within each country. For the United States and Germany, however, the years of investigation are more consistent, and the most recent data available are for 2010, 2011, or 2012, depending on the indicator being analyzed.

[10] For detailed information, see the World Family Map (Child Trends, 2014).

Number of children

In the last century, there have been discussions about decreasing fertility rates and the consequences for society. Although this was the case in Germany during the early 2000s, fertility rates have since increased. In 2011, the average fertility rate in Germany was 1.4, whereas in the United States, the corresponding fertility rate was 1.9 (Child Trends, 2014).

Mother's age. As might be expected, a woman's age at the time of her first birth often determines the number of children she will have: on average, the younger the woman, the more children. For example, the average age of mothers with only one child is 30 years at the first birth, those with two children had their first child at an average age of 27, and those with three or more started having children at an average age of 25 (BPB, 2013).

Mother's education. Women with an academic degree become mothers later in life than do non-academic women, and their difference in age at first birth averages 3 years. However, if a first birth occurs later in an academic woman's life, she is likely to have fewer children than a non-academic woman would under the same circumstances (BPB, 2013). Whereas mothers with less education have on average 1.6 children, highly educated mothers have 1.3 children; between moderately educated and highly educated mothers, the number of children differs only minimally. The reason for these education-related differences can be explained by the length of time spent matriculating (BiB, 2012; BPB, 2012).

Mother's employment. There is a relationship between women's employment and the number of children. Whereas mothers of one or even two children still try to combine work and childcare, mothers of three or more children are significantly less likely to participate in the labor market. To be precise, approximately 23 percent of mothers with one child and 28 percent of mothers with two children are unemployed, but the proportion increases to 49 percent among mothers with three or more children (Keddi, Zerle, & Lange, 2010).

Birth spacing

In 2013, the average time between the first-born and second-born child was 4.1 years, but the median was lower, 3.3 years. However, the average age gap

between the second and third child increased by roughly one year to 4.9 years (median 3.9 years) (OECD, 2013).

Maternal characteristics

Mother's age. Although women postpone having their first child until they are older, most women become mothers before they reach the age of 30. In Germany, the average age of first-time mothers is 29 years (BPB, 2013), and the majority of women already gave birth to their first child with 30 years of age.

Marital status. In Germany, 35 percent of all children are born to unmarried mothers, with a slightly higher percentage, 41 percent, in the United States (Child Trends, 2014). If the indicator is considered a proxy for societal traditionalism or conservatism, Germany would be slightly more tradition-oriented than the U.S. Although a rough measure of traditional attitudes, this factor may at least indicate a tendency. This tendency is also supported by results for the percentage of married couples. Whereas in Germany 52 percent of all couples are married, in the U.S. the percentage is 45 percent. However, slightly contrary to the more conservative tendency in Germany is the fact that 13 percent of couples in Germany are cohabiting as opposed to only 9 percent in the U.S. (Child Trends).

Attitudes toward family life. A better measure of Germany's more conservative tendencies is the view of family makeup. For example, the proportion of Germans who approve the idea that a woman who chooses to have a child as a single parent does not want to have a stable relationship with a man is only 36 percent, whereas 52 percent of Americans agree with this choice. Similarly, only 63 percent of Americans believe that a child needs a home with both a mother and a father in order to grow up happily, whereas 88 percent of Germans are of this opinion (Child Trends, 2014).

Preschool education

German children are participating far more often in preschool education than are American children. For example, in 2012 in Germany, 91 percent of 3-year-olds were enrolled in early-childhood education as opposed to only 39 percent of children in the U.S. (OECD, 2013).

Childcare time

As mentioned earlier, a child's age has an effect on the mother's employment status and is also the main predictor of the amount of time a mother spends on childcare. Data from 2001 and 2002 show that employment also has an effect on childcare time. Unemployed mothers spend more time in childcare of children under the age of 6 than do their employed counterparts, and for both groups the time decreases significantly when the children are between 6 and 18 years of age. Mothers who are employed full time and whose children are younger than age 6 work an average of 6 hours a day from Monday to Friday, whereas their unemployed counterparts do not use their extra time solely for childcare: the latter spend more time not only doing housework but also engaging in social activities, sport, hobbies, and media, as well as sleeping, eating, and attending to personal hygiene. Compared with unemployed mothers, however, employed mothers manage to find on average of 2 hours for childcare by reducing the time they spend on personal activities (Statistisches Bundesamt, 2003).

All in all, the statistics cited above concerning family makeup and lifestyle not only reflect similarities within the German population, but also show how Germans differ from Americans, which are important considerations when one is asked to draw conclusion based on the statistical results in studies from both countries. For example, Germany and the United States differ in the average number of siblings in a family. Because American children are likely to have more siblings as compared with German children, theoretical assumptions about the influence of the number of children are more meaningful in the U.S. Similarly, proxy indicators of traditionalism and conservatism indicate that Germany is slightly more conservative than the U.S. Again, assumptions regarding norms might be more or less distinct in each country. The statistical information provided here is certainly not exhaustive but rather serves to orient the reader regarding the character of the German populace.

1.2.3 Structural Characteristics

Population statistics alone do not characterize a country; its structural features, such as social expenditures by the government, employment situations and benefits, and parental and public assistance programs, are also an important aspect to which the inhabitants are exposed and must adapt their lives.

Government social spending. One structural indicator is governmental spending on social programs. In 2013, Germany spent 26 percent of its GDP on such expenditures, where the U.S. spent only 20 percent (OECD, 2013). Similar patterns emerge when one considers family benefits alone. More precisely, the OECD states that in 2011 Germany spent 0.9 percent of its GDP on family allowances in contrast to only 0.1 percent in the U.S. Thus, German citizens seem to profit at least financially from their country's more generous administration.

Employment. Harmonized unemployment rates ranged from 5 percent in Germany to 7 percent in the United States in 2013. However, the German rate has been continuously decreasing since 2005, when it was 11 percent. In the United States, the corresponding unemployment rate was 5 percent, which rose to almost 10 percent in 2010 but has again decreased to 7 percent (OECD). It should be noted, however, that Germany has disproportionately more part-time workers than does the U.S. (22% vs. 13% in 2012) (OECD). This affects women, particularly mothers, more than men because they work more often part-time (BPB, 2013).

The employment status of mothers depends strongly on the age of their youngest child. The majority of mothers with children younger than 3 years of age do not work (68%), but the largest proportion of this group is made up of mothers whose youngest child is under 1 year of age; only 9 percent of these mothers with infants are employed, and then most of them work only part-time. As their children get older, mothers are much more likely to be employed: 62 percent when the youngest child is between 3 and 6 years of age and this percentage remains about the same until their children reach the age of 18 years, when it rises to 73 percent (BPB, 2013).

Parents' rights and public assistance. In Germany, parents are statutorily supported not only by job security but also by transfer payments received for the period following a child's birth. Both forms of assistance are given to parents who foster their children themselves and therefore work only part-time or not at all. The following paragraphs summarize the parental allowance policies in effect in Germany.

Parental leave and pay rights have been repeatedly changed and modified. Since 1952, pregnant women who are employed are legally protected in terms of leave periods and reemployment. Based on statutory laws about maternity leave, expectant and new mothers can suspend work without fear of losing their jobs. Although the duration of such leave periods was subject to changes in the past, it has remained substantially unchanged during the last decade,[11] and one or both parents can leave their jobs or reduce working hours to a maximum of 30 hours for up to 36 months to care for their child with the guarantee that the same job position will be open for them.[12]

Before 2007, parents could receive monthly benefits for a maximum of 24 months, although, if eligible, they could choose to receive a higher monthly allowance for 12 months. Parents were entitled to a fixed payment independent of their previous income but the amount was reduced if parental income exceeded predefined thresholds.

In 2007, new laws were again introduced. The main change was in the calculation of the benefit amount (Drasch, 2011). Since that date, mothers or fathers have been entitled to a parental allowance for 12 months, but if both share parental leave, it is paid for a maximum of 14 months. Before 2011, parents received 67 percent of their previous income, with minimum and maximum thresholds for the benefit amount; after 2011, the percentage was adjusted downward for mothers and fathers whose income exceeded certain thresholds. Moreover, top wage-earners are paid no parental allowance at all. Parents with more than one child receive a sibling bonus if, in addition to the newborn child, one child under the age of 3 years or at least two children under the age of 6 years are living within the household. Mothers are thus financially encouraged to have more children within short time periods (BMFSFJ, 2010).

[11] There have also been changes before 2007. Since 1952, employed women were guaranteed a 3-month maternity leave, which was increased incrementally to 6 months in 1979, 10 months in 1986, 12 months in 1988, 15 months in 1989, and 18 months in 1990 (Drasch, 2011). As of 1992, maternity leave has been held constant at 36 months.

[12] Certainly, although the return to one's job is guaranteed by law, there may still be consequences for an employee. As summarized by Drasch (2011), the laws try to protect mothers' reintegration into the labor market, but they are often abused by mothers as a way to leave a job or by employers who dismiss a woman quickly after her return or exclude her from job training or other benefits.

Apart from these benefits for very young children, parents are also eligible to receive benefits based on the number of children living in the same household. For each child up to the age of 18 years (and under certain circumstances even longer), the parents receive a fixed child benefit allowance. Until 2008, the amount was equal for the first three children and was increased for each additional child. Since 2009, not only have these allowances gotten higher, but also the benefits are distributed differently according to the number of children. Parents receive equal amounts for the first two children, slightly higher amounts for the third child, and even higher amounts if they have four or more children (BA, 2015).

In summary, although expenses rise with each additional child, parents with more children and shorter lengths of time between births enjoy preferential treatment from a financial point of view. Thus, parents might decide to have more children at more frequent intervals to receive greater governmental benefits.

1.3 CONTRIBUTIONS

Each chapter of this dissertation is devoted to specific areas of interest and results of relevant studies, but more general contributions to this field are also provided. As previously noted, research on inequalities among siblings has focused on siblings' outcomes but has rarely included data from Germany. Using data from the German Socio-Economic Panel (SOEP), this dissertation focuses on the early phases of a child's life – that is, preschool age – because it is during this period when families have the strongest influence on children and parental nonmaterial resources are especially important for a child's development. This dissertation looks at how these resources are distributed among children based on different sibship characteristics. However, it does not focus on only one characteristic, but includes the number of siblings, birth spacing, sex of siblings, and birth rank as well as some of these characteristics in combination. Although previous studies have also investigated sibship characteristics, their aim was to explain children's outcomes but they failed to elucidate the underlying mechanisms. By examining the relationship between the sibling constellation and the allocation of resources

among siblings, this dissertation strives to uncover the mechanisms responsible for producing inequalities between different persons and, specifically, between siblings. To reach this goal, both theoretical and empirical contributions will be offered.

Theoretical ideas from various scientific domains are presented to explain the relationship between sibling constellation variables and the distribution of maternal time. Theoretical debates concerning the distribution of resources based on sibship characteristics are rather rare, and until now, more general theories in this regard were seldom applied to sibling inequalities. While suggesting possible theoretical candidates for each sibling characteristic, this dissertation also, whenever possible, subjects contradicting theories to empirical tests. In some cases, existing theoretical ideas cannot thoroughly clarify possible relationships, so a new explanation is offered – the "resource augmentation hypothesis" – which seems to hold true under certain conditions, at least empirically.

Investigations of siblings must focus on within-family analyses in order to discern the true effects of family. Therefore, not only interpersonal but also intrapersonal analyses have been carried out. When within-family analysis was not possible owing to data requirements, individuals from different families were compared to each other. Moreover, this dissertation uses a unique instrument for measuring cognitively stimulating activities that mothers engage in with their children. Its advantage is that the mothers themselves were asked to report how many times a week they undertook various activities with their children, and the frequency was determined for each individual child. Hence, detailed information on specific children and specific activities was made available, so it was not necessary to use a different instrument on the overall time spent in childcare with all the children in a given family.

Thus, this dissertation contributes information not only on the topic of sibling configuration and resource allocation, a somewhat neglected issue until now, but also on theoretical as well as empirical innovations.

1.4 STRUCTURE OF THIS WORK

The rest of this dissertation is structured as follows. Chapter 2 describes the theoretical context of this work. First, the importance of cognitively stimulating activities for children is discussed, followed by a section on definitions and on the main theoretical ideas for explaining the relationship between sibship characteristics (number of siblings, their birth spacing and sex composition as well as birth order) and the distribution of maternal activities. Within the framework of the life course perspective, these theoretical approaches are based on parental action, according to the subcategories of economics, heuristics, and social norms. The newly developed resource augmentation hypothesis is then introduced, which compensates for the lack of the other theoretical ideas. The chapter ends with a summary of these theoretical considerations.

Chapter 3 provides information about the data, measures and operationalizations, and methods used. It begins with a general overview about the potentials and limitations of the used surveys, the German Socio-Economic Panel (SOEP) and Families in Germany (FiD), followed by a more detailed explanation of the data used in the analyses. The operationalizations of the dependent variable (i.e., frequency of cognitively stimulating activities) and of all the independent variables are then clarified. Section 3.3 on measures, however, describes only those variables used in all the models presented in this dissertation. Specific operationalizations of the variables used in the four empirical chapters (Chapters 4 to 7) are explained in the respective chapters (see below for individual descriptions of these four chapters.) Section 3.4 delivers an overview of the data in terms of descriptive statistics for the whole sample. Finally, Section 3.5 offers the analytic strategy by outlining the specific methods applied; note that these methods differ depending on the questions posed in each of the four empirical chapters, so they will be mentioned again in each respective chapter.

Chapters 4 through 7 present the empirical results of the dissertation. They are all similar in structure but deal with different sibship characteristics, as follows:

Chapter 4 investigates the effect of the number of siblings on the frequency of cognitively stimulating activities mothers engage in with their preschool children. After an introduction, which lists the main contributions to the present study, the theoretical background is presented, that is, the resource dilution and resource augmentation hypotheses. After a short description of the data and methods,

Section 4.4.2 explains which independent variables are used and how they are operationalized, and Section 4.4.3 presents the descriptive statistics. It is followed by the results obtained using the random effects and the fixed effects models and ends with a discussion of the key findings.

Chapter 5, the second empirical chapter, considers birth spacing between siblings as the main independent variable and analyses its effect on the amount of cognitively stimulating activities a child receives from the mother. Again, it consists of a short introduction, contributions of the present study, descriptions of the data, methods, the main dependent and independent variables along with descriptive statistics. These subsections are followed by the results, which are respectively described for each of the two model variants: one for children ages 2 to 3 years and one for their older counterparts, ages 5 to 6. The chapter includes a sensitivity analysis and concludes with a discussion of the results.

Chapter 6, the third empirical chapter, describes a study of the sex composition of the sibship and how it affects maternal activity frequency. Following an introduction and the study's contributions, an overview of previous research is given, as well as possible explanations for the relationship between these two factors. This part is followed by a report on the data used, the analytic strategy, and the operationalizations of important independent variables. The descriptive statistics and results are then presented in detail, and the chapter ends with a discussion and conclusions.

Chapter 7, last empirical chapter, concerns the effects of the number of siblings, birth order, and a child's gender on a mother's investment in time spent with her children. Chapter 7 begins with an introduction and contributions, provides the theoretical background, and describes the data used, the methods, the operationalizations of relevant variables, and descriptive statistics. Similar to the other empirical chapters, Chapter 7 then presents the results in detail and ends with a discussion and conclusions.

Chapter 8 begins with a summary of the main results of each empirical chapter and ends with some general conclusions, discusses appreciable results of the earlier chapters, and offers suggestions for the direction of future research.

2 THEORETICAL CONSIDERATIONS

Empirical evidence has again and again shown that inequalities are consistently reproduced by generation after generation. This relationship has been investigated predominantly with respect to educational or labor market outcomes (Björklund, Jäntti, & Solon, 2007; Blau & Duncan, 1967; Corak, 2004; D'Addio, 2007; Heineck & Riphahn, 2007) but also for other outcomes such as antisocial behavior (Thornberry, Freeman-Gallant, Lizotte, Krohn, & Smith, 2003), attitudes (Dohmen, Falk, Huffman, & Sunde, 2014), or divorce (Teachman, 1995). The disciplines that most often deal with the continuous correlations between parents' and children's outcomes are biology (in particular genetics), psychology, the social sciences (primarily sociology) and economics. However, the investigation of correlations per se does not suffice to understand why they exist, it is important to understand how this relationship between parents' and their offspring with respect to outcomes is produced (Black & Devereux, 2010). Although all disciplines take different basic approaches to explain this relationship, they agree on one point: children's success in many life domains depends on the kind and amount of resources they receive from their parents.[13]

Sociological models of intergenerational inequality group individuals into social classes. There are different ways of defining such classes[14] (Erikson &

[13] In addition to resource distribution within families, the field of biology offers a second explanation for the intergenerational transmission of inequality: the heritability of genes (Turkheimer & Waldron, 2000). As discussed in Chapter 1, to gain an overall comprehension of the forces driving the relationship between parents and children, studies combining different disciplines would be desirable (Diewald, 2010).

[14] The most commonly used class scheme in social research is the Goldthorpe typology (Erikson & Goldthorpe, 1992), which is based mainly on employment relations (Erikson & Goldthorpe, 2002).

Goldthorpe, 2002; Wright, 2005), but no matter which class scheme is chosen, the transmission of inequalities emerges when families of different social classes distribute their resources among the next generation, particularly resources that are necessary for success in life or that will at least facilitate its achievement. The main contention is that families from different social classes are not equally equipped with the types and amounts of resources that can be passed on to the next generation. Based on theories about social class, the resources of families in higher classes are greater and more valuable than those available from lower-class families, and children of higher-class parents profit from the advantageous resources given to them. These resources may be both quantitatively profitable, such as in the form of money given to a child for better school equipment, and qualitatively profitable, such as when a child is provided with cognitively stimulating activities such as reading to children instead of watching TV.

All in all, it is assumed that resources are passed down from the older generation to the younger generation, but studies to determine the mechanisms underlying such transmission have not been forthcoming. Although some theories touch on these kinds of relationships, such as Boudon's (1974) assumptions about the primary and secondary effects of educational decisions, they are not able to predict how parents will allocate resources among their children, whether equally or non-equally. In a nutshell, social stratification research assumes, not necessarily explicitly, that families influence all their members in an equal way (Conley, 2008) – that is, within the same family, parents treat all the children similarly or even equally and resources are distributed equally among siblings. Thus, in most cases, studies that rely on sociological models lack a framework for interpreting and explaining their empirical results in more depth.

In contrast, economic models do offer such a behavioral framework (Becker & Tomes, 1986). The transmission of resources within the family is directly modeled as rational decision-making, including parental choices about how to distribute their resources among their offspring. Based on the family income and a child's endowments or abilities (Mulligan, 1997), parents choose the amount of resources they want to consume themselves and, at the same time, how much they want to give their children in the form of direct transfers and how much they want to invest in their children's human capital. Although the economic literature

makes assumptions about the allocation of resources within families, parents will always act rationally to maximize an outcome, mainly the wealth or income of their children. Nevertheless, parental decisions about resource allocation may be influenced by factors other than maximization, such as social norms regarding a child's gender or birth order.

On the one hand, sociological theories concerning the intergenerational transmission of inequality have neglected to account for variations between siblings within the same family. This is partly compensated for by the use of economic theories, which are confined to more rational explanations.

2.1 Cognitively Stimulating Activities

Parents distribute not only material resources among their children, such as money or toys, but also nonmaterial resources, such as time. This distinction is necessary because, as Downey (1995) suggests, changes in the sibling structure seem to have different effects on the distribution of nonmaterial versus material resources. Because material resources are finite in character, they must be divided more strictly among siblings. Nonmaterial resources are not finite at all, and the amount can be increased more easily and in addition, they are easier to share among siblings. For example, parents may have saved a certain amount of money over their lifetime to be spent for their children's education. Since each child needs money for education, parents need to split the money up, so that each child gets only one slice of the money pie. In contrast, the amount of time spent with children may be increased or decreased according to each child's needs, but it may also be shared with siblings, as, for example, when the mother reads a book aloud to more than one child at once. Therefore, the differentiation between nonmaterial and material resources is necessary (see also Lawson, 2009); however, in this dissertation, only nonmaterial resources are investigated. The literature has shown that children profit more or less from each of these two categories depending on their age group. While financial resources from parents are more likely to benefit older children and teenagers, parental time and attention are more

advantageous for young children, particularly those of preschool age (Cunha & Heckman, 2008; Downey, 1995). Still, it is not time spent with children per se that matters, but rather what activities are engaged in during that time.[15] In her dissertation, Hsin (2008) showed that the amount of cognitive stimulation, or more precisely the types of activity and level of verbal stimulation, is the key factor.

To be sure, cognitively stimulating activities are of particular interest in sociological research because they have been shown to promote children's skill development (Cunha & Heckman, 2008; Gauthier, Smeeding, & Furstenberg, 2004; Hackman et al., 2010; Hofferth & Sandberg, 2001; Hsin, 2006; Villena-Roldán & Ríos-Aguilar, 2012; Zick, Bryant, & Österbacka, 2001). In turn, these activities are a strong predictor of individual disparities in life outcomes (e.g., education, earnings, health, well-being, and deviant behavior later on in life) (Heckman & Kautz, 2012; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). The extent of activities parents engage in with their children is therefore a crucial factor for the emergence of inequalities.

The literature on cognitive stimulating activities has taken several directions, most of which tend to stem from sociological as well as psychological research. All in all, activities were rather used as explanatory variables, particularly to explain a child's outcomes. For example, Yeung, Linver, & Brooks-Gunn (2002) showed that cognitively stimulating activities (e.g., the letter-word score) act as mediators between parental income and a developmental outcome.

As with sibling configurations, time spent with children is also confounded by other variables. To begin with, better-educated mothers seem to spend more time with their children not only in general (Guryan, Hurst, & Schettini Kearney, 2008) but also in cognitively stimulating activities (Leibowitz, 1974). Interestingly, most mothers with higher levels of education spend more hours working than do mothers with less education, but the time spent in stimulating activities with their children does not differ significantly from that of women who work less or do not work at all (Hsin & Felfe, 2014; Huston & Rosenkrantz Aronson, 2005). Theoretically, this is an important point because higher-class parents tend to

[15] See Section 2.2 for a discussion of class-specific parenting styles.

engage more often in these kinds of activities than do lower-class parents (Lareau, 2011) (see Section 2.1.1).

Income might also play a role in determining the amount of activities. Downey (1995) explains that parents with low incomes meet only the basic needs of their children, but an increase in their income leads to a rise in the investments they make in their children. This finding is only partly applicable to the issue of cognitively stimulating activities because money is not necessarily needed to engage in them. Still, the availability of financial resources certainly makes it easier to provide special, age-specific educational toys or books (Yeung, Linver, & Brooks-Gunn, 2002).

2.1.1 Definitions/Explanations

From the economic point of view, cognitively stimulating activities are considered parental investments, defined as all types of parental resources that have a positive effect on a child's later success, for example, in skill development, school grades, or income. Similarly, these activities can also be evident in sociological theories regarding the transmission of inequalities between generations. According to Lareau (2011), one parenting practice intended to promote children's later success through the transmission of cultural capital is "concerted cultivation". The key to this practice is that, in these families, children's leisure time tends to consist of structured activities organized by adults (Lareau). This parenting practice also applies to cognitively stimulating activities. Both economic and sociological definitions are not mutually exclusive, however. First of all, parenting practices can also be considered "investments" if they are positive for a child's life success. Since parents who practice concerted cultivation aim (consciously or not) to enhance children's later outcomes, this practice is always an investment. But concerted cultivation is not an exclusive investment, for example, parents may also pay to protect their children's health or to provide good-quality food. Lastly, to invest in their children, parents need to have access to applicable resources. Parental resources may be material (e.g., money or food) as well as nonmaterial

(e.g., time and attention).[16] Nor do parents' resources have to be used exclusively for investments in their children; for example, parents may spend financial resources as well as time if they go out to dinner alone, without their children, or, in an extreme case, if they beat their children in order to discipline them.

In summary, in this dissertation, the cognitively stimulating activities mothers engage in with their children are termed investments and are seen as one aspect of concerted cultivation; the time spent on these activities is a resource used by mothers to make this investment.

2.2 Parental Action

All investment strategies assume that parents have a sufficient amount of resources to be able to pass them on to their children. Moreover, different amounts of resources may lead to different strategies. This is particularly clear when it comes to material resources such as money. On the one hand, if parents do not have enough money available, they cannot allocate funds to their children, and the discussion about their eventual decision strategies becomes moot. On the other hand, research has shown that parents act in different ways according to their resource availability (Conley & Glauber, 2008; Dahan & Gaviria, 2003). For example, Aizer and Cunha (2011), Cardona and Diewald (2014), and also Hsin (2009) found that parents who face resource constraints tend to concentrate their investments on the more able child, whereas parents who have no limitations tend to compensate for the less well-endowed child.

But the story changes when it comes to nonmaterial resources such as time, because all parents are equally equipped with this resource. They may choose how they want to spend each hour of the day, provided they are not faced with extraordinary circumstances such as disability or illness or have other obligations

[16] This is a very general albeit sufficient classification of resources for the purposes of this dissertation. However, other authors classify resources in more detail (Blake, 1981; Hertwig et al., 2002). See also Section 2.1.1 in Chapter 2 on nonmaterial and material resources.

that do not allow for individual choices about how to allocate their time. This is not to say that certain countries or cultures do not differ in terms of how people spend their time, but within Germany such differences should not present much of a problem.

In conclusion, the amount of time parents initially have available to distribute among their children is always positive and never zero, so parents are always able to provide resources to their children. In addition, time is a universal resource, equal for each person, so parental investment strategies should not differ based on variations in the amounts of available resources.

2.2.1 Economics

Until now, studies of parental investment behavior either have not been modeled at all, and the models have been rather one-sided and limited to parents as optimizers. Cardona (2014) argues that models based on biology or economics traditionally assign parents the role of "optimizers". From the viewpoint of evolutionary biology, parents hope to maximize reproductive success by investing resources in their offspring, whereas from the viewpoint of economics, parents hope to maximize the "quality" of their children (Becker, 1981), that is, their children's wealth when they become adults, a product of the child's own endowments, the resources invested in each child, and the extra income eventually earned by the child later in life (Hertwig et al., 2002).

Again, different resources might be differently distributed among siblings. Time spent with children is certainly of special value, since all families – and, more specifically, all mothers – have time available for this purpose. Certainly, the cost of childcare provided by the mother varies with her human capital endowments, since income earned in the labor market is lost if she stays at home. Therefore, mothers with considerable human capital and whose families have a relatively high income – and therefore high opportunity costs – might choose to work and to compensate for the time they would have spent with their children by electing to employ childcare substitutes such as daycare or help provided by siblings or grandparents (Becker, 1983).

As long as parents assume that all their children will achieve identical outcomes, they would have no reason to accord privilege to one child over another, so they will invest the same amount of resources in each of them. Briefly, the "quantity-quality" model (Becker & Lewis, 1973; Becker & Tomes, 1976) predicts that the characteristics of quantity and quality of children are tightly linked, meaning that increases in child quantity lead to decreases in child quality owing to an equal distribution of resources among siblings. However, if there are discrepancies in the expected outcomes among siblings as a result of their different skills and abilities, then the parents should invest more resources in the more able child (Becker, 1986) as a way to maximize that child's outcome. However, Behrman et al. (1982) suggests that parents are naturally averse to the notion of inequality among their children and therefore still try to strive for equal outcomes even if their children are not all similarly endowed. In such cases, parental resources should not be distributed equally, nor should they be concentrated on the more able child; instead, the less well-endowed siblings should receive more resources to compensate for this disadvantage and to bring the outcomes of all the siblings in line.

Despite considerable interest in these assumptions, both theoretical and empirical, they have rarely been tested with respect to differences in parental investments among their children (Black et al., 2004). Research designed to test the family-maximization model has shown mixed results. On the one hand, studies have found that parents invest in children's education and human capital in a reinforcing manner, meaning that the more able children receive more resources than the less well-endowed children (Akresh, Bagby, Walque, & Kaziang, 2010; Behrman, Pollak, & Taubman, 1986). On the other hand, earlier work by Behrman et al. (1982) suggested that parents invested educational resources in a compensatory way, that is, the less able children received more parental resources than the more able children. Hsin (2006) offered more differentiated findings. The factor of birth weight influences whether resources were distributed in a compensatory or a reinforcing manner. Lower birth-weight children received more resources from poorly educated mothers, whereas normal- or high-birth-weight children received more resources from better educated mothers (Hsin, 2006). Parents' income also seems to be an important factor in resource investment decisions. Assuming no differences among siblings in terms of their individual abilities, Dahan and Gaviria (2003) reported that low- and middle-

income parents in Latin American countries made human capital investments in only a few children to ensure that those children's outcomes would be maximized.

Considering the results of all these studies, it is often difficult to compare them and even more difficult to generalize about them because of the diversity of the data and methods used. Nevertheless, the empirical evidence gathered so far suggests that siblings are treated differently by their parents and hence receive varying amounts of resources according to a child's birth order and gender.

Although the economic optimal behavior model dominates in explanations of parental resource allocation behavior, some objections must be raised. For one thing, parents in the real world differ from those posed theoretically because the former cannot know everything about their "child's endowments… [or] know the exact functional form of skill formation…; [they are not] capable of allocating, in real time, just the right amount of nourishment, toys, emotional support, cognitive stimulation, and other parental inputs that will produce the best possible outcome in all their offspring many years into the future" (Cardona, 2014: 2). Gigerenzer offers an example to illustrate the practicability (or lack thereof) of such choices in everyday life (Gigerenzer, 2004: 62): "A decision theorist from Columbia University was struggling whether to accept an offer from a rival university or to stay. His colleague took him aside and said, 'Just maximize your expected utility – you always write about doing this.' Exasperated, the decision theorist responded, 'Come on, this is serious.'" The assumptions in economic theory demand the computation of seemingly unsolvable equations, requiring one to consider everything that might have an impact on a child's outcome; this would include translating different forms of investments (such as toys, conversations, or a visit to a museum) into a kind of "common currency" (Hertwig et al., 2002: 102). Despite the fundamental criticism of the economic theory, other models of parental behavior have been rather neglected up to now. However, Cardona (2014) has introduced two different resource investment strategies, modeled as heuristic-based and norm-oriented, that do not demand such tremendous computational power and absolute knowledge of the environment and take into account the possibility that parents may have different motives and goals.

2.2.2 The Heuristic-Based Model

Considering that people do not have unlimited time, knowledge, and computational power (Todd & Gigerenzer, 2000: 728), a more realistic approach to behavior strategies has been developed: heuristics. Its main determining characteristic of this model is that decision-making is based on a simple rule that consciously or unconsciously ignores information but is nevertheless efficient. Intuitively, this method should predict outcomes worse than methods that include more information, such as approaches that maximize economic utility, but research indicates that under certain circumstances heuristic strategies may actually result in more accurate decisions (for examples, see Gigerenzer & Gaissmaier, 2011). Various types of heuristics apply to different situations and conditions; however, regarding parents' decision about how to allocate resources among their children without knowing each sibling's ability and skill level, only two heuristics can be extracted from the literature: the 1/N rule, or equality or resource dilution,[17] and the "one-clever-cue heuristic", which relates to reinforcement and compensation (Gigerenzer & Gaissmaier, 2011; Cardona, 2014).

2.2.2.1 The 1/N rule, or equity heuristic, or resource dilution hypothesis

Parents may apply a simple heuristic when deciding how to allocate resources among their children. The 1/N rule (in this context, N stands for number of children) requires an egalitarian distribution of resources, so that each child receives the same amount of a given resource (e.g., time spent with his or her parents). The literature on the effects of sibling composition also contains the so-called "resource dilution hypothesis" (Hertwig et al., 2002), which makes exactly the same assumptions as the equity heuristic but includes outcomes. In its initial form, it was worked out in 1890 by Arsène Dumont and derives from his "law of

[17] Following Hertwig et al. (2002), the terms "equity" and "equality" are used interchangeably in this dissertation.

capillary action", which states that an increasing number of siblings will limit the resources available for each individual child, and the amount of received resources, in turn, will affect a child's social mobility. Similarly, although the resource dilution hypothesis was implicit in some studies long before Blake (1989) (e.g., Anastasi, 1956), this more recent work has solidified it. The resource dilution hypothesis postulates that parental resources are finite and are distributed equally among siblings. As the sibship size grows, the amount of resources needs to be divided again and again and thus gets diluted for each child. Resource inputs are essential to future child outcomes, and the amount of received resources will influence the quality of these outcomes. It follows that each child's "piece of the pie" of parental resources gets smaller and smaller with the birth of each additional sibling. The resource dilution model considers "money, space, and, perhaps most importantly, parental time and attention" to be dilutable resources (Conley, 2004: 65).

The equity heuristic predicts that all children should get the same amount of resources from their parents. Therefore, the main sibling constellation characteristic for determining resource distribution is *number of siblings*. Hertwig et al. (2002) stressed that even if all children receive the same amount of resources, it can still lead to inequality. The driving forces are two other sibship constellation variables: birth order and age spacing between siblings. Unless the children are born twins, the first child will receive all the available parental resources up to the moment when a second child is born. The second child can never profit from being the only child in the household, as the first child did, and from the start will receive only half the available resources. It is even worse for the third child, who will receive only one third of the resources available if the parents apply the equity heuristic (see Figure F1 in the Appendix for an illustration of the relationship between birth order and the amount of resources a child receives).

Nevertheless, Hertwig et al. (2002) assume that the last child to be born into a household may have an advantage if the first and middle-born (if applicable) siblings move out while the last-born child is still living at home. At this point, he or she would be likely to receive the same amount of resources as the first-born child. In addition, longer times between births reinforce the effect of birth order. Wide age differences between siblings imply longer periods in which the first-

born child will benefit from all the resources available, and the total amounts of resources received between the births of additional siblings will be even higher. On the contrary, the smaller the age gaps between siblings, the more similar the amounts of resources they will each receive.

However, an objection, also noted by Hertwig et al., must be raised in this regard. As mentioned above, certain resources do not have a universal impact on a child's life but are instead more or less effective depending on the child's age when they receive such benefits. Because these sensitive and critical periods occur during early childhood, the advantage to the last-born child of receiving all the available resources once the older siblings have moved out will be diminished simply because by that time the remaining child will usually be too old to benefit from his or her birth status. Therefore, the surplus advantage gained through greater spacing between births is particularly important for young children and mainly profits first-born children. In effect, the number of siblings, which is the main variable explaining the equity heuristic, not only dilutes the amount of parental resources available for each child, but must also more or less indirectly involve birth order and even birth spacing for it to have an effect on parental resources.

The equity heuristic has also received some criticism. Its main advantage, the fact that it is so simple, is also its main disadvantage. How can parents ignore a child's individual abilities or needs and his or her associated chances in life? Hertwig and his colleagues call such claims "naïve" (Hertwig et al., 2002: 728). Even if the resource dilution hypothesis predicts that the addition of siblings to a child's household is detrimental, it may also have a positive impact, either through the effects described below concerning the "resource augmentation hypothesis" or, as Zajonc (1976) assumes, through positive, instructive, profitable interactions with siblings.

2.2.2.2 The "one-clever-cue heuristic"

The "one-clever-cue heuristic" (Gigerenzer & Gaissmaier, 2011) applies when decisions are made based on a child's particular characteristic, dubbed the "cue". In parental decisions about resource allocation, reinforcement or compensation is based on such cues. A prominent example of a cue is skill level. Parents will

notice whether one of the children in their household is better or worse equipped than another and, based on this cue, will decide to give that child more or fewer resources, respectively (Cardona, 2014). Such cues may vary from family to family. In terms of children's characteristics, the cue might be, for example, their birth order or the gender of the child or its siblings.

With regard to gender of the whole sibship, the sex minority hypothesis and the revised sex minority hypothesis try to explain the relationship between sibling sex composition and parental resource allocation. According to Rosenberg's sex minority hypothesis (1965), a child takes advantage of being outnumbered by siblings of the opposite gender by receiving special attention for being of the minority gender. The effect should be even more exaggerated if a child is the only girl or the only boy among many children of the opposite sex. In such cases, the cue would be a combination of the number of siblings and the children's genders.

In contrast, Conley (2000) has suggested a revision of Rosenberg's sex minority hypothesis. He claims that children benefit from having siblings of the same sex while opposite-sex siblings are detrimental. Again, the cue here is a combination of number and sex of siblings, but unlike the sex minority hypothesis, a child would presumably get more attention if it is in the sex majority. Conley provides three possible explanations for his assumptions, only one of which can be applied to the decisions about parental allocation of time resources (instead of educational attainment). Gender-specific investments in children may yield returns to scale through a combination of gender-specific activities. For example, a mother can read a gender-specific book to multiple siblings simultaneously only if all the children are of the same gender. If both genders are represented, she must read two different books, one adapted to boys and one to girls. But since the mother's total daily childcare time is predetermined, restricted due to the fact that days consist of 24 hours, the total number of books she can read will be limited when the siblings' genders are mixed. Certainly, it is questionable whether one needs to take into account sex-typing when considering the activities that mothers engage in when their children are very young. But as Conley mentions, certain items – which can apply to types of activities as well as to the materials or toys used in these activities – tend to be rejected by children because they are thought to be

sex-specific. This bias is internalized in both children and parents as a result of sex-specific socialization.

2.2.3 The Norm-Oriented Model

Along with parental behavior based on optimal principles or heuristics, social and cultural norms may influence parental decisions about how to distribute their resources among their children. Certainly a child's gender and birth order are two of the most familiar norms; they have prevailed throughout history and in some cultures may still prevail in more extreme forms. Notable examples can be found in Asian countries such as China, where the preference for a male offspring can result in sex-specific mortality and abortions or even infanticide, which in turn has led to skewed sex ratios in these countries.[18]

Even in countries where the son preference is less pervasive, gender preferences still exist, such as the persistent effort to maintain patriarchal lineage patterns as well as to consider the male as head of the household and the expectation that the children will provide help, particularly financial, later in the parent's life (Brockmann, 2001: 190; Buchman, 2000). But Brockmann (2001) argues that the preference depends on the types of services a welfare state provides. She hypothesizes that the preference for female children increases with the degree of state benefits because of the positive relationship between welfare services and women's participation in the labor market. In addition, even if women work, they tend to be the gender who is responsible for the household. Daughters are more likely to provide help with household tasks compared to sons. Brockmann argues further that even if the state provides services for the elderly, such as public pensions, biological daughters are still the primary caregivers when they come of age. Therefore, parents who have a daughter rather than a son expect that she will be of greater help to them than a son would be. Finally, according to Brockmann, increased participation in the labor market reduces the financial differential

[18] For a deeper understanding and discussion of the consequences of such practices, see Hesketh, Lu, & Xing, 2011, or Sen, 1992, 2003, and the references cited therein.

between daughters and sons, allowing daughters to support their parents financially (Brockmann, 2001). All in all, the previous preference for sons might be superseded by indifference toward children's gender.

Birth order may also play a crucial role in decisions about resource distribution. This characteristic has been valued in traditional and former cultures and in so-called "Confucianism-influenced" societies (Yu & Su, 2006: 1059), and it may still hold true in some more modern societies. The most prominent is the practice of primogeniture, the preference for the first-born child, which is often observed in combination with gender, meaning the first-born male gets all or the majority of parental resources (see, for example, Hrdy & Judge, 1993; Lawson, 2009). As mentioned before, boys have been traditionally favored over girls, and the first-born son is still seen as the "heir to the throne" who inherits the parent's role in society (for Taiwan, see Yu & Su, 2006). Although this belief no longer seems to be the case in modern societies, it may still be the norm in some cultures.

2.3 The Resource Augmentation Hypothesis[19]

A logical consequence of the quantity–quality model and the resource dilution hypothesis is that the transition from no siblings to one sibling represents the greatest loss of resources from the perspective of the first-born child. For example, a mother with an only child might spend 10 hours a day caring for that child. According to the logic of resource dilution, the appearance of a sibling would decrease the time the mother spends with the first-born by 50 percent. The effect of two, three, or more siblings would be less detrimental because the appearance of a second sibling would reduce maternal childcare time from 5 hours to 3.3 hours, a further decrease of only 16.7 percent, while a third sibling would result in a

[19] The resource augmentation hypothesis was first proposed in 2012 in the framework of a working paper co-authored by Andrés Cardona, and some parts of this dissertation have been drawn from this paper (Osmanowski & Cardona, 2012).

further reduction of only 8.3 percent. In short, as the size of the sibship increases, the negative effect of the appearance of each additional sibling decreases.

In truth, there are reasons to believe that the presence of siblings does not necessarily have the negative impact predicted by the quantity–quality model and the resource dilution hypothesis; it might even lead to resource gains. Siblings may not always constitute a source of competition for scarce time resources, as the dilution hypothesis asserts, but rather a source of resource gains, at least for some types of resources. We call this the "augmentation hypothesis" and argue that it is a plausible alternative explanation for the relationship between sibship size and time resources received by children if one considers the potential advantages, such as the reallocation of maternal time, efficiency gains, the public-good character of maternal activities, and the shift of childcare to older siblings (Osmanowski & Cardona, 2012). With each additional child, the mother might learn from experience how to use her time more efficiently without reducing the time she spends with each individual child. Mothers might even increase the frequency of activities despite having a fixed amount of time available for childcare.

Thus, higher numbers of siblings may not always have a detrimental effect but may also be seen as positive. This may happen through two mechanisms. On the one hand, mothers might engage in activities with more than one child simultaneously, in which case certain activities would be considered a form of sharing and thus a public good (e.g., reading a book aloud or painting with more than one child in attendance) (Folbre, Yoon, Finnoff, & Fuligni, 2005). On the other hand, mothers might combine activities and accomplish them in the same amount of time. For example, a mother can at once care for one child who paints and for another who is looking at picture books. This dual resource leads to returns of scale for mothers, because they do not always have to spend the same amount of time with each child but can maintain a constant level of attention without decreasing the time spent with each individual child even if the number of children increases. In addition, children may profit from the spillover effects of being able to share certain group activities with their siblings, and a sibling might suggest a new activity that wouldn't have been considered without their input. Changes in the number of children may also result in a reorganization of the mother's daily schedule; for example, when she devotes less time to housework or

sleep (Bianchi, 2011; Cáceres-Delpiano, 2006), she will free up more time for childcare. To be sure, time reallocation strategies can also lead to resource dilution. If time reallocation occurs during childcare activities, as when the mother shifts from engaging in cognitively stimulating activities with her children to fulfilling their basic needs, such as providing meals, the resources become diluted. In fact, even with an overall increase in the time spent with her children, a decrease in cognitively stimulating activities can occur (Downey, 2001).

Finally, older siblings can be seen as resources themselves if they help the mother by taking over some childcare activities (Lamb & Ahnert, 2007). This is especially the case when the siblings are old enough to do so. Here again, the benefits to the mother can take two forms. In one case, mothers can spend less activity time with both children because the younger child is being cared for by the older sibling (Folbre et al., 2005); both older and younger siblings are spending time with each other and therefore do not need additional attention from the mother. In the other case, mothers will have more time available for cognitively stimulating activities with all their children if older siblings can assume basic childcare tasks such as feeding their younger siblings.

Theoretically, in order to maximize all children's future outcomes from the point of view of economics, mothers may rationally calculate how to engage in childcare activities while most efficiently serving all her children with the maximum amount of time and the minimum of input. Mothers can consciously choose activities that can be shared with more than one child or can involve each child in different activities simultaneously. In addition, they may reorganize their daily time schedule to make more time available for childcare as the number of children increases. What is even more, mothers may ask their children to help with caring for the other siblings, which can lead to direct cognitive stimulation by siblings or by the mother herself if such help frees up more time for the mother to reinvest in stimulating activities. Such behaviors can be based on rational calculations as a way to maximize children's outcomes; however, resource augmentation may also be a byproduct of everyday life as mothers act either consciously or unconsciously to successfully accomplish their everyday tasks.

2.4 THE LIFE COURSE PERSPECTIVE

With the work of Cunha and Heckman (for example, Cunha & Heckman, 2007), new ideas have been put forward in the area of economics. Not only do these authors provide a life course perspective and thereby identify sensitive and critical periods in a child's development, they also consider the family environment and the quality of parenting to be important investments in this development (Heckman, 2011; Knudsen, Heckman, Cameron, & Shonkoff, 2006). In their view, it matters at what point in a child's life parents make certain investments; after that point, substitutions for investments that were not made earlier become more costly. Consequently, children develop some skills or traits more easily at certain ages. For example, when learning a second language, children will be able to speak without an accent only if they learn the language before they reach the age of 12 (Cunha & Heckman, 2007). Or, some abilities, such as cognitive and noncognitive skills, can be altered by parents only when the child is in a certain age group (Cunha & Heckman). These time intervals, when parental investments are more productive with respect to child outcomes, are called "sensitive periods". Some investments are only productive during a single period, the so-called "critical period" (Cunha & Heckman, 2008). Moreover, the authors assume that returns to parental investments diminish the later investments are made, and furthermore, the sensitive and critical periods may vary depending on the outcome desired. For example, Cunha and Heckman (2008) assume that the sensitive period for attaining cognitive skills occurs earlier in a child's life than the sensitive period for noncognitive skills (see also Heckman, 2007). Another case in point is the empirical study by Borghans, Duckworth, Heckman and ter Weel (2008) in which family environment interventions were shown to be most effective when the child is 4 and 5 years of age; thereafter, the effects decrease and by the age of 8 become almost nihil.

This kind of research indicates that some investments must be made during specific age windows for optimal returns, but another point can be made that supports the advantages of early investments, that is that the development of skills is cumulative over a person's life span. Skills and accomplishments that accrue

later in life depend on the foundations built at the outset (see, for example, Knudsen et al., 2006).

As mentioned earlier, the types of resources a child receives also play a crucial role in child development. Although parental money has been shown to have a significant effect on child outcomes, Cunha and Heckman qualify this finding in their statement "Good parenting is more important than cash" (Cunha & Heckman, 2009: 330).

To sum up, recent economic research has highlighted the importance of the family environment, mainly parenting, and has emphasized the importance of life course research. Children's early environments and experiences have an effect on their development and on a range of important adult outcomes. In order for quality parenting and the majority of investments to have an effect on children's outcomes, such resources must be made available early in a child's life.

In addition, parental investments made during certain age phases may be the most important factor in determining children's outcomes, a life course perspective must also consider other environmental factors. This is particularly true for young children and their experiences with different institutions, the most prominent being the kindergarten or school they attend. Their daily routines change, not only because attendance is compulsory, but also because they assume new tasks at home (such as doing homework and studying for exams) and add a social component to their lives (such as meeting peers after school). These changes, which relate more to children's social and institutional environments than to their particular age, must be considered in investigations of the relationship between sibling constellations and maternal time resources.

2.5 SUMMARY

All in all, parents may follow different behavior strategies, whether they are based on economic calculations, norms and stereotypes, or heuristics. Although such classifications may help explain the driving forces behind parental behavior, they often lead to similar or identical conclusions. Such homogeneity might make it

difficult or even impossible to distinguish between these behavior types when one is trying to interpret statistical results. This problem is especially true with regard to the resource dilution hypothesis or the quantity–quality model, both of which make the same predictions concerning not only the number of siblings but also implicitly birth spacing and birth order. The resource augmentation assumptions may also rely on the rational or on unconscious behavior of mothers. The preferential treatment of a child based on gender or birth rank may be due to simple heuristics based on "clever cues" or to social or cultural norms. Without knowing parents' attitudes or role models, cues, or calculation strategies, one cannot make clear statements about what it is exactly that leads to equal or unequal behavior toward their children. Unfortunately, the data used in this dissertation do not include this information, so that the supposed underlying behavior strategies will have to be based on assumptions that in some cases cannot be clearly differentiated from one another.

3 DATA, MEASURES, AND METHODS

3.1 POTENTIAL VALUE AND LIMITATIONS OF THE SOEP AND FID FOR SIBLING ANALYSES

The analyses in this dissertation are based on data obtained from two surveys: the German Socio-Economic Panel (SOEP) and Families in Germany (FiD). Most of the existing research on sibling inequalities has relied on data from American surveys, except in some cases when information from other countries has been used. Empirical studies regarding Germany are scant, however, and almost no research has been undertaken regarding preschool-age siblings. This deficiency may be the result of insufficient databases, but also an interest in the sociological relevance of family inequalities has only recently emerged. In any case, combined data from the SOEP and FiD offer an excellent foundation for investigating the relationship between sibling configurations and family inequalities in Germany, especially with respect to the allocation of nonmaterial resources.

The SOEP is a panel study that focuses on representative households in Germany. It is headed by academicians and is located at the German Institute for Economic Research (Deutsches Institut für Wirtschaftsforschung [DIW]). Fieldwork is carried out by the survey institute TNS Infratest Sozialforschung in Munich. The SOEP is currently financed by the federal government of Germany and the State of Berlin. In 1984, the SOEP undertook to make life course research possible by conducting annual surveys of individuals from private households. These surveys are conducted using a mixed-mode design (paper and pencil interviewing [PAPI] and computer-assisted interviewing [CAPI]) and consist of questions about a

variety of topics related to the participants' lives, including contexts such as their neighborhood, networks, and the environment (Wagner, Frick, & Schupp, 2007). In addition to multidisciplinary research questions that serve the fields of economics, the social sciences, and more recently also psychology, the SOEP emphasizes the subjective and economic well-being of respondents but also intermittently introduces blocks of questions on specific themes (e.g., intelligence or personality).

The SOEP collects data from not only one person but all adult household members 18 years of age or older, making the data of higher quality and less prone to bias (Wagner et al.). Each respondent answers first an initial (once only) Biography Questionnaire and second an annual Individual Questionnaire. In 2000, a Youth Questionnaire was introduced to be filled out by children in the households of existing respondents once they reach the age of 16 or 17. It is equivalent to the Biography Questionnaire but is designed for these teenagers who are providing their personal information for the first time. There is also a Household Questionnaire to be filled out by one representative per household to provide information on that household's characteristics. A few special questionnaires are also used, including one that concerns deceased family members, and the Mother and Child Questionnaires, which represent an important innovation in the SOEP and are used mainly for the analyses discussed in this dissertation.

The FiD was initiated by the Federal Ministry for Family Affairs, Senior Citizens, Women and Youth (BMFSFJ) in response to the lack of qualitatively and quantitatively sufficient data for an evaluation of family policy measures in Germany (Schröder, Siegers, & Spieß, 2013). These policy measures focus mainly on minority groups within the society. Although the SOEP provided some data relevant to this purpose, it simply contained too few observations concerning these minority groups and therefore could not be used for inferential statistical analyses. On account of that, the FiD focuses in its sampling on low income families, single parents, large families, and families with young children (i.e., cohorts born in 2007 or later). Low income families are defined as households with an income of less than €2,500 for at least two adults and at least two children, €2,000 for at least two adults and one child, and €1,500 for one adult and at least one child. Single parent families are those with one adult and at least one

child. Families with at least three children are assigned to the category "large families". Apart from their sampling strategies, the FiD is almost identical to the SOEP with regard to structure and questionnaire content, but its first data wave was collected in 2010. All interviews are conducted face to face, but the FiD also uses CAPI and in some cases PAPI (General Information, FiD Documentation). However, for the mother–child questionnaires, the number of observations is even higher in the FiD than in the SOEP, which makes the FiD particularly appropriate for analyses of young children. Pooling data from both surveys is possible owing to their similarities and allows for larger sample sizes.

The data used in this dissertation are based on responses to the mother–child questionnaires. Mothers fill out these questionnaires as proxy interviewees if their children's ages correspond to the designated age brackets of 0 to 1 year (file name = bioage01), 1 to 2 years[20] (bioage02), 2 to 3 years (bioage03), or 5 to 6 years (bioage06). If the children are ages 7 to 8 (bioage08) or 9 to 10 (bioage10), both mothers and fathers are surveyed if possible. In 2014, a new questionnaire was designed to be filled out by 11- to 12-year-olds with the stipulation that the children complete it themselves. Before this questionnaire was created, information could be collected only for children from birth to age 10 and for teenagers from 17 to 19, thus leaving a void regarding those 12 to 16 years of age. The intention is to fill this gap with age specific questionnaires.

Sometimes the same information from one of the age specific questionnaires is available for siblings who have reached the appropriate age. In addition, longitudinal information is available from families who have been participating in the surveys over a long time. Nevertheless, robust sibling analyses as well as panel analyses are hardly feasible because unfortunately the sample sizes are too small in each particular age group. Another constraint is the questions themselves because they rarely appear in more than a single age bracket questionnaire; moreover, questions related to any kind of parental investment in children only appear as follows in the following order: (1) hours spent in childcare by mothers (not part of the mother-child questionnaires); (2) whether the mother is

[20] Available only for the FiD; not included in the SOEP.

breastfeeding (bioage01, bioage02, bioage03); (3) help with homework[21] (bioage08); and (4) diverse activities with the children undertaken by the mother in the last 14 days (which covers some items included in bioage02, bioage03, and bioage06, others only in bioage02 and bioage03, and still others only in bioage06). Although general maternal childcare might be a relevant indicator of investments in children, it is measured for all children without specifying information for each individual child and does not spell out exactly what is done if all the activities (including fulfilling basic needs such as feeding and cognitively stimulating activities such as reading aloud) are subsumed under the term childcare and cannot be teased out. The relationship between breastfeeding and later outcomes of children is certainly of importance but can be explained rather biologically, not sociologically. The item "help with homework" is included in the FiD but not in the SOEP. Similarly, the questionnaire for 1- to 2-year-olds is not part of the SOEP and therefore its contents are not included in the analyses. In contrast, the frequency of activities seems to be a relevant indicator of investments in children because at least some of these activities are theoretically important, as mentioned in Chapter 2.

All in all, quantitative information on (very) young children is eminently scarce in Germany, so the introduction of the mother–child questionnaires in the FiD and SOEP can be used to fill this void and is innovative. However, even such a data base has its limitations when it comes to investigating the relationship between family structure and parental investments in children, especially with regard to both longitudinal and within family sibling analyses.

3.2 DATA

For the analyses, data were pooled from all completed SOEP and FiD mother–child questionnaires on children ages 2 to 3 and 5 to 6 between 2005 and 2013,

[21] Not included in the SOEP.

when data on mother's frequency of activities were collected. Although 4,381 children were observed at ages 2 to 3 and 3,080 at ages 5 to 6 (totaling 7,461), almost half (2,862) were surveyed in both age brackets. One third of the children who were observed at ages 2 to 3 were still too young to be surveyed in the next age bracket and will be surveyed in future waves of the study. An additional 20 percent of the children appear in the sample only once owing to attrition. Thus, the data are unbalanced with respect to both design and missing values. In the pooled dataset, a child is sometimes included twice when a mother has answered two questionnaires for the same child in both age brackets.

To obtain information about the reasons for differences among siblings, researchers usually opt for one of two approaches. In one, siblings themselves can be asked about their individual perceptions of their families (Turkheimer & Waldron, 2000); in the other, parents can be queried about differential treatment of siblings at a given point in time (e.g., Price, 2008). In this dissertation, a third approach is taken. The data collected in the SOEP and FiD mother–child questionnaires is selected to focus on one particular child at one particular point in time during that child's life course.

3.3 Measures

3.3.1 Dependent Variable: Frequency of Cognitively Stimulating Activities

Mothers' frequency of activities with their children. The dependent variable was constructed based on mothers' self-reports of the frequency with which they engaged in the following activities with their children: singing children's songs with or to the child, painting or doing arts and crafts, reading or telling stories, and

looking at picture books.[22] The frequency of activities was rated on a four-item scale: daily, several times per week, at least once a week, and never. It was assumed that the frequency would correlate positively with the actual time spent in those activities. Although higher frequencies might not necessarily correspond to higher time inputs, it was assumed that mothers who engaged in these activities more frequently would spend more time at them than did mothers who engaged in such activities less frequently, at least on average.

Obviously this measure of maternal time and attention is only approximate, but it is an improvement over the operationalizations commonly found in the literature, where parents' employment status or working hours are used as a proxy for childcare time, meaning that the latter is measured indirectly on the assumption that all non-employment time is devoted to childcare (Booth & Kee, 2009; Huston & Rosenkrantz Aronson, 2005; Price, 2008; Ruhm, 2004). Moreover, some studies rely on parents' report about time spent in childcare, but childcare per se can include many different tasks, for example, basic care, such as feeding or washing a child, as well as engaging in quality time (Sayer, Bianchi, & Robinson, 2004). Still other studies must often rely on overall measures that capture time spent with the whole sibship instead of specific information regarding each individual child within one family (see, for example, Fox, Han, Ruhm, & Waldfogel, 2011; Kimmel & Connelly, 2007).

The items from the questionnaires are analyzed first with the whole sample using both factor analysis and Mokken scale analysis, which is a more natural way to test scalability of categorical data (Mokken, 1971; Molenaar, 1997). Analyses are then repeated with some subgroups: first, children from the SOEP alone and those from the FiD alone, and then only 2- to 3-year-olds and only 5- to 6-year-olds. The splitting of the sample and a reanalysis are necessary to test whether the activities have unequal meanings for different populations (owing to the sampling of the FiD) and for children of different ages. Results obtained from both methods suggest that one scale can be used for both age brackets for the whole sample as

[22] These activities are chosen based on the analyses reported in Osmanowski and Cardona (2012).

well as for the subgroups.[23] To make scales comparable across time (despite the absence of the item on picture books for 5- to 6-year-old children), standardized sum indices for each measurement point are built. This also reduces the potential bias introduced by higher or lower age-specific frequencies of activities, because mothers tend to engage in these activities more often with 2- to 3-year-old children than with 5- to 6-year-olds. The variable is found to range from −4.00 to +1.71, with a mean value of 0.

Despite its advantages, the measure of cognitively stimulating activities also has some limitations. One of these is a lack of distinction between or within categories and another is the possible discrepancy between the use of stylized data and the recording of time diaries. First, mothers are not asked to specify the exact duration of their activities, just the frequency. Therefore, it is not known whether the mother who reports that she reads with her child on a daily basis engages in this activity for only 10 minutes or for 2 hours. Similarly, the category "several times per week" cannot be explicitly distinguished from the category "at least once a week". In the first category, a mother may report that she undertakes activities at least twice a week, whereas the fact that the second category includes the words "at least" means that a mother might choose this category because she too engages in the activities twice a week, so the categories cannot be said to be mutually exclusive and the responses can potentially overlap. Another potential source of imprecise results is the fact that the stipulated categories do not account for all possibilities; for instance, if a mother sings with her child only fortnightly, the only categories she has to choose from are "at least once a week" and "never", which does not accurately reflect the frequency of this activity.

The other limitation is related to the nature of the questionnaires. No distinction is made between results based on time diaries and results based on stylized questions, such as those posed in the SOEP and the FiD.[24] Time diaries have the advantage that they preclude the category-related limitations described above because respondents provide more details about their activities, noting (in the best

[23] See Tables A1.a to A1.f and Tables A2.a to A2.f in the Appendix for results of the factor analysis and the Mokken scale analysis.

[24] See Juster, Ono, and Stafford (2003) for a comparison of different measures of time use.

case) what they did, for how long, at what time of day, where, and with whom (Harvey & Pentland, 2002). In contrast, stylized data inherently have three main biases – recall error, social desirability, and secondary activities – which are not captured by the questionnaires. Nevertheless, stylized data offer an advantage when it comes to replicability; in cases where respondents engage in these activities regularly, stylized questions are at least as good as time diaries (Juster, Ono, & Stafford, 2003). It appears that activities with children are usually undertaken regularly because families tend to structure their daily schedules more or less consistently. Although this conjecture cannot be tested, it is assumed to be a reliable measure as long as its limitations are kept in mind.

Studies reported in the empirical literature have often relied on maternal working hours as a proxy for time spent with children[25] (see Price, 2008, for a short discussion). However, this operationalization has two clear drawbacks: first, it disregards maternal activities other than work that may also compete with childcare, such as hobbies, sleeping, or housework; and second, as stated by Folbre et al. (2005), it does not take into account other persons who participate in the child's care, such as a partner or grandparent, thus biasing the measurement of activities. Use of the SOEP avoids these difficulties because it relies on self-reported measures of maternal activity frequencies for each individual child and controls for childcare delivered by grandparents, fathers, or partners as well as daycare arrangements. In addition, it controls for the mother's self-reported total amount of time spent in childcare, thus countering critics who complain about subtracting childcare activities such as passive care, as for example when the child is sleeping (Folbre et al., 2005). Even with changes in the overall resource pool (e.g., an increase in the size of the family that increases the total amount of time devoted to childcare) (Sayer et al., 2004), the SOEP allows the effect of the number of siblings on the frequency of stimulating activities to be isolated.

[25] Baydar, Greek, and Gritz (1999) investigated how a mother's time spent at work relates to her time spent in different activities with her children. They found that increases in working hours have different effects on different childcare activities, but taken together, they result in a negative effect on all activities.

3.3.2 Independent Variables

The next section describes the operationalization of independent variables that are not the main explanatory variables. Chapters 4 to 7 include detailed descriptions of these independent variables as they relate to the respective questions being explored. The variables included here may be divided into five categories: sampling, maternal characteristics, household characteristics, childcare arrangements, and children's characteristics.

Sampling

Because the data used in this dissertation are derived from two surveys with different sampling strategies, it is important to account for the special sampling of the FiD data, with its overrepresentation of low-income families, single-parent families, and families with many children. That is why a dummy variable measuring the data source, SOEP or FiD, is included.

Maternal characteristics

For a theoretically meaningful reason, this study has to control for the social background of the mother. It is predicted that parenting practices differ according to the social class of the parents; for example, it is assumed that higher class mothers spend more time in cognitively stimulating activities than do mothers at the lower end of the class spectrum. To address this issue, the educational level of the mother is included in the analyses, operationalized as a categorical variable with general secondary school (the reference category), intermediate secondary school, upper secondary school, and tertiary education. Maternal employment has a practical meaning for activity frequencies because mothers who work many hours have less time available to devote to childcare. Zick et al. (2001) found that mothers' employment affects parental activity frequencies. Therefore, the number of hours a mother works per week (0 to 9, 10 to 29, or 30 hours and more) is considered in the models. Apart from this, to account for changes in activity frequencies related to a mother's age, this factor is entered as years in the models.

Household characteristics

To measure a household's financial resources, the equivalent post-government income per year in thousand euros is used. In addition, family type is included to distinguish among single mothers (the reference category), couples, and multigenerational households. In the empirical literature, the number of siblings is consistently shown to have an impact on the amount of resources given to children. This variable is used in the majority of analyses as a continuous variable ranging from 1 to 11; otherwise, alternative operationalizations are clearly stated in the relevant chapters that follow. The information on number of siblings in a household is obtained from mothers' reports on the number of births and is therefore a measure of biological siblings.

Childcare arrangements

Although information on the overall number of hours a mother spends per week in childcare can also be obtained from the FiD as well as the SOEP, it does not specify this value for each individual child but rather the sum of time spent with all children together; it also includes everything a mother perceives as childcare, which might include different basic childcare tasks as well as activities. It is not a perfect measure of maternal overall childcare because it does not explicitly indicate what that category comprises, but it still provides an estimation based on information reported by the mothers themselves. Therefore, it is employed in the analyses as self-reported childcare time. In the questionnaires, mothers report this separately for weekdays and weekends. These figures are added up and the result is divided by the number of hours in a 7-day week to yield an index (ranging from a minimum of 0 to a maximum of 1) of time devoted to childcare. Dummy variables that indicate help with childcare provided by a partner, the father (if he is not living within the same household), grandparents, siblings, and daycare are also considered.

Children's characteristics

Children's attributes may also affect the frequency of maternal activities. To begin with, values for the child's gender are included (girl = 0; boy = 1). In addition, an

indicator of the child's health status is considered as a dummy variable (yes = 1) that measures whether the child does or does not have at least one health impairment (atopic dermatitis, ametropia, nutritional disturbances, movement disorders, or other problems). Because children are not all in the same birth year or month when the survey is conducted, those classified in the age bracket 2 to 3 years of age may be anywhere from 24 to 47 months old, and those in the age bracket 5 to 6 years of age may be anywhere from 60 to 83 months old. This means that even within a single age bracket, children's ages can vary by up to 2 years. Therefore two variables are included: a child's age in months and the age bracket of the questionnaire (age 2 to 3 years = 1; age 5 to 6 years = 2).

3.4 DESCRIPTIVE STATISTICS

Table 3.1 shows summary statistics for the whole sample, including mean values or percentages, standard deviations, minimum and maximum values, and the number of observations. The dependent variable, frequency of cognitively stimulating activities, ranges from −4.00 to +1.71, with a mean value of 0 and a standard deviation of 1 (it was standardized before), and has 7,052 valid observations. Children's age ranges from 26 to 82 months for both age brackets, and slightly more children participated in the questionnaire designed for children ages 5 to 6 than the one for children ages 2 to 3. The bulk of the children are represented on the FiD questionnaire (63%), and 37 percent of all the completed questionnaires come from the SOEP survey. The sex of the children is almost perfectly balanced, with about half the target children girls and half boys. Around 20 percent of all the children have some kind of health impairment. Although the number of siblings in the sample ranged from 0 to 11, the average number of siblings per household is 1.39, with a relatively high standard deviation of 1.18. There are only a few cases in which the number of siblings is very high.

Concerning childcare provided by persons other than the mother, the partner of the mother is the one mainly involved (for 70% of all children). More than half of the children (64%) are cared for in daycare institutions, and about half of all

the children are cared for by their grandparents; in 13 percent of all cases, older siblings care for their younger siblings, and the reason for this small percentage is certainly the limited number of older siblings. Similarly, only 7 percent of the children are cared for by fathers who do not live in the same household, the low number being due to the large number of children whose fathers live with them. This latter finding is confirmed by the frequency distribution of the type of household. The overwhelming majority of children live in households where both parents live together as a couple (87%), but almost 13 percent of the children share the household with a single mother. The proportion of children who live in a multigenerational household is less than 1 percent.

A mother's time spent in caring for all her children averages 35 percent of the overall time she has available per week. Assuming that mothers sleep about 8 hours a day, they claim to spend approximately half their awake time involved in childcare, or roughly 8 hours per day. Surely this percentage is based on a whole week's worth of hours, since mothers are likely to spend more time with their children on the weekends than on weekdays. In this study the average age of the mothers is 35 years. Admittedly, the lowest and highest ages for this group of mothers (13 and 75, respectively) are extremes and represented less than 1 percent of the whole sample. Overall, 98 percent of all the mothers are within the range of 22 to 48 years of age.

In terms of educational level, the mothers are roughly equally distributed among the four categories. About one fourth of all the mothers are in the lowest level (up to general secondary school) and about one fourth are in the highest level (tertiary school); of those remaining, the majority (37%) has completed intermediate secondary school but only 15 percent have reached an upper secondary school level. As for employment status, over half the mothers work up to 9 hours per week; the remaining mothers are equally divided into those who work between 10 and 29 hours per week and those who work 30 or more hours per week. The average monthly household income is €3,300, with a standard deviation of €2,000.

Table 3.1 Summary statistics for the whole sample

Variables	Mean / %	Standard Deviation	Min	Max	N
Mothers' frequency of activities with their children	0.00	1.00	-4.00	1.71	7052
Child's age (months)	49.51	17.80	26	82	7447
Child's sex (boy=1)	0.51	0.50	0	1	7461
Number of siblings	1.39	1.18	0	11	7424
Child's health impairments (yes=1)	0.21	0.40	0	1	7461
Childcare (yes=1)					
…by partner	0.70	0.46	0	1	7461
…by father	0.07	0.25	0	1	7461
…by older siblings	0.13	0.34	0	1	7461
…by grandparents	0.49	0.50	0	1	7461
…by daycare	0.64	0.48	0	1	7461
Time spend in child care (% available time/week)	34.39	0.21	0	1	7383
Household type					
Single mother	12.57 %				937
Couple	86.56 %				6452
Multigenerational household	0.87 %				65
Household's income (net, monthly in thousand euros)	3.30	2.04	0.15	35.00	6856
Mother's age (years)	35.14	5.91	13	75	7454
Mother's education					
Up to general secondary school	23.38 %				1700
Intermediate secondary school	37.38 %				2718
Upper secondary school	14.96 %				1088
Tertiary school	24.27 %				1765
Working hours					
0-9	51.25 %				3739
10-29	25.25 %				1842
30 and more	23.51 %				1715
Age group					
2-3 Years	58.72 %				4381
5-6 Years	41.28 %				3080
Data source					
SOEP	36.60 %				2731
FiD	63.40 %				4730

3.5 Analytic Strategy

To estimate the effects of the sibship characteristics on mothers' frequency of activities (A) for each child (i), a panel model for two time periods with child-specific intercepts (ζ_i) was specified. The model is described by the following equation and was fitted as both random-effects and fixed-effects models.

$$A_{i,t} = \beta_0 + \zeta_i + \beta_1 \bullet x_{1,i,t} + ... + \beta_n \bullet x_{n,i,t} + \varepsilon_{i,t} \text{ for t = age}_{2,3}, \text{age}_{5,6}$$

Perhaps more interesting than the statistical properties of both model variations are the different questions that can be answered using these models. While the random-effects models allow the measurement of differences in the level of mother–child activities with varying values of the sibling characteristics, the fixed-effects models quantify the extent to which mothers' frequencies of activities change between t1 and t2 (which correspond to measurements taken when the children were 2 to 3 years of age and 5 to 6 years of age, respectively). In a way, the random-effects models can be interpreted substantively as an interindividual comparison that pools all children from both age groups and compares their levels of activities. In contrast, the fixed-effects models are intraindividual comparisons that consider what happens to children between measurement points.

Compared with the random-effects models, the fixed-effects models control for child-specific time-constant and effect-constant factors, both measured and unmeasured (Halaby, 2004). This comes at a cost, however. Fixed-effects models require at least two measurement points, which reduces the samples to a balanced panel with only roughly one third of the original sample.

In addition, if analyses were done for each age group individually, simple ordinary least squares (OLS) regressions with robust standard errors are employed. Which of the model variations is used depends on the research question and the structure of the data, and this is explained in the corresponding section of each of the chapters.

4 Is Less More? Number of Siblings and Frequency of Maternal Activities with Preschool Children[26]

4.1 Introduction

Siblings receive unequal amounts of resources from their parents (Behrman, 1997; Conley & Glauber, 2005a), an incongruity that is not without consequences. As mentioned earlier, research on brain development suggests that, aside from prenatal factors, two of the most relevant conditions that affect children's emotional and cognitive development are parental care and a cognitively stimulating environment (Hackman et al., 2010). Emotional and cognitive capacities are, in turn, strong predictors of individual disparities in such areas as education, earnings, and health (Heckman & Kautz, 2012; Roberts et al., 2007). Thus, in Conley's (2004) words, inequality starts at home!

One prominent explanation as to why resources might be distributed unequally among siblings is sibship size. The so-called resource dilution hypothesis predicts a negative relationship between family size and resource distribution (Blake, 1981, 1989; see Section 2.2). Accordingly, as the number of siblings grows, parental resources as varied as money, time, love, and affection must be divided into ever smaller portions. Until now, empirical studies regarding this hypothesis

[26] A previous version of this chapter was coauthored by Andrés Cardona.

have sought a direct connection between the number of siblings and children's outcomes (Black et al., 2004; Conley & Glauber, 2005b; Jæger, 2008). Yet less attention has been paid to the very premise that the presence of more siblings unequivocally translates into fewer resources per capita among the offspring within the family (Downey, 1995).

In this chapter, the first of four empirical chapters, a negative relationship between family size and parental resources is explicitly tested. Does the frequency with which mothers engage in stimulating activities with their children vary as a function of family size? Such parental input is considered a key to promoting a child's skill development (Hofferth & Sandberg, 2001; Hsin, 2006; Zick et al., 2001). In addition to testing the dilution hypothesis, this chapter proposes the alternative 'resource augmentation hypothesis'. Based on mothers' agency, this competing theory predicts that the resources received by a child who has additional siblings will increase, or at least not decrease.

To investigate the plausibility of these two opposing hypotheses, dilution and augmentation, this study analyzes data obtained from both the SOEP and the FiD regarding children ages 2 to 3 years and 5 to 6 years (see Chapter 3 for details about data collection and methods). What follows is an examination of differences in the frequency of maternal activities among families of varying sizes as well as intra-individual differences that develop over time as a result of the birth of a younger sibling.

4.2 Contributions of the Present Study

Although there is a growing body of literature dealing with the effect of the number of siblings on different outcomes, comparatively few researchers have explored its effect on the resources available to the children within these family groups. Thus, it is still not clear whether the relationship between resource allocation and sibship size is positive, negative, or zero (Downey, 2001). The answer depends

both on the nature of the resources being investigated (especially interpersonal resources such as time) and on the data and methods used for the analyses.

The research presented in this dissertation makes several contributions to the ongoing discussion about the number of siblings and its effects, if any, on resource dilution. Based on data from surveys carried out in Germany, the resource dilution hypothesis is tested by asking first how the *level* of frequency at which mothers engage in activities with their children varies while fixing the age of the child and controlling for different family characteristics, and then asking how *changes* in this frequency of activities for a given child are brought on by the birth of a younger sibling within a particular family over time. This approach allows an exploration of the differences between families in this regard, as well as the intra-individual changes that take place over time. According to the resource dilution hypothesis, the relationship between the number of siblings and the frequency of activities should be negative in both models; based on the resource augmentation hypothesis, however, the opposite should be the case.

4.3 BACKGROUND

4.3.1 THE RESOURCE DILUTION HYPOTHESIS

Popularized by the work of Blake (1981, 1989), the dilution hypothesis has been present in sibling studies for decades (Anastasi, 1956). The basic idea is fairly simple. A family has finite resources available to distribute among siblings. As sibship size grows, these resources need to be divided among the increasing number of children and thus are spread ever more thinly. This condition, in which children receive smaller and smaller amounts of resources as the size of the sibship increases, may be due to parents' rational calculations or to their heuristic behavior if they apply the simple 1/N rule (see Section 2.2.2.1). Unfortunately, it is not possible to differentiate between these two parental strategies with the data that are available.

Although the resource dilution hypothesis has been tested both directly and indirectly, the empirical evidence tends to support the use of indirect tests. Indirect tests assume a negative relationship between the amount of resources a child receives and his or her outcomes, such as schooling. In keeping with this assumption, a negative relationship between family size and children's outcomes, say schooling, is interpreted as evidence in support of the resource dilution hypothesis. Direct tests, on the other hand, measure the effect of sibship size on the resources received by children without further exploring the effect of resource allocation on children's outcomes.

4.3.1.1 INDIRECT TESTS: NUMBER OF SIBLINGS AND CHILD OUTCOMES

Studies that employ indirect strategies have focused on outcomes as varied as educational achievement (Black et al., 2004; Lawson, 2009; Steelman, Powell, Werum, & Carter, 2002), educational and occupational aspirations (Marjoribanks, 1989), verbal skills (Steelman et al., 2002), and IQ (Zajonc & Markus, 1975). For example, Baydar, Hyle and Brooks-Gunn (1997) report that the birth of a new sibling increases children's behavior problems, lowers reading recognition scores in children of disadvantaged families, and leads to a negative self-perception. Similar results have also been reported in studies conducted in Germany.[27] For example, Eschelbach (2009) showed that, for both East and West Germany, being at least the second-born child has a negative effect on educational attainment, as compared with the first-born (see also Bauer & Gang, 2000; Blaess, 2005). Jacob (2010) finds that, in Germany, the number of siblings is negatively associated with graduation from higher education institutions. Conley and Glauber (2005b) and Jæger (2009) also report negative effects of family size on IQ, educational achievement, and the likelihood of attending private schools.

But the finding of such negative effects has also been challenged. First, some studies have suggested that cross-country differences with respect to macro-

[27] See Park (2008) for a cross-national literature review and comparison of different welfare systems.

economic conditions can be a moderating factor when it comes to resource dilution. Whereas the above-mentioned studies investigate data from economically advanced countries, the pattern seems to be different in countries with developing economies. Maralani (2008) points out that the negative effect of sibship size on educational outcomes depends on the national context and may change as a society is transformed. For Indonesian urban areas, the effect changed from positive to negative when the cohorts studied changed from older to younger. In their studies of families in Brazil, Marteleto and Souza (2012) found that family size translated into nearly no effect on resource dilution over time.

Moreover, the negative effects attributed to the resource dilution hypothesis have been challenged on methodological grounds. Guo and Van Wey (1999b) replicated the negative effect of family size and child outcomes – in this case, IQ – using standard OLS regressions; however, they noted that the negative effect of the number of siblings detected on OLS regression translated into no effect when they applied fixed-effects models, which control for unobserved factors that remain stable over time. On the other hand, Black et al. (2004) found that using the birth of twins as an instrumental variable for family size had a statistically significant positive effect on educational attainment in Norway; however, the inclusion of birth order made the effect of number of siblings negligible.

These incongruities could indicate a varying effect of family size on different outcomes. Perhaps more importantly, however, they emphasize the need for a direct test of the dilution hypothesis – that is, whether resources are indeed affected by an increase in sibship size.

4.3.1.2 Direct tests: Number of siblings and parental resources

Most of the studies focusing on the relationship between sibship size and the parental resources available to the children in a household have found evidence to support the dilution hypothesis (Downey, 1995; Steelman & Powell, 1989). For instance, Blake (1989) investigated the effect of the number of siblings on the amount of time children ages 6 to 11 spent in different activities, such as reading books and newspapers, watching television, and engaging in sports. Consistent

with the resource dilution hypothesis, she reported a negative relationship. Furthermore, Stewart (2005) also provided evidence for a decrease in the frequency of various activities after the birth of a new sibling. Despite these documented decreases in time resources, first-born children can profit from being an only child before new siblings arrive. If it is the case that the cumulative amount of time spent with parents during a person's entire childhood has positive effects on that person's outcomes, first-born children should have the best outcomes, even in the presence of siblings. Klein and Biedinger (2009) investigated possible determinants of the frequency of developmentally stimulating activities with children in Germany and found that the number of siblings had a negative effect on these activities.

4.3.2 The Resource Augmentation Hypothesis

Despite the predicted negative effects purported by the dilution hypothesis, there is evidence in the literature that a child with one sibling sometimes receives more parental resources than an only child does. Blake (1989) explains such results by pointing to selectivity regarding the family structure when there is only one child (e.g., single-parent families) or to the choice to stop reproducing when the first-born child is considered to be of "low quality" (e.g., intellectually disadvantaged) (see also Bobbitt-Zeher & Downey, 2013; Downey, 2001). Baydar et al. (1997) found that in advantaged families the birth of a sibling has a positive effect on children's reading recognition score; they hypothesize that this effect is due to the general increase in the time a mother spends in childcare after the birth of a baby.

These empirical results suggest that the presence of siblings might not always have a negative impact on maternal time resources as predicted by the dilution hypothesis but might also lead to an increase in the resources available to some or all of the other siblings. As discussed in Section 2.3, this advantage might derive from the mother's efficiency gains, the public-good character of maternal activities, a reallocation of maternal time, and a shift of childcare responsibilities to older siblings. In contrast to the resource dilution hypothesis, the "resource augmentation hypothesis" has been proposed to explain the finding that the

presence of siblings can exert a positive effect on the amount of cognitively stimulating activities available.

For one thing, some activities can be shared among siblings, taking the form of a public good from which all siblings benefit. For example, reading a book or going to the park can be done simultaneously with more than one child (Folbre et al., 2005). In addition, different activities can involve different children in combination; for example, being at the park with one child should not prevent the mother from nursing a smaller child at the same time. Aside from this shared character of maternal activities, mothers who have more than one child may also be more experienced and proficient at childcare and thus able to complete the same activity in less time than a first-time mother would take. As Price (2008) notes, this tends to be true for material or physical types of childcare, such as feeding, but may be less true for nonmaterial activities that promote children's development, such as time. Thus, in a way, mothers would benefit from what might be described as increasing returns of scale, multiplying the output (in terms of frequency of activities) by a factor greater than 1 for each unit of total time spent.

Moreover, increasing numbers of children may compel mothers to reschedule their time commitments, such as shifting time spent doing housework or sleeping to childcare (Bianchi, 2011; Cáceres-Delpiano, 2006). However, reallocation strategies may not necessarily have a positive effect, as when a mother engages in less cognitively stimulating activities with their children so she can devote more time to their basic needs or to doing housework.

Siblings themselves may get involved in childcare duties so that mothers can devote more time to engaging in cognitively stimulating activities with their children (Lamb & Ahnert, 2007). This situation only works if the children are old enough and sufficiently responsible to care for their siblings. Again, such help can also serve to relieve the mother and allow her to spend more time on activities other than childcare.

In a nutshell, through a combination of efficiency gains, the public-good nature of maternal activities, the reallocation of the mother's time, and older siblings' involvement, a larger number of siblings may make it possible for mothers to have more, not less, time available to spend on childcare. The latter two mechanisms, however, may also lead to resource dilution, and thus the nature of these effects

remains an empirical question. These mechanisms go beyond the sheer number of children in the household. They rely on agency: maternal learning and reallocation of activities, as well as the active role of siblings.

4.4 Data and Research Strategy

4.4.1 Sample and Analytic Strategy

The SOEP and the FiD were used for the analyses. The dataset consists of all completed mother–child questionnaires from 2005 to 2012 (SOEP) and 2010 to 2013 (FiD) in which data were collected on maternal frequency of activities with children 2 to 3 and 5 to 6 years of age. Both random-effects models and fixed-effects models are applied to investigate the effect of number of siblings on this frequency.

4.4.2 Measures

The dependent variable is mothers' frequency of activities with their children.[28] Information about the two key independent variables that measure different sibship sizes are obtained from mothers' reports on the number of their biological children. First, the number of siblings is included in the between-family analysis as an interval variable and alternatively as a multiple dummy variable. The latter results in four variables: one sibling, two siblings, three siblings, and four and more siblings (see also Bobbitt-Zeher & Downey, 2013). Although Downey had suggested in 1995 that the relationship between the number of siblings and parental resources does not have a linear form but rather a $1/x$ form, with x being

[28] For details, see Section 3.3.1.

the number of siblings, studies often still include a linear form; however, here, the dichotomous variant is used to capture nonlinear effects.

Second, in the intra-individual analysis, which for statistical reasons allows only covariates that change over time, the birth of new siblings is operationalized as a dummy variable, with "1" indicating that the mother gave birth to at least one new child between time points 1 (t1) and 2 (t2). To get more information about the number of siblings, a categorical variable for birth of a new sibling is constructed based on the dummy to indicate whether those children with a value of 1 had older siblings prior to the birth of a younger sibling or not (none, one or more).

To account for rescheduling in maternal childcare time that occurred as the number of children grew, a variable measuring the self-reported childcare time by mothers is employed as an index of time devoted to childcare. To control for the possibility that mothers with different numbers of children differ in other covariates that correlate with frequency of activities, covariates for family characteristics were included, as described in Section 3.3.2: the mother's age, education, and working hours, as well as the household equivalent post-government income per year expressed in thousand euros. In addition, five dichotomous variables were used to indicate whether or not the partner or father, grandparents, daycare facility, or older siblings were also engaged in care of the children. This last variable on childcare by siblings tests whether siblings complement or substitute for maternal activities. Furthermore, the family type, data source (SOEP or FiD), and age bracket from the questionnaire are included. Children's attributes may also affect the frequency of maternal activities; here, in particular, a child's diagnosed health conditions or impairments as well as age and sex are controlled for (boy = 1).

Summary statistics for all the variables can be found in Appendix B (in Table B1 for all cases used in the random-effects model and in Table B2 for those included in the fixed-effects models).

4.4.3 Descriptive Statistics

Table 4.1 shows the mean values for cognitively stimulating activities individually for each number of siblings; only cases without missing values are used in the analyses of the random-effects model (model M4.1, see next chapter). (Note that children with four siblings and those with more than four siblings have been combined.)

Table 4.1 Summary statistics for activity frequencies and number of siblings (random-effects model)

Number of siblings	Mean	Standard Deviation	Min	Max	N
0	0.13	0.91	−4.00	1.71	1200
1	0.05	0.99	−4.00	1.71	2672
2	−0.03	0.98	−3.35	1.71	1576
3	−0.16	1.04	−4.00	1.71	517
4 and more	−0.34	1.19	−4.00	1.71	286
Total					6251

A clear picture emerges: As the number of siblings grows, the frequency of cognitively stimulating activities decreases. The relationship is almost linearly negative. However, children with no siblings or one sibling are still above the population mean, and children living in big families with at least four siblings engage in activities with their mothers less frequently.

In Tables 4.2 and 4.3, only those children are included who are observed at two time points, t1 and t2, which correspond to measurements taken when the children were 2 to 3 years of age and 5 to 6 years of age, respectively. If no new siblings were born between t1 and t2, the activity frequency is slightly beneath the mean

value; however, if there was at least one birth of a new sibling between t1 and t2, the children were found to be engaged in significantly more frequent activities.[29]

Table 4.2 Summary statistics for activity frequencies and birth of a new sibling between t1 and t2 (fixed-effects model)

Birth of a new sibling	Mean	Standard Deviation	Min	Max	N
No	−0.02	1.00	−4.00	1.71	2222
Yes	0.07	1.05	−3.00	1.71	241
Total					2463

Actually, if the variable for number of siblings and birth of a new sibling are combined with variables in the categories "no sibling between t1 and t2", "0 older siblings and a new sibling between t1 and t2", and "at least one older sibling and a new sibling between t1 and t2", a new picture emerges (see Table 4.3). Surely, the mean value for children who did not experience the birth of a new sibling remains the same and is almost 0, which is the mean for the whole population; however, the positive effect of the birth of a new sibling between the two time points becomes split. Of all the children who get a new sibling when they are between ages 2 to 3 and 5 to 6, the only ones who will profit from the birth – and compared with the other mean values, will profit to a great extent – are those who do not have older siblings. On the contrary, if a child already has at least one older sibling, the birth of a new sibling is correlated negatively with activity frequencies. This result can be puzzling and therefore requires a deeper investigation with the help of multivariate analyses.

[29] A t-test is applied to see whether the difference between the two mean values would be statistically significant. (The results are not displayed.)

Table 4.3 Summary statistics for activity frequencies and number of older siblings at birth of a new sibling between t1 and t2 (fixed-effects model)

Number of older siblings at birth of a new sibling	Mean	Standard Deviation	Min	Max	N
No new sibling	−0.02	1.00	−4.00	1.71	2222
0	0.24	0.91	−2.89	1.71	160
1	−0.27	1.22	−3.00	1.51	81
Total					2463

4.5 RESULTS

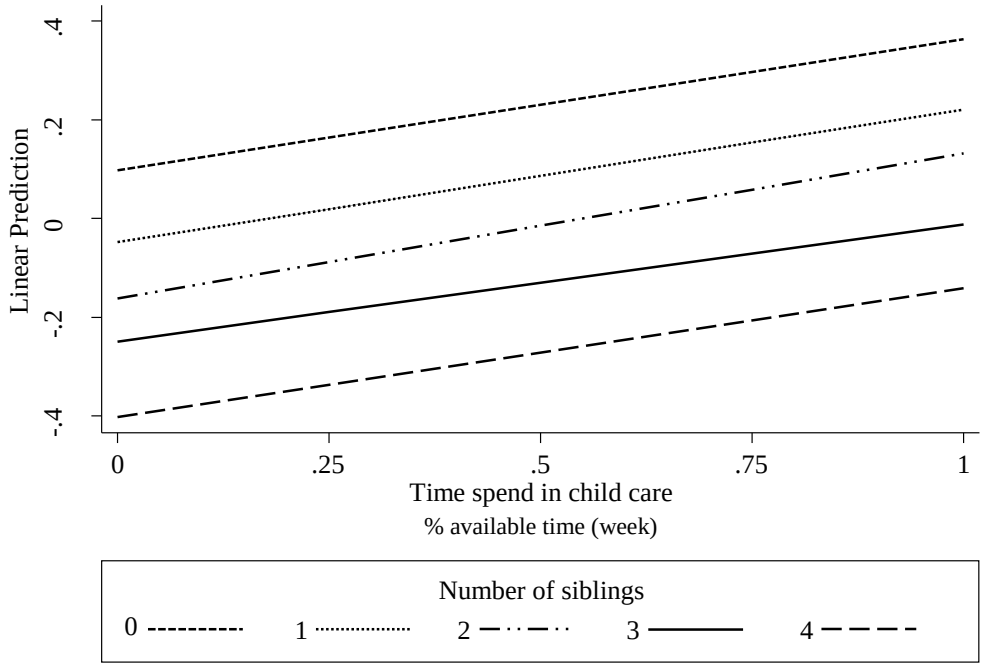
4.5.1 RANDOM-EFFECTS MODEL (M4.1): DIFFERENCES IN LEVELS ACROSS FAMILIES

Four model variations of M4.1 were specified. In the first model the number of siblings is measured as a continuous variable (M4.1a), in the second as a categorical variable (M4.1b); the third and fourth variations (M4.1c and M4.1d) add an interaction term between self-reported childcare time and number of siblings to the first two models. Models M4.1a and M4.1b are treated as the main models for testing the resource dilution and augmentation hypotheses. Models M4.1c and M4.1d are fitted to test the maternal time reallocation hypothesis more directly. The results of these tests are displayed in Table 4.4.

In M4.1a, the one-sided hypothesis that the coefficient for the number of siblings is equal to or greater than zero is rejected. Even though the size of the coefficient is statistically smaller than zero, it is not large. Referring back to the raw scores of the scale, a decrease of 0.12 on the standardized scales for each additional sibling means that the mother of an only child would have to give birth to at least five children in order to reduce the frequency of one of the four activities summarized in the index (for example, lowering the number of times she reads stories to her children from “daily” to “more than once a week”).

M4.1b tells a slightly different story. Compared with being an only child, having one sibling reduces the frequency of maternal activities by 0.15 on the standardized scale, but the effect does not become consistently negative as sibship size grows. However, the differences among the coefficients for having no, one, two, three, or four siblings are statistically different from each other. In contrast, older siblings' help in childcare seems to have no effect on maternal frequency of activities; these coefficients are around zero and are not statistically significant.

Figure 4.1 Predictive margins for frequency of activities as a function of number of siblings and percentage of time spent per week in overall childcare



Not surprisingly, mothers who spend a larger proportion of their time in childcare tend to engage in more activities with their children. Yet, including an interaction term with the number of siblings (in models M4.1c and M4.1d) does not affect the conclusions in models M4.1a and M4.1b. Figure 4.1 shows the interaction results for M4.1d, with the predictive margins for the frequency of activities as a function of the categorical version of number of siblings and overall maternal childcare time. Independent of overall childcare time, a higher number of siblings is associated with fewer activities engaged in with the mother. As sibship size grows, however, the effect of overall childcare time on the frequency of activities

does not change and is always positive (see coefficients for both main effects and the interaction term in Figure 4.1 and Table 4.4). This implies that even when they have a larger number of children, mothers manage to engage in cognitively stimulating activities with their children more often.

In short, increased sibship size appears to be related to fewer maternal activities, which gives support to the resource dilution hypothesis. However, the nonlinearity of the effect and the fact that the relationship between overall childcare time and frequency of activities is not influenced by the number of siblings suggests that there might be countervailing, resource-augmenting processes at work that are not related to childcare delivered by older siblings and that prevent attention from being diluted in families with more than one child.

Regarding covariates, the children drawn from the FiD sample seem to have an advantage over those drawn from the SOEP in that they receive cognitively stimulating activities more often. Although the differences among the coefficients are statistically significant, they are only of minimal relevance owing to their very small size. Moreover, the models show no health and age (in months) effects but reveal a comparably high negative coefficient for boys. The frequency of activities tends to be slightly higher for children in the 5 to 6 years age bracket as compared with those in the 2 to 3 years age bracket. Although the coefficient for household income (in thousand euros) is in two of the four models significant at the 10 percent level, its size is too small to have a relevant effect on the frequency of activities. Mothers' age, the use of daycare, and childcare by older siblings, as mentioned above, are all near zero, but results for mothers' educational level and working time indicate sizable effects. The higher a mother's educational level, the more she engages in activities with her children. Therefore, it is best for children to have a mother with tertiary education or at least one who graduated from intermediate secondary school. However, it does not matter whether mothers have completed intermediate or upper secondary school because the coefficients do not differ significantly from each other. Increasing working hours have a negative effect on activities, but the extent of the change matters. Whereas the effect of working 10 to 30 hours per week is negative and barely statistically significant as compared with the effect of working fewer than 10 hours, the effect of mothers working more than 30 hours per week is almost three times higher and highly significant. Moreover, mothers

whose partners live within the household (as a couple) tend to spend more time with their children in cognitively stimulating activities than do single mothers, whereas living in a multigenerational household has almost no effect on mothers' time spend in activities. This is congruent with the small but statistically significant positive effect of childcare delivered by the mother's partner. Childcare by the father, if he is not living in the same household, as well as grandparents' help also have a small positive but significant effect on this variable. Regarding maternal working time and education, results are only partially consistent with those of previous studies.[30] In contrast, household income has been shown to correlate with greater parental time resources, which is not supported by the results reported here.[31] The irrelevance of income to the frequency of activities in the data here might be explained by the different measurements of both the frequency scale and the list of activities used in existing studies.

[30] There is ample evidence that better educated mothers not only spend more time with their children than less well educated mothers do (Guryan et al., 2008; Sayer et al., 2004), but they do so in qualitatively different activities, such as reading instead of watching TV (Bianchi & Robinson, 1997; Hofferth & Sandberg, 2001). Only working time, especially of women, does not appear to have a large impact on time spent with children. It has long been documented that employed mothers somehow manage to compensate for their working time by spending more time with children during non-working hours, including weekends (Booth, Clarke-Stewart, Vandell, McCartny, & Owen, 2002; Nock & Kingston, 1988) or by reducing the time spent in other activities not related to childcare, such as leisure pursuits or sleep (Bianchi, 2000; Hofferth & Sandberg, 2001).

[31] Household income correlates positively with more time spent by parents with their children (Guryan et al., 2008; Hill & Stafford, 1974; Zick & Bryant, 1996).

Table 4.4 Parameter estimates for frequency of activities (random-effects models)

	M4.1a	M4.1b	M4.1c	M4.1d
Child's age (in months)	-0.001 (0.004)	-0.001 (0.004)	-0.001 (0.004)	-0.001 (0.004)
Child's sex (boys)	-0.212*** (0.025)	-0.210*** (0.025)	-0.212*** (0.025)	-0.211*** (0.026)
Child's health impairments	0.008 (0.028)	0.008 (0.028)	0.007 (0.028)	0.008 (0.028)
Childcare				
…by partner	0.064** (0.033)	0.063* (0.033)	0.064** (0.033)	0.063* (0.033)
…by father	0.070 (0.058)	0.071 (0.058)	0.069 (0.058)	0.071 (0.058)
…by siblings	0.007 (0.041)	-0.002 (0.041)	-0.009 (0.041)	-0.003 (0.041)
… by grandparents	0.075*** (0.025)	0.077*** (0.025)	0.075*** (0.025)	0.077*** (0.025)
…by daycare	-0.038 (0.027)	-0.036 (0.027)	-0.039 (0.027)	-0.036 (0.027)
Time spend in child care (% of available time/week)	0.276*** (0.063)	0.271*** (0.063)	0.208** (0.093)	0.265** (0.123)
Household Type				
Single mother (ref.)				
Couple	0.190*** (0.053)	0.197*** (0.054)	0.190*** (0.053)	0.197*** (0.054)
Multigenerational family	-0.023 (0.191)	-0.014 (0.191)	-0.023 (0.191)	-0.013 (0.191)
Household's net income	0.011* (0.006)	0.010 (0.006)	0.011* (0.006)	0.010 (0.006)
Mother's age	0.003 (0.003)	0.003 (0.003)	0.003 (0.003)	0.003 (0.003)
Mother's education				
Up to general secondary school (ref.)				
Intermediate secondary school	0.255*** (0.038)	0.256*** (0.039)	0.254*** (0.038)	0.256*** (0.039)
Upper secondary school	0.276*** (0.046)	0.275*** (0.047)	0.275*** (0.046)	0.275*** (0.047)
Tertiary school	0.420*** (0.042)	0.426*** (0.042)	0.419*** (0.042)	0.426*** (0.043)
Mother's working hours				
0-9 (ref.)				
10-29	-0.054* (0.031)	-0.051 (0.031)	-0.054* (0.031)	-0.051 (0.031)
30 and more	-0.153*** (0.035)	-0.152*** (0.035)	-0.155*** (0.035)	-0.152*** (0.035)
Age group (5 to 6 years)	0.090 (0.125)	0.091 (0.125)	0.090 (0.125)	0.091 (0.125)
Data source (FiD)	0.059* (0.031)	0.061** (0.031)	0.059* (0.031)	0.061** (0.031)
Number of siblings	-0.115*** (0.014)		-0.132*** (0.025)	

(continued)	M4.1a	M4.1b	M4.1c	M4.1d
Number of siblings (cat.)				
0 (ref.)				
1		-0.145*** (0.034)		-0.146** (0.060)
2		-0.250*** (0.041)		-0.260*** (0.071)
3		-0.358*** (0.059)		-0.347*** (0.107)
4 and more		-0.502*** (0.081)		-0.500*** (0.147)
Number of siblings * Time spend in child care			0.043 (0.050)	
*Number of siblings (cat.) * Time spend in child care*				
1				0.004 (0.152)
2				0.029 (0.167)
3				-0.028 (0.229)
4 and more				-0.005 (0.290)
Constant	-0.467*** (0.153)	-0.449*** (0.153)	-0.446*** (0.154)	-0.447*** (0.159)
N	6251	6251	6251	6251

Standard errors in parenthesis. *** p < .01, ** p < .05, * p < .10.

4.5.2 Fixed-Effects Model (M4.2): Changes across Time

As with the random-effects model, similar model variations were fitted to investigate *changes* in the frequency of activities for a given child over time. Results are shown in Table 4.5. In M4.2a, the effect of the birth of a sibling, measured as a binary event (yes/no),[32] on the frequency of maternal activities is positive but small in magnitude and not significantly different from zero.

[32] Variables on number of siblings in models M4.1 and M4.2 are not comparable. Whereas M4.1 includes the number of siblings, the variable in M4.2 measures whether a new sibling enters the family between two measurement points. Thus, the contradictory results are caused not by the model specifications of random-effects and fixed-effects models but by the different operationalizations of the main explanatory variable. Replacing the variable for number of siblings in the random-effects model with the variable for birth of a new sibling results in similar (and not contradictory) coefficients when compared with the fixed-effects models.

When considering the number of older siblings present before the birth of a new sibling (M4.2b), a more complicated picture emerges. Of those children without missing values in any of the variables included in the fixed-effects model (N = 2,196; number of groups = 1,098), only 222 children experienced the birth of a younger sibling between time points one and two. Out of those 222 children, 67 percent (N = 148) had no older siblings and 33 percent (N = 74) had at least one older sibling.[33] For only children, the birth of a sibling affects the frequency of maternal activities *positively*. The coefficient is statistically larger than zero and comparable in magnitude to the negative effect of the number of siblings predicted by the random-effects model M4.1a. In contrast, for children with one older sibling, the coefficient is negative but small, not significant, and statistically smaller than the coefficient for only children. Contrary to the results of the random-effects model, the overall time spent in childcare by mothers is negative; however, statistically speaking, it is not significant. As in the random-effects model, the coefficient for childcare by older siblings is slightly negative and is not statistically significant.

When the interaction terms (M4.2c and M4.2d) are included, a more detailed picture emerges. To visualize the interactions,[34] predictive margins are displayed in Figure 4.2 for model M4.2c and in Figure 4.3 for model M4.2d. In Figure 4.2, the interaction term consists of the overall childcare time and the dummy variable if a new sibling was born between the two measurement points; in Figure 4.3, the interaction term consists of the overall childcare time and information about whether children who experienced a birth between two measurement points already had older siblings.

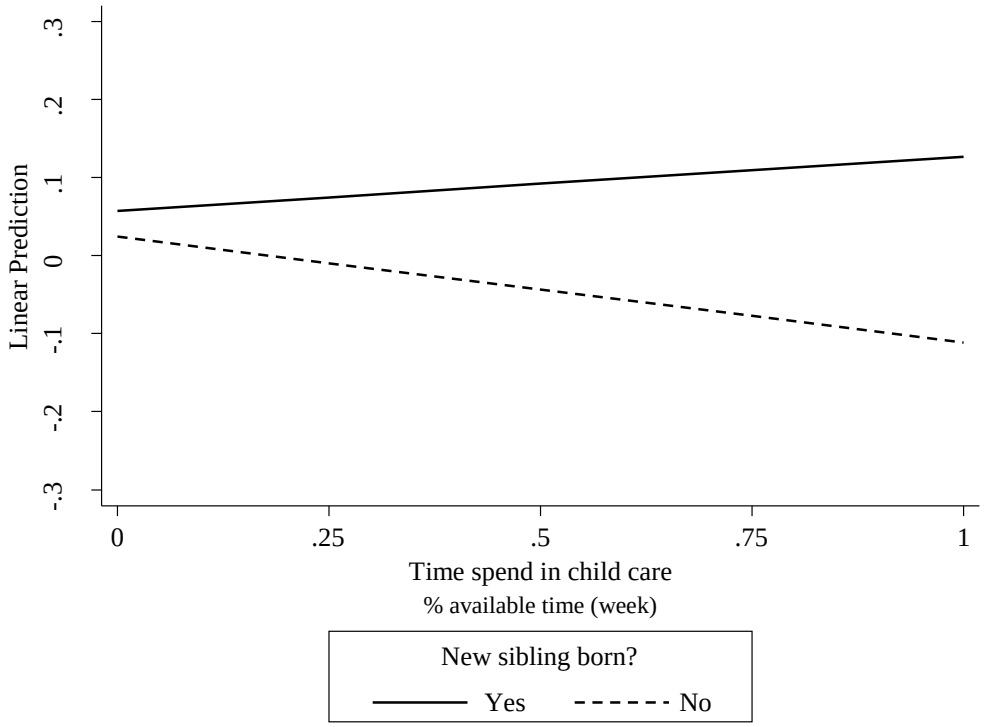
Figure 4.2 shows that mothers who increase their overall time spent with children also engage in activities more often only if a new child was born. Otherwise, even if

[33] Adding a category for children who had two or more than two older siblings prior the birth of a new sibling was considered in order to provide even more insights into the effects of number of siblings; however, if this had been done, the already small group of children with at least one older sibling (N = 74) would have had to be split again, resulting in even smaller group sizes (for children who had one older sibling, N = 49, and for children who had two or more older siblings, N = 25).

[34] Confidence intervals are large in these models and are not displayed in the figures for the sake of legibility.

the overall time spent in childcare increases, children do not profit from cognitively stimulating activities. Indeed, the differences between the coefficients and zero, or of the coefficients from one another, are neither statistically different from zero nor from each other, so the assumptions made cannot be generalized. If children who experience the birth of a new sibling are further differentiated into those who had one or more siblings before the birth and those who were only children, a deeper understanding of what happens within families is possible. Whereas the coefficient of children without new siblings between the time points is almost identical in both model M4.2c and model M4.2d, the coefficients of children who had no siblings or at least one sibling prior the birth of a new sibling differ from each other.

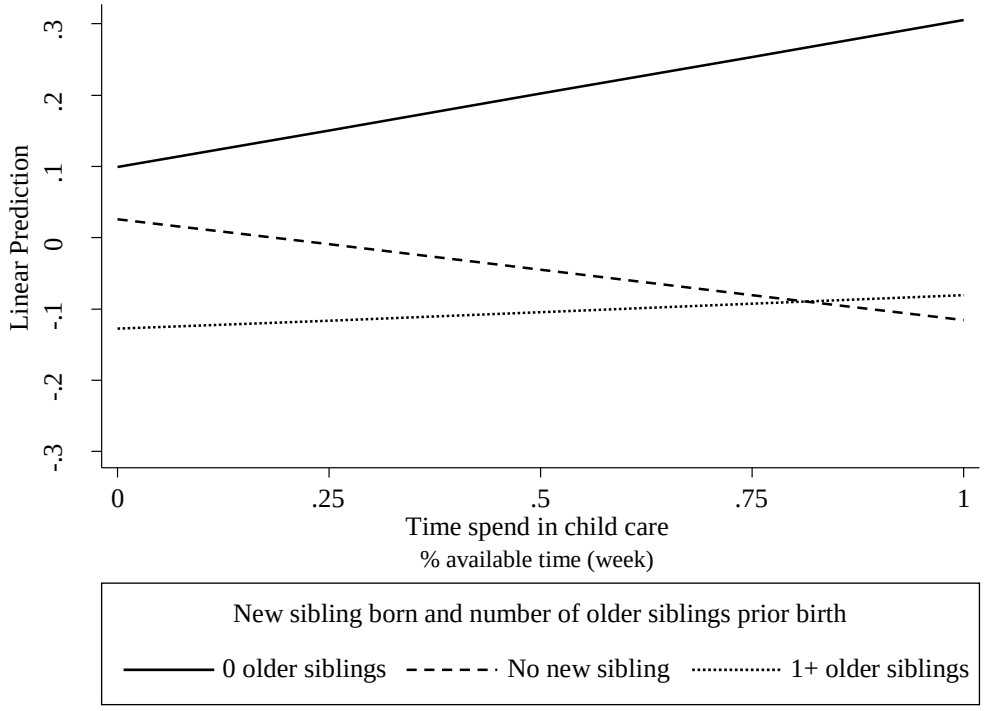
Figure 4.2 Predictive margins for frequency of activities as a function of the birth of at least one new sibling between t1 and t2



Mothers who give birth to a new child and who increase their overall childcare time between two measurement points engage in activities with their older child more often only if it the first-born (then only) child, and the coefficient is comparably high. This advantage disappears if this older child was the youngest at

the first measurement point (at ages 2 to 3), meaning that the child already had an older sibling and moves in birth rank from youngest to middle child through the birth of a new sibling. Therefore, even if mothers increase their overall time spend in childcare, it will have no effect on the activity frequency for the (then) middle child. Again, given the small sample size, however, interaction terms are estimated very imprecisely.

Figure 4.3 Predictive margins for frequency of activities as a function of number of older siblings and birth of at least one new sibling between t1 and t2



In short, there is evidence for both resource augmentation and dilution after the birth of a child: the oldest children gain more maternal attention, children who already have an older sibling (and are therefore middle-born after the birth of a new sibling) seem to lose attention.

Table 4.5 Parameter estimates for frequency of activities (fixed-effects models)

	M4.2a	M4.2b	M4.2c	M4.2d
Child's health impairments	-0.115*	-0.117*	-0.112*	-0.114*
	(0.068)	(0.067)	(0.067)	(0.067)
Childcare				
…by partner	0.062	0.059	0.063	0.060
	(0.076)	(0.076)	(0.075)	(0.076)
…by father	0.160	0.165	0.160	0.167
	(0.130)	(0.130)	(0.130)	(0.131)
…by siblings	0.001	0.012	0.000	0.011
	(0.107)	(0.106)	(0.107)	(0.106)
…by grandparents	-0.001	-0.003	-0.001	-0.003
	(0.066)	(0.066)	(0.066)	(0.066)
…daycare	-0.021	-0.024	-0.025	-0.030
	(0.060)	(0.060)	(0.060)	(0.060)
Time spend in child care (% of available time/week)	-0.091	-0.080	-0.135	-0.142
	(0.149)	(0.148)	(0.167)	(0.167)
Household Type				
Single mother (ref.)				
Couple	0.100	0.092	0.096	0.087
	(0.151)	(0.151)	(0.152)	(0.152)
Multigenerational family	-0.019	-0.028	-0.027	-0.039
	(0.468)	(0.467)	(0.467)	(0.466)
Household's net income	0.029	0.029	0.030	0.029
	(0.022)	(0.022)	(0.022)	(0.022)
Mother's education				
Up to general secondary school (ref.)				
Intermediate secondary school	-0.232	-0.273	-0.229	-0.271
	(0.399)	(0.398)	(0.399)	(0.397)
Upper secondary school	-0.420	-0.448	-0.415	-0.441
	(0.412)	(0.410)	(0.411)	(0.408)
Tertiary school	-0.458	-0.497	0.449	-0.485
	(0.414)	(0.412)	(0.413)	(0.410)
Mother's working hours				
0-9 (ref.)				
10-29	-0.109	-0.108	-0.109	-0.109
	(0.073)	(0.073)	(0.073)	(0.073)
30 and more	-0.014	-0.010	-0.018	-0.015
	(0.086)	(0.086)	(0.086)	(0.086)
Age group (5-6 years)	-0.042	-0.042	-0.042	-0.041
	(0.048)	(0.048)	(0.048)	(0.048)
Birth of new sibling	0.120		0.033	
	(0.091)		(0.153)	
Number of older siblings prior birth of new sibling				
No older sibling		0.213**		0.073
		(0.107)		(0.191)
1 and more older siblings		-0.069		-0.154
		(0.134)		(0.233)
Birth of new sibling (yes) * Time spend in child care			0.204	
			(0.271)	

(continued)	M4.2a	M4.2b	M4.2c	M4.2d
*Number of older siblings prior birth of new sibling * Time spend in child care*				
No older sibling				0.348 (0.355)
1 and more older siblings				0.189 (0.361)
Constant	0.238 (0.346)	0.275 (0.344)	0.250 (0.347)	0.294 (0.345)
N	2196	2196	2196	2196

Standard errors in parenthesis. *** p < .01, ** p < .05, * p < .10.

Health impairments, the only child covariate that changes over time, shows a negative effect on frequency of activities. Coefficients for income, household composition, and childcare delivered by other persons or institutions tell a similar story as in the random-effects models; only the effect of childcare by the father, if he is not living within the same household, grows in magnitude but is still not significant. Notwithstanding a negative coefficient for age group in the random-effects models (questionnaires for 2- to 3-year-olds or 5- to 6-year-olds), it is now small as well as not statistically significant. However, maternal covariates change in the fixed-effects regressions. For one thing, the educational level of mothers was significantly positively related to the frequency of cognitively stimulating activities in the M4.1 models. Now, the opposite is true. With increasing educational level, the activity frequency decreases.

What at first glance seems to be counterintuitive can easily be explained when one compares the meanings of the random-effects and fixed-effects models. M4.1 compares different mothers with different educational levels and concludes that better educated mothers engage in activities more often than do less well educated mothers. In contrast, M4.2 looks what happens to a given mother over time. Naturally, there is not much variation in this variable because educational levels are relatively constant over time. However, if a mother manages to achieve a higher educational degree and at the same time cares for at least one child between the ages of 2 and 6 years, she has less time available to spend in stimulating activities with her child. For another thing, compared with the random-effects models, coefficients for maternal working time changed in the fixed-effects models; again, this can be explained when one considered the

meanings of the different models. Whereas longer working hours affect mothers' activity frequencies negatively if different mothers are compared, investigations of the same mothers over time show different results. Consistent with the M4.1 models but even greater in magnitude is the finding that mothers who increase their working time from less than 10 hours per week to more than 10 but less than 30 hours per week spend less time in activities with their children. In contrast, an increase from a total of 10 to 30 hours to more than 30 hours has a very small effect in the M4.2 models. This result is probably due to the very low number of mothers who increase their working time to such an extent; on the contrary, they rather tend to decrease it.

4.6 Discussion and Conclusions

By combining the results of the random effects and fixed effects models, the following conclusions can be drawn concerning the relationship of sibship size and the frequency of maternal activities with children. The effect of the number of siblings on the frequency of activities is not linear. Across families with two, three, and four children, the negative effect of sibship size flattens at comparable levels. However, even if mothers have more children, with increasing overall childcare time, they engage more often in cognitively stimulating activities with their children.

It seems that cognitively stimulating activities are an inherent part of everyday life. Even if mothers have many children and must therefore increase the time they spend on other childcare obligations, such as washing, cooking, or bringing their children to kindergarten, they still manage to engage in activities with them. This might happen through three mechanisms:

(1) Mothers might decrease childcare activities other than cognitively stimulating ones overall (e.g., cooking meals that can be prepared more quickly or doing the laundry less often).

(2) Mothers might reschedule their own daily routines to make more time available for cognitively stimulating activities (e.g., by sleeping less or doing fewer household chores).

(3) Mothers might combine activities with more than one child the same time or at least in less than twice as much time (e.g., feeding the children simultaneously or bringing them to the kindergarten together).

Within individuals across time, children engage in more activities with the mother when they are joined by a small sibling if they are first-borns and in fewer activities if they are laterborns. Thus, the positive effect of the birth of a younger sibling turns negative if a child already had one or more siblings. Across time, resource augmentation seems to be related to the presence of younger and older siblings and thus correlates with birth order. Thus, if, as hypothesized, an increased sibship size might go along with efficiency gains in maternal care and capitalizes on the public-good character of maternal activities, these processes appear to lead to higher frequencies of activities when younger children (ages 0 to 3) but not older siblings (ages 7 to 17) are involved. One can only speculate about this asymmetrical effect of the birth of a new sibling. For one thing, the compatibility of activities among children ages 5 to 6 and their younger siblings might be higher than with older siblings, presumably because of older siblings' school attendance and the tasks and duties connected with it.[35] In addition, the intensity of maternal care may increase when a new baby is born, thus increasing the likelihood of positive public-good spillover effects on the focus child despite the countervailing negative effect of having to share maternal care time. In short, maternal time resources appear to be a function not only of sibship size but also of sibship age composition.

All in all, dilution seems unavoidable in larger families. The frequency of activities for children with many siblings, both in levels across families and in changes over time, is clearly lower than for children without siblings. More children take a larger proportion of mothers' time, which consists less and less of cognitively stimulating activities as sibship size grows. However, the relationship is not linear and can be reversed from negative to positive depending on the presence of younger siblings.

[35] For more on this topic, see Chapter 5 on birth spacing.

5 MATERNAL ACTIVITIES WITH CHILDREN: DOES BIRTH SPACING MATTER?

5.1 INTRODUCTION

Most studies that have investigated the relationship between the sibling constellation and the amount of resources that siblings receive emphasize sibship size and birth order as the structural variables. Much less research has been done on birth spacing and its effect on parents' distribution of time, although its relevance for sibling inequality seems intuitively clear. Parents provide their children with different kinds and amounts of resources depending on the age of the child (Price, 2008). From a life course perspective, however, it is not age per se that matters; rather, parental time with children is influenced by developmental stages and involvement in institutions such as daycare facilities or schools. Siblings who are close in age have similar developmental stages and attend similar institutions, whereas this is not the case when siblings are spaced further apart. Based on this fact, two contrasting hypotheses can be proposed concerning birth spacing between siblings and the activities that children engage in with their mother: either mothers can involve more than one child in age-specific activities, which would increase the frequency of activities, or, conversely, children may compete for their mother's time, which would reduce the frequency of activities.

5.2 Contributions of the Present Study

This chapter makes three main contributions to the research. First, this study aims to connect birth spacing with the amounts of resources given to children 2 to 3 and 5 to 6 years of age. More precisely, it answers the question: "Does the frequency of cognitively stimulating activities differ with the difference in ages between both the next older sibling for the youngest children and the next younger sibling for the oldest children?" More than 30 years ago, Kidwell (1981) noted the fact that birth spacing was being neglected in the literature. Since his report, there has been no appreciable change in this deficiency, and studies that explicitly examine birth spacing are still very rare, especially research that makes use of data collected after 1990. In addition, although there has been some research on birth spacing and child outcomes, the underlying factor connecting family structure to outcomes – assumed here to be the amount of parental resources – has also been neglected.

Second, both an empirical examination of sibling spacing and the theoretical debate concerning its effect on parental time have so far been wanting, and the results of previous research have been contradictory. Considering the different attempts to explain this relationship, it is necessary to examine the contrasting assumptions about whether siblings share parental time or compete for it, but it is also important to consider each child's life context. This means that both the institutions to which the child is connected as well as the needs of each sibling should be considered.

And third, although family relationship studies in Germany have considered birth spacing, or more generally sibling constellations (see, for example, Bollman, 2012), no definitive attempts have been made to connect this factor to resource distribution or even to child outcomes. Therefore, this dissertation is one of the first to address this issue based on German data.

5.3 BACKGROUND

5.3.1 PREVIOUS RESEARCH

Although the literature on birth spacing as related to the distribution of parental resources is scant, more research has been conducted on the relationship between birth spacing and various child outcomes. The majority of these studies confirm that closer birth spacing leads to more negative outcomes[36], including higher child mortality (Bhalotra & van Soest, 2008; Maitra & Pal, 2008; Whitworth & Stephenson, 2002) lower verbal, math, and reading scores (Buckles & Munnich, 2012; Powell & Steelman, 1990); and underachievement in preschool (Hanushek, 1992). Buckles and Munnich provide a short résumé of studies that deal with the negative effects on child health and development of closer spacing between siblings.

A review of the literature by Steelman et al. (2002) showed that, in general, closer spacing leads to worse academic performance. Using a more specific approach, Black et al. (2004) focused on families with at least three children to determine whether the birth spacing between two subsequent siblings had an effect on the older child's IQ. These investigators also found that close spacing between the two younger siblings led to lower IQ scores for the third, older sibling. In another study, Powell and Steelman (1993) found that when siblings were close in age, the likelihood of dropping out of high school increased and post–secondary school attendance declined; even more interesting, however, was their attempt to test whether parental economic, intellectual, and social resources mediated this relationship. They reported that close birth spacing had a negative effect on these resources and, furthermore, that the direct effect of spacing on outcome variables declines when they added parental resources to the model as independent variables.

[36] See also report of the World Health Organization (WHO, 2006) for a summary of study findings and expert positions.

The majority of studies dealing with the effect of birth spacing on the distribution of parental resources have acknowledged that closer spacing leads to fewer resources. Powell and Steelman examined this relationship in a series of studies in the early 1990s. In 1995, in their study of economic resources in young adulthood, these authors showed that in addition to the growing numbers of siblings, closer spacing was also associated with less money for schooling, even when the results were controlled for test scores. Moreover, children who were close in age more often attended public school rather than private school, had less access to educational materials at home, and talked less about the school program with their parents (Powell & Steelman, 1993). In an earlier paper, Powell and Steelman (1990) looked at siblings whose births were either closely spaced or widely spaced to see whether birth spacing affected the frequency with which parents read to their pre-elementary school children. Particularly interesting is their differentiation between older and younger siblings. Their results showed that older as well as younger siblings who were close in age were read to less, but this effect was greater for the older siblings who were closely spaced. However, close spacing has not been shown consistently to have negative effects on resources. Although not the focus of the article, Price (2008) included birth spacing in his analysis of the effect of birth order on parent–child quality time for children 7 to 11 years of age. He found that as the years between the first-born and second-born sibling increased, differences in quality time with both mothers and fathers also increased. In other words, siblings who are closer in age receive more equivalent time resources than do more widely spaced siblings. Price concludes that a broader investigation of birth order is necessary. All in all, research tends to predict that wider spacing between siblings will have a positive effect on the amount of resources. Nevertheless, the studies discussed in this section were conducted with highly divergent operationalizations of parental resources, making their results difficult to compare. Accordingly, it seems important to bear in mind that different resources may be unequally affected by birth spacing.

5.3.2 EXPLANATIONS

To date there is no solid theoretical basis for the understanding of parental resource distribution based on birth spacing between siblings. However, some plausible hypotheses have been put forward, and logical conclusions can also be drawn from other theories.

One possible model to explain the relationship among number of siblings, parental resources, and children's outcomes is the resource dilution model (Blake, 1981, 1989; Downey, 1995). In a nutshell, it postulates that parental resources are finite and are distributed equally among siblings.[37] This means that each additional child will dilute the amount of parental resources that can be allocated to the other siblings and, furthermore, that the resources received will have an effect on outcomes, such as school achievement. In its initial form, this hypothesis did not consider birth spacing. Powell and Steelman (1990) extended the resource dilution model to include birth spacing, which influences the relationship between number of siblings and parental resources. These authors concluded that the effect of resource dilution can be increased or decreased depending on birth spacing.

Results reported by Hertwig et al. (2002) also suggest that birth spacing and birth order are inextricably linked to number of siblings (see Section 2.2), but this relationship is not immediately obvious. But the longer children remain with no or few siblings, the more they can profit from not sharing resources. This is particularly the case for first-born children for whom there is a wide gap before the birth of the next younger sibling because they do not have to share parental resources as long as they do not have another sibling. This advantage is especially important because, as argued in Section 2.4, the most sensitive periods for developing cognitive and even non-cognitive skills is when the child is very young (Cunha & Heckman, 2008).

In order to understand the effects of birth spacing, a distinction must be made between the different kinds of resources parents can provide to their children (Downey, 1995). First, the allocation of economic resources, such as money for

[37] See Chapter 2 for more on the resource dilution hypothesis.

schooling, is contingent on the number of siblings because such resources cannot be easily shared. If the age gap between two siblings is wide, parents have more time to accrue monetary resources during that interval so there will be sufficient funds for both children. If this gap is narrow, the expenditures related to having two children similar in age allow parents no time to recover financially (Steelman et al., 2002).

Although the relationship between birth spacing and economic resources is fairly clear, sharable resources can be either positively or negatively related to birth spacing (Steelman et al.). One such resource is parental attention. In households with more children but also closer spacing between births, individual children get less parental attention (Powell & Steelman, 1990). Siblings who are close in age tend to have similar needs and interests and engage in the same activities, thus have to share their parents' attention (Kidwell, 1981). This can result in competition between the siblings when the age gap is small; however, the negative effect of competition can be offset.

First, having closely spaced siblings may be an advantage because mothers can combine age-appropriate activities (Buckles & Munnich, 2012; Craig & Bittman, 2005; Powell & Steelman, 1995) and can profit from economy-of-scale effects by engaging in these activities with more than one child at a time (Folbre et al., 2005; see also Section 2.3). Wider age gaps between siblings mean the children will have different needs and interests, such as the demand for age-specific books. To stimulate her children cognitively, the mother would need to select different books to read aloud based on the different ages of her children; thus, the larger the birth spacing, the less economies of scale can take effect. This should be especially true if the older child is already attending school while the younger is not. In this case, the probability that both siblings have different childcare needs increases, so the siblings compete for maternal time. This discrepancy between children's needs and interests applies to other resources as well, such as the need for age-appropriate toys and clothes if the birth spacing between siblings is large (Steelman et al., 2002).

Second, the positive effect of close birth spacing should be greater when the children are still very young because mothers tend to decrease their working hours as the number of young children grows, leading to an increase in the overall

availability of the mother for childcare. However, some would argue that the effect of birth spacing on parental resources, as well as on children's outcomes, is spurious (Powell & Steelman, 1993) because of an endogeneity bias – that is, whether mothers have closely or widely spaced children is not random, nor is the frequency with which these groups of mothers engage in activities with their children. Accordingly, there is an unobserved causal factor (most prominently the socioeconomic status of the mother) that influences both the spacing between siblings and how often a mother engages in activities with her children (Powell & Steelman). Nevertheless, empirical studies on this topic usually control for socioeconomic status and the results still indicate a strong and statistically significant relationship between birth spacing and parental resources as well as child outcomes. In addition, Buckles and Munnich (2012) investigated the relationship between birth spacing and educational achievement and compared estimates using an OLS regression and an instrumental variable strategy to account for the endogeneity of spacing. Although both methods yielded the same conclusions, the OLS estimates were underestimated.

5.4 DATA

5.4.1 SAMPLE AND ANALYTIC STRATEGY

The data for this study are retrieved from the SOEP and the FiD and include information from all completed questionnaires for children in the age groups 2 to 3 and 5 to 6 years. Twins, only children, and middle children were excluded from the analysis for various reasons. Twins are usually not compared with children who have siblings or with only children because they face different conditions during pregnancy and at birth (e.g., lower birth weight) (Downey, Condron, & Yucel, 2013). Only children are not included because they have no siblings so there is no dependent variable value. As for middle children, excluding them means the loss of important information but including them would impair the

analysis because either their status as an older or younger sibling would need to be specified or they would need to be observed twice. In both cases, the inclusion of middle children would lead to biases in the data and results. Thus, the dataset consists only of a mother's oldest (first-born) and youngest (last-born) children who are not twins. OLS regressions with robust standard errors were estimated to test the effect of birth spacing on the frequency with which a mother engages in activities with her children for each age bracket respectively.

5.4.2 Measures

5.4.2.1 Dependent variable

The dependent variable is mother's frequency of cognitively stimulating activities with her child.[38] Mothers rate the frequency of the following activities during the past 14 days on a four-item scale (daily, several times per week, at least once a week, and never): singing children's songs with or to the child, painting or doing arts and crafts, reading or telling stories, and looking at picture books. Because these particular activities are known to be important for child outcomes, the scale is designed to measure "quality time" (Price, 2008).

5.4.2.2 Independent variable

The main independent variable is birth spacing between siblings. Studies that deal with the effects of birth spacing do not agree about the thresholds of wide and close. Powell and Steelman (1990, 1995) as well as Downey et al. (2013) defined closely spaced siblings as being 1 to 2 years apart and all spacings of 3 years or more are considered wide. Kasten's (2001) analysis differentiates between close and wide but also includes middle spacing. He agreed with Powell and Steelman

[38] For more detailed information about this variable, see Section 3.3.1.

that close spacing should be defined as up to 2 years but defined middle spacing as 2 to 5 years and all spacings above 5 years as wide. In addition, Kasten argued that wide spacing thus defined has rarely been investigated. For example, Price (2008) removed from his study all children who were born more than 6 years apart, assuming that these children represented either unwanted pregnancies or the products of remarriages, thus biasing the results. Similarly, Chasiotis (1999) differentiated between biological and functional roles of siblings, arguing that siblings with an age spacing of more than 6 years are equivalent to only children rather than to children with siblings. In contrast, Guo and VanWey (1999a) defined close spacing as up to 5 years.

Not only is there disagreement about thresholds for birth spacing, but studies also differ in terms of the operationalizations used. The studies cited above included either the number of closely and widely spaced siblings or a dummy variable, but a variety of operationalizations have also been applied. For instance, Kidwell (1981) worked with both the mean spacing and the density of all siblings and concluded that there is no marked difference between his density measure and simply including number and spacing of siblings. Powell and Steelman (1995) introduced another dimension to sibship size, the distinction between older and younger siblings, which is also used in later studies (Downey et al., 2013).

Considering the various operationalizations of birth spacing, spacing is not categorized as wide or close but is instead used as a categorical variable and a distinction is made between older and younger siblings. The advantage of such an operationalization is that it can capture eventual nonlinear effects. More specifically, an interaction term between birth spacing and birth order is used. However, the birth order variable has only two categories: youngest and oldest children. This results in two variables that measure the age interval in terms of years until the next older sibling for the youngest children and years until the next younger sibling for the oldest children. Owing to the small sample sizes for large age gaps, spacings from 5 to 8 years are combined in one category. Very high spacings (8 years or more) are excluded from the analysis because it is assumed that adolescent or even adult siblings do not influence the mother’s frequency of activities.

5.4.3 Descriptive Statistics

Table 5.1 shows the frequency distribution and mean values for age spacing to the next older sibling for the youngest and to the next younger sibling for the oldest child for the age groups 2 to 3 years and 5 to 6 years. No frequencies exist for spacings of more than 4 years for the oldest children in the age bracket 2 to 3 years because the maximal possible spacing to the next younger child is 3 years. Similarly, owing to the study design, the maximum birth spacing (category 5 years or more between births) of oldest children to their next younger sibling was limited to 6 years for the age bracket 5 to 6 years.

Table 5.1 Mean values and frequency distribution (in italics) of birth spacing of youngest and oldest children in age brackets 2 to 3 years and 5 to 6 years

Age group	Birth order	Age gap to next older sibling				
2-3		1	2	3	4	5
	Youngest	0.03	0.00	-0.08	-0.22	-0.17
		137	*470*	*475*	*295*	*448*
		Age gap to next younger sibling				
		1	2	3	4	5
	Oldest	0.02	0.18	0.19	-	-
		100	*269*	*142*	-	-
5-6		Age gap to next older sibling				
		1	2	3	4	5
	Youngest	0.02	-0.24	-0.29	-0.21	-0.10
		90	*304*	*264*	*163*	*287*
		Age gap to next younger sibling				
		1	2	3	4	5
	Oldest	0.25	0.34	0.30	0.30	0.09
		65	*231*	*273*	*131*	*72*

The youngest children constitute the largest percentage in both age brackets, particularly in the group of children 2 to 3 years of age, in which the number of youngest (last-born) children is almost four times higher than the number of oldest (first-born) children. In terms of the distribution of birth spacings, mothers seem to prefer spacings of 2 or 3 years and, to a smaller extent, 4 years between children instead of the close spacing of 1 year. The number of mothers who spaced their children 5 and more years apart is also relatively high and decreases slowly with increasing age gaps.[39] There seems to be no threshold at which mothers completed childbearing. Certainly, birth spacings of up to 4 years are preferred, but longer gaps are also represented.

Concerning mean values, very high spacings of 5 years are not in keeping with the other spacings in that for each age group and birth position in the latter a clearer picture emerges. If only spacings of up to 4 years are considered, higher age gaps for the 2- to 3-year-old youngest (last-born) children to their next older sibling are associated with lower activity frequencies. In contrast, for oldest (first-born) children in this age bracket, the age gap does not seem to matter as long as the spacing is not less than 1 year. Similarly, for children ages 5 to 6 years, higher age spacing is again associated with lower activity frequencies for the youngest (last-born) children if the age spacing is greater than 1 year; however, differences between the age gaps are small and not constantly decreasing. For the oldest children in the 5- to 6-year-old group, age spacing seems to have no effect. Mean values for all age gaps are at a comparable positive level.

5.5 RESULTS

Table 5.2 displays the model results for the 2- to 3-year-old children (M5.1) and the 5- to 6-year-old children (M5.2). For a better understanding of interaction coefficients, predictive margins of the interaction terms are shown in Figure 5.1

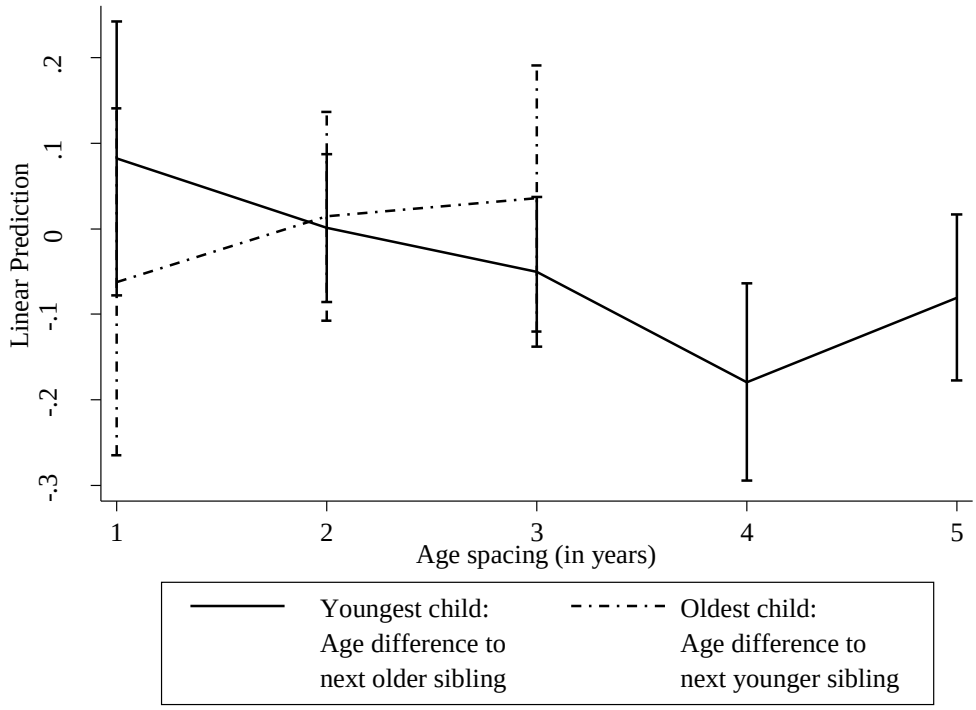
[39] Results are not shown in this figure owing to the small sample sizes.

for the 2- to 3-year-olds and in Figure 5.2 for the 5- to 6-year-olds. Tests were also carried out to determine whether marginal values are different from each other as well as different from zero, and the results are described below. For both models, summary statistics for valid cases can be found in Appendix C (see Tables C1 and C2).

5.5.1 Ages 2 to 3 (M5.1)

Figure 5.1 shows not only that birth spacing effects vary according to birth order, but also that different age gaps between siblings have different effects on the frequency of quality time provided by the mother. For the oldest (first-born) children in the age group 2 to 3 years, birth spacing has a positive effect; however, none of the coefficients are statistically different from zero.

Figure 5.1 Predicted margins for frequency of activities as a function of birth order and birth spacing for 2- to 3-year-old children, including 95 percent confidence intervals



It appears that the difference in age to the next younger sibling has no effect on frequency of activities. A quite different picture emerges for the youngest (last-born) children. With the exception of the last spacing group (5 or more years), an increase in birth spacing has a negative effect on activity frequency. But age gaps of 1 to 3 years are not significantly different from zero and not different from each other. The same is true for the birth spacings of 5 years or more. The only marginal value that is not only different from zero but also from 1-, 2-, and 3-year spacing is the 4-year age gap. In other words, the youngest sibling experiences a disadvantage caused by the age spacing to the next older sibling only if the sibling is 4 years older. Actually, an age spacing of 4 years seems to be the worst sibling constellation for the children 2 to 3 years of age.

Table 5.2 Parameter estimates for frequency of activities (OLS regression)

	M5.1	M5.2
Child's age (in months)	-0.001 (0.006)	-0.008 (0.006)
Child's sex (boys)	-0.216*** (0.039)	-0.155*** (0.045)
Child's health impairments	0.050 (0.047)	0.026 (0.049)
Childcare		
…by partner	0.056 (0.054)	0.073 (0.058)
…by father	0.008 (0.118)	0.119 (0.115)
…by siblings	0.176** (0.071)	-0.025 (0.076)
… by grandparents	0.075* (0.041)	0.031 (0.045)
…daycare	-0.061 (0.045)	-0.045 (0.052)
Time spend in child care (% of available time/week)	0.333*** (0.102)	0.228* (0.121)
Household Type		
Single mother (ref.)		
Couple	0.301*** (0.110)	0.146 (0.098)
Multigenerational family	-0.154 (0.332)	0.516* (0.313)
Household's net income	0.023** (0.010)	0.007 (0.012)

(continued)	M5.1	M5.2
Mother's age	-0.003 (0.005)	0.002 (0.005)
Mother's education		
Up to general secondary school (ref.)		
Intermediate secondary school	0.325*** (0.062)	0.065 (0.065)
Upper secondary school	0.425*** (0.074)	0.079 (0.080)
Tertiary school	0.622*** (0.067)	0.202*** (0.075)
Mother's working hours		
0-9 (ref.)		
10-29	-0.022 (0.053)	-0.075 (0.056)
30 and more	-0.181*** (0.062)	-0.242*** (0.065)
Data source (FiD)	0.101** (0.051)	0.050 (0.057)
Number of siblings	-0.134*** (0.026)	-0.038 (0.036)
Sibling rank (oldest)	-0.145 (0.133)	0.240 (0.170)
Age spacing		
1 (ref.)		
2	-0.081 (0.092)	-0.242** (0.120)
3	-0.133 (0.094)	-0.279** (0.124)
4	-0.262** (0.102)	-0.176 (0.136)
5	-0.163* (0.097)	-0.055 (0.126)
Child's sibling rank (oldest) Age spacing*		
2	0.158 (0.147)	0.293 (0.187)
3	0.231 (0.158)	0.316* (0.189)
4		0.181 (0.204)
5		-0.195 (0.215)
Constant	-0.506 (0.259)	0.272 (0.487)
N	2336	1880

Reference categories in parenthesis. *** p < .01, ** p < .05, * p < .10.

Other covariates also influence the frequency of cognitively stimulating activities that mothers engage in with their children. Reconfirming the results in Chapter 4, the number of siblings has a negative effect on activity frequency. With regard to activity frequency, children who have more siblings are disadvantaged when compared with children who have fewer siblings. The birth month and health status of the child have no effect, whereas a child's gender exerts one of the greatest effects in the model. Girls receive quality time more frequently than boys do. Childcare provided by persons or institutions other than the mother (i.e., the mother's partner, the father, or daycare) has no statistically significant effect on the dependent variable with the exception of childcare provided by grandparents or siblings. The coefficient for grandparents' help is small, but help from siblings lead to a noticeable increase in activities with mothers; still, the results in both cases are statistically significant. The presence of siblings does not compensate for less maternal time; on the contrary, it increases it.

Maternal and household characteristics are important influences, although the mother's age has no effect on activity frequency. The mother's employment status has an effect only if she works many hours. The effect of working up to 30 hours a week does statistically not differ from zero or from the effects of mothers who do not work. Nevertheless, working more than 30 hours per week has a negative effect. It seems that mothers can combine work and childcare up to a threshold of around 30 working hours per week, but if they work more, they are no longer able to keep activity frequencies at a higher level.

Children of mothers who achieved a higher level of education seem to profit enormously. The coefficients are all statistically significant and very high compared with the other variables in the model. This is particularly true for mothers with a tertiary educational degree. Another important maternal covariate is overall childcare time.

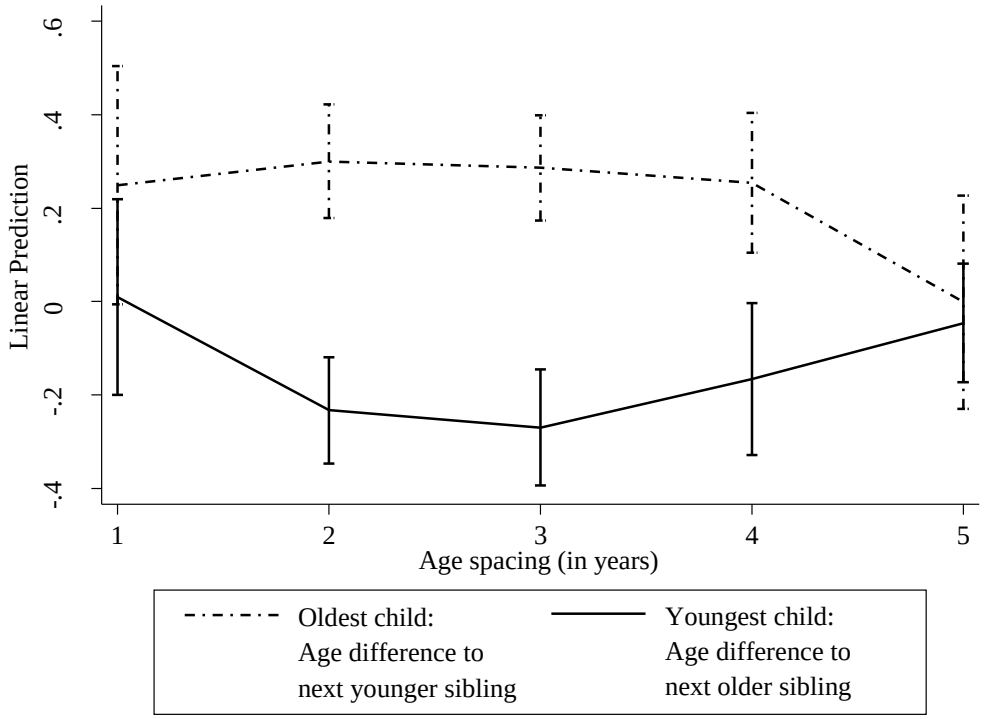
Confirming the results discussed in Chapter 4, an increase in childcare time leads to an increase in activities. The additional time translates directly into cognitively stimulating activities. Household net income is statistically significant, but the coefficient is very small and therefore not important for children. With regard to household constellation, results are varied. As compared with single mothers,

couples influence the frequency of activities in a positive way, whereas multigenerational households have an appreciably negative effect, but the coefficient was not significant. Partners may help each other with basic childcare tasks so that more time remains for activities. And lastly, mothers from the FiD sample report higher activity frequencies than do mothers from the SOEP sample.

5.5.2 Ages 5 to 6 (M5.2)

Figure 5.2 shows the predicted values for the interaction term between birth order and birth spacing for the 5- to 6-year-old group. Youngest and oldest children exhibit vast differences in terms of age gap effects on maternal activity frequency. For the oldest children, a clear picture emerges.

Figure 5.2 Predicted margins for frequency of activities as a function of birth order and birth spacing for 5- to 6-year-old children, including 95 percent confidence intervals



Almost independent of the birth spacing to their next younger sibling, these children engage in significantly more activities with their mothers than do the youngest children in this age bracket. Coefficients for age gaps of 1 to 4 years are statistically significant but not different from each other. However, they are significantly higher than the predicted values for the youngest children – except for an age spacing of 1 year, which is higher for the oldest than for the youngest 5- to 6-year-olds, but the difference is not statistically significant. Accordingly, only the fact of being the first-born leads to more activities. But the coefficient of oldest children with a birth spacing of 5 to 8 years is not significantly different from zero nor from the coefficient for this age gap of youngest children.

Another picture emerges for the youngest children. First, very close spacing of 1 year as well as wide spacing of 5 years or more have no effect on activity levels, whereas age gaps of 2 to 4 years are significantly associated with lower activity frequencies. However, these age gaps do not differ from each other. The only spacing coefficients that differ from each other within the youngest group of children are between 1 and 2 and 1 and 3 years, as well as between 2 and 5 and 3 and 5 years.

The majority of covariates for 5- to 6-year-olds is similar to those described earlier for the group of 2- to 3-year-olds. However, a few variables indicate diverse relationships with the frequency of cognitively stimulating activities. One of these variables is the number of siblings, a coefficient that is smaller for the age bracket 5 to 6 years and also loses its statistical significance. The size of the sibship seems to be much less important with regard to the older children. Only one childcare variable that now has a relevant effect on activity frequency is childcare by a sibling, which is positive for younger children but zero for the 5- to 6-year-olds. Mother's educational level, which was the most important variable for in the 2- to 3-year-olds, clearly drops in magnitude. Children ages 5 to 6 years profit from their mothers' higher educational level only if the mothers have a tertiary education degree. Coefficients from mothers with lower educational levels do not differ significantly from one another. Moreover, older children (ages 5 to 6 years) seem to profit more from different household types than do younger children. Whereas 2- to 3-year-olds can profit from a couple being in the

household, this factor becomes less important for the 5- to 6-year-olds, but the effect of a multigenerational household increases. The last covariate that changes in terms of its effect on activity frequency is the survey source (SOEP or FiD), which is no longer significant for the older children.

5.5.3 Sensitivity Analysis

For the purpose of robustness, operationalizations for several measures in certain selected models are changed. First, thresholds in the wider age spacings category are varied. The category of 5 or more years was split into two variables: 5 years, and 6 or more years. Although the conclusions do not change with this adjusted operationalization, the sample size for children with an age spacing of 5 years gets smaller. In addition, the maximum age spacing was experimented with by excluding the age spacings of 7 or more years and 11 or more years. In the selected models, age spacings of more than 9 years are excluded. Results remain almost identical. The same is true when number of siblings is included as a categorical variable and mother's working hours as a continuous variable. All in all, the results turn out to be robust even after changes are made in the operationalization of variables.

5.6 Discussion and Conclusions

Taking all the results concerning birth spacing together, some main conclusions can be drawn.

First, very close spacing of 1 year is advantageous – or at least not disadvantageous – for all children, independent of age. Mothers seem to be able to manage sibling activities better when children are close in age, probably due to scale effects or efficiency gains. The larger the age gap between two children, the fewer activities can be combined because of growing differences in the individual children's needs and preferences.

This leads directly to the second conclusion: the needs and preferences are similar not only among children close in age, but also between siblings who are both young, up to around 5 years of age. The data show that up to a specific age, spacing is rather not important in terms of the frequency of cognitively stimulating activities. For example, the spacing to the next younger sibling for the oldest children in the age bracket 2 to 3 years is not relevant frequency of activities. The same is true for the youngest children in the same age bracket up to an age spacing of 3 years, but this conclusion changes when at least one sibling reaches (pre-) school age. For the youngest children in the 2- to 3-year-old age bracket, the age gap to the next older child of school age is about 4 years. Figure 5.1 shows impressively that a 4-year spacing becomes a disadvantage for the younger child, as compared with smaller age gaps. From the perspective of school-age children, this conclusion still applies. The oldest children in the 5- to 6-year-old age bracket who have younger siblings engage in very frequent activities with their mothers, independent of birth spacing. Mothers might make preparations for school or support early school experiences by investing more time in activities with these children. This advantage for older children goes hand in hand with a disadvantage for younger children. However, the advantage no longer holds true once all children reach school age. Although the youngest children in the age bracket 5 to 6 years have reached (pre-)school age, they do not profit from their mother's flexible time allocation but instead depend on their older sibling's time schedule, which is still influenced by the higher frequency of activity while the younger sibling was at pre-school age.

And third, youngest children with a large age gap to the next older sibling receive higher activity frequencies in both age brackets. Most research on sibling spacing has excluded large spacings between siblings from the analysis because it is assumed that these families differ from families with closer spacing. For example, Price (2008) includes only spacings up to 6 years because he expects wider spacings to reflect remarriages or unwanted pregnancies. But no matter what the cause of the large spacing is, children who are very young relative to their siblings may take on the role of the baby of the family. Latecomer favoritism and the fact that the older siblings have reached an age at which they no longer need basic childcare lead to higher maternal activity frequencies with the younger child.

In addition to the main results, resource dilution is again evident, but the effect is stronger for younger children. More siblings lead to lower activity frequencies. Moreover, mothers seem to prefer girls for these kinds of cognitively stimulating activities. One explanation for this impression could be the selection of typically girl-specific activities for the dependent variable. Perhaps mothers engage in different activities with boys and girls[40]; however, this is not possible to test based on the data used here. Unlike the results described in Chapter 4, mothers who got help from older siblings are probably more likely to have a surplus of time available, which can then be invested in cognitively enriching activities. And again, mothers seem to use the increase in available time not only for basic childcare but also for cognitively stimulating activities.

All in all, the results show that it is not birth spacing per se that matters when it comes to the frequency of activities mothers engage in with their children. The hypotheses discussed in Section 5.3.2 have pointed to reinforcing or weakening functions of birth spacing, and it seems that both mechanisms are at work. Whereas for young children, small age gaps lead to higher activity frequencies, for older children, they seem to have no effect. Life course events such as school enrollment and the tasks and needs associated with each particular age also lead to differences in the allocation of activities among the children. Siblings do not live just side by side in a family; rather, each sibling's life influences other members of the family (Moen & Hernandez, 2009). Since activities undertaken with parents as measured in this paper should have a positive effect on children's skills, the frequency of these activities plays a crucial role for future outcomes of children and therefore, extending the scope, for social inequality. The sibling structure a child is born into co-determines his or her later life success; however, this paper has accentuated the need to integrate sibling structure and life course contexts, including not only birth spacing but also birth order and number of siblings.

Several caveats are in order when considering the results reported here. The measure of activities is not necessarily generalizable. For example, other studies involving similar measures of time have reported divergent results, such as the

[40] See Chapter 6 for more on siblings' gender composition.

study by Powell and Steelman (1990). They showed that close spacing has a negative effect on the frequency with which parents read to pre-elementary school children. Price's (2008) results, on the other hand, are fairly consistent with the results of this study. His "quality time" measure includes the following activities with the child: reading to and with the child, playing, helping with homework, talking with and listening to the child, helping/teaching, doing arts and crafts with the child, eating together, playing sports, attending cultural performances and visiting museums, participating in religious practices, looking after the child as primary caregiver, and physical care.

One has to be careful when comparing the results on birth spacing without explicitly differentiating between the measures of parental resources. Birth spacing may influence diverse activities differently even though they seem to have a common factor. In addition, the results have shown that girls profit more from higher activity frequencies than boys do. This could be due to a sex-specific bias of the dependent variable or to real discrimination.

Explanations for birth order and birth spacing patterns remain speculative owing to data requirements. Although the results tell a plausible story, this chapter did not empirically test whether assumptions hold true.

Another caveat concerns causality. Analyses with cross-sectional data always have to deal with the question of cause and effect. It can only be assumed that mothers decide on the basis of spacing between siblings how often they want to spend time with their children. However, some mothers might choose specific age gaps between their children on the basis of efficiency gains and scale effects. These decisions may also rely on other mother-specific characteristics that are not controlled for in the models and that may bias the results. But, as Buckles and Munnich (2012) have shown, the results of this study should, at most, be underestimated.

On the one hand, future research should test the assumptions made in this article empirically and in more detail; on the other hand, it must fix the possible problem of unobserved factors that might bias the results. Furthermore, a solution for a correct and precise operationalization of birth spacing is needed that includes middle children. Another important suggestion for future studies is the use of longitudinal data to minimize questions about causality. Also, the study design used here precluded estimations of sibling models or within-family analyses

(Conley et al., 2007); the latter would be preferable to between-sibling analyses. Ideally, data should combine both longitudinal and within-family information to allow analyses of family processes. In that way, one could investigate not only how resources are distributed between siblings as a function of birth spacing, but also the effect that age-specific frequency of activities has on future outcomes as well as whether these activities are more influential for skill formation when performed during certain age periods (Cunha & Heckman, 2007) .

6 HAVING BROTHERS, HAVING SISTERS, HAVING BOTH: HOW DOES THE SEX COMPOSITION OF SIBLINGS AFFECT MATERNAL ACTIVITY FREQUENCIES?

6.1 INTRODUCTION

In addition to number of siblings and birth spacing, a third sibship constellation characteristic, gender, is examined in this chapter. It focuses on whether the sex composition of the sibship influences the frequency of cognitively stimulating activities that mothers engage in with their children. Although the previous chapters have consistently shown that boys engage in cognitively stimulating activities with their mothers less frequently than girls do, the focus in this chapter will be on not only the gender of the target child but most notably the sex composition of the whole sibship. The question to be answered is whether certain constellations of sibling's genders are more or less advantageous for girls and boys in the age groups 2 to 3 years and 5 to 6 years. Until now, research on sibling sex composition has provided extremely mixed results (Conley, 2000).

6.2 CONTRIBUTIONS

The first and foremost contribution of this chapter to the existing literature is its analysis of sibship constellations per se. To date, there has been a lack of research both on sibship sex constellations and, even more importantly, on their relationship to parental resources. This chapter investigates the relationship between sibling sex composition and the allocation of resources – specifically, cognitively stimulating activities – among siblings. In doing so, it teases out one possible mechanism responsible for the correlation between sibling constellation and outcomes.

Another contribution of this chapter is that the results were made possible and reasonable because they rely on information about (pre-)school children available from two valuable databases: the SOEP and the FiD. Parental time resources are most effective when children are young (Pavan, 2013; Bernal & Keane, 2011; Del Boca, Flinn, & Wiswall, 2014); therefore, the amount of resources children receive should have long-lasting effects on their outcomes later in life (Kaestner, 1997; see also Section 2.1).

The third contribution is that the study provides results that pertain to Germany, whereas most previous research on this topic involved data about America and Asia. Germany is an interesting country to study because it has some unusual characteristics. For example, on average, men have higher incomes than women in Germany despite equal educational attainment or similar job positions. But in recent years, girls have caught up and even surpassed to boys in their performance at school as well as at university (BMFSFJ, 2009); their school grades are better, and more girls than boys graduate from secondary school (Abitur) (Helbig, 2013). Thus, if men earn more on average even though their level of educational achievement is lower, it would appear that the effect of education on income is stronger for men than for women in Germany for different reasons (see, for example, Holst, Busch, & Kröger, 2012).

6.3 BACKGROUND

6.3.1 PREVIOUS RESEARCH

Research on the relationship between the sex composition of sibships and the frequency of cognitively stimulating activities has, to my knowledge, not yet been carried out. Therefore, this discussion will begin with a review of the studies concerned with the effect of a child's gender on parent-child activities rather than the effect of the sex composition of the whole sibship. The discussion then focuses on the influence of siblings' sex composition on educational outcomes. Since cognitively stimulating activities have a positive effect on children's skills and these skills, in turn, have a positive effect on educational success, the studies cited here on the relationship of sibling sex composition and educational outcomes should at least give some clues as to the negative or positive nature of these effects.

6.3.1.1 CHILD'S SEX AND PARENT-CHILD ACTIVITIES

There is evidence showing that a child's gender influences parent-child activities (Bryant & Zick, 1996). Sex discrimination by parents might even begin before their children are born. In many countries parents openly express their wishes regarding the sex of their children (Dahl & Moretti, 2008), not to mention the extreme case of infanticide (Hesketh et al., 2011).

With regard to cognitively stimulating activities undertaken by the mother, results from previous chapters have consistently shown that boys are less frequently involved in such activities than girls are. Explanations for this finding are speculative: on the one hand, mothers may want to promote girls' development more than boys'[41]; on the other hand, activities as measured in this dissertation are

[41] Explanations for such behavior are discussed in Chapter 2.

somewhat girl-specific, and mothers and sons may engage in different activities that are not included in the questionnaire and are therefore not measured by the data. Another explanation might be that even if mothers intend to equalize the outcomes of their children independent of gender, they might have to invest more time with their daughters because boys and girls develop skills unequally during early childhood (Serbin, Zelkowitz, Doyle, Gold, & Wheaton, 1990), the activities as measured here might show certain skills come more easily to boys than to girls.[42]

Data from mainly U.S. sources indicate that sex stereotypes can also lead to unequal treatment (Jacob, 2010). Parents, mostly fathers (Brody & Steelman, 1985; Lundberg, 2005; Yeung, Sandberg, Davis-Kean, & Hofferth, 2001), allocate the time they spend with their children differently, in both quantitative and qualitative terms, depending on the child's gender, and they spend different amounts of time for different activities (Lundberg, 2005; Yeung et al., 2001). According to Lawson (2009), parents tend to favor children of their own sex when it comes to parenting activities; thus, mothers invest more in girls and fathers more in boys (Zick & Bryant, 1996). But because the effects are greater for fathers and sons than for mothers and daughters, Lawson concludes that there is an investment bias in favor of sons. In contrast, Kendrick and Dunn (1980) found that maternal attention to siblings of both genders was equivocal.

6.3.1.2 Sibship sex composition and educational outcomes

Most studies on the sex composition of sibships have focused on explaining its effects on educational outcomes. But the results of such studies do not seem to be robust, probably owing to different operationalizations of both the sex composition of sibships and educational success, noncomparable samples and age brackets of respondents, and a lack of methodological comparability (Conley, 2000; Steelman et al., 2002). These incongruities may be responsible for inconsistent findings, ranging from the conclusion that sex composition has no

[42] However, it is by now not possible to examine this idea with the data used in this dissertation and therefore remains rather speculative.

effect at all to the conclusion that having only sisters is advantageous or, conversely, that having brothers produces best outcomes.

Researchers do not agree about whether or not sex composition in general has any effects, and parents in different countries may also differ in the way they respond to their children's gender. Two studies with mixed results, both conducted by Powell and Steelman for America (1989 and 1990), exemplify how vague general statements are about the relationship in question. In their earlier paper, the authors concluded that it is only the number of brothers that influences parental financial contributions to college expenses for senior students, whereas in their second paper, they found no effect of sibling sex composition on standardized test scores as well as a negative effect on grades of the number of brothers and the number of sisters, with the coefficient for brothers being more negative. Similarly, in their report on West and East Germans as well as migrants in Germany, Bauer and Gang (2001) concluded that educational attainment is independent of sibship sex composition with two exceptions: West German men are disadvantaged if they have sisters, whereas for female migrants in Germany, sisters have a positive effect.

Another study, which involved race, shows that much more research is needed. Kaestner (1997) found no significant effect of sibship sex composition on adult educational achievement for whites, whereas for blacks, growing up with more sisters than brothers had a positive effect. In terms of geographic location, Hauser & Kuo (1998) reported no clear effect of sibship sex composition on educational outcomes, and Chen, Chen, and Liu (2008) and Amin (2009) came to the same conclusions in their studies in Taiwan and Britain, respectively. One explanation for this lack of effect could be that different generations were examined. Chu, Tsay, and Yu (2008) report for Taiwan that although the older generations of parents treat girls worse than boys, such differential treatment diminishes and finally disappears with ever-younger generations (see also Butcher & Case, 1994). In addition to the ages of respondents, it seems that the population chosen for study also makes a difference.

The results described above also indicate that even if sex composition has an effect, there is no agreement as to which sibling constellation is favorable or disadvantageous. Some studies have shown that having sisters leads to better outcomes than having brothers (see Bauer and Gang, 2001, for educational levels

of foreigners in Germany, Kaestner, 1997, for educational achievement of blacks and Powell and Steelman 1990, for grades). In their studies in Ghana, Garg and Morduch (1998) found that a child does better on measured health indicators if it has only sisters and no brothers independent of the sex of the child itself. In contrast, Bucher and Case (1994), using data on men and women born between 1920 and 1965, showed that the women who grew up with only brothers received more education than women who had any sisters, but for the men, sibship sex composition had no effect; as Conley (2000) pointed out, however, this study was limited by a restricted sample and questionable measures. Moreover, both Kaestner (1997) and Hauser and Kuo (1998) replicated the study and found no effect of sex composition (see above).

There are also studies that report an opposite-sex effect, independent of the sex of the respondents themselves. For example, Rosenberg (1965) showed that opposite-sex siblings led to more parental warmth and affection toward a child, but also that this effect was greater if boys were the minority sex in a family. In contrast, Chu, Tsay, and Yu (2008) reported that opposite-sex siblings are unfavorable in terms of educational opportunities. Similarly, Conley (2000) showed with regard to educational attainment that men were at a disadvantage if they had sisters, as were women if they had brothers in 1989.

Some researchers have reported on the presence of other variables that influence the relationship between sibship sex composition and outcomes, specifically social class and birth order.[43] In particular, the Trivers-Willard hypothesis predicts that high-status parents prefer to invest their resources in sons, whereas in low-status families girls are preferred owing to the difference in reproductive success of both sexes at different rungs of the social ladder (Hopcroft, 2005; Trivers & Willard, 1973). Nevertheless, the evidence is mixed, particularly for developed countries. One of the few studies that found such an effect with regard to parental time spent with children up to the age of 18 comes from Kanazawa (2001), but his analyses are based on data from the National Survey of Families and Households from 1987 and 1988, which is an old cohort and therefore makes it difficult to

[43] The relationship with social class arises from assumptions in evolutionary biology that can also be transferred to humans.

compare with younger cohorts. In contrast, for example, Keller, Nesse, and Hofferth (2001) found no such effect after examining 1998 data drawn from the Panel Study of Income Dynamics, nor did Kaestner (1997) and Conley (2000). For birth order, a case in point is the work of Price (2008), who noted that mothers invest unequally in their children in two variations of sibling constellations: first, when the first child is a boy and the second a girl, and second, when both children are girls. Quality time was equal when the constellation consisted of two boys or a girl and a boy. Kaestner (1997) included birth spacing in his analysis of sex composition effects and reported that for educational achievement the age gap between siblings did not matter when combined with sibship sex composition.

All in all, the vast majority of studies deal with the sex of one child and not the whole sibship. If the sex of all siblings is included, the focus lies on educational outcomes instead of parental action. For parent-child activities, no appreciable empirical database exists.

6.3.2 Explanations

There are many explanations for the relationship between sibship sex composition and parental investments or child outcomes. The most popular goes back to Becker and Tomes (1979, 1986) and their economic model of the family.[44] In short, they assume that parents invest in children with the objective of maximizing the sum of their children's wealth. Because time resources are equal for all families (controlling for childcare subsidies), returns to investments and preferences for equity between children determine how parents allocate their resources among siblings. As noted earlier, in Germany there is still a clear tendency for women's income to be lower than men's (Holst et al., 2012; BMFSFJ, 2009). Accordingly, investments in boys should lead to greater future incomes. With regard to income, parents who do not intend their children's outcomes to be equitable will choose to invest in a boy rather than in a girl. Increasing numbers of brothers should therefore dilute the resources for children

[44] See Chapter 2 on theoretical considerations.

independent of parents' own genders. This conclusion changes if parents have a preference for equity, in which case parents should compensate for children whose expected outcomes are lower than the outcomes of their siblings. Consequently, mothers would spend more time with girls because girls are expected to have lower future incomes than boys will. But overall, if the number of brothers or sisters increases, the resource pie must be divided into ever-smaller pieces, which will lead to a decline in received resources.

Altogether, based on the theory, if parents want to reinforce a child's advantage, they should tend to invest in the children of one gender, and having siblings of the advantaged sex should be more damaging than having siblings of the opposite sex. If parents favor equality of outcomes for their children, they compensate for lower expected outcomes, which results in a disadvantage for children whose outcomes are expected to be better.

Whereas economic theory predicts that a respondent's gender per se plays a role in decisions about the amount of resources to be allocated, certain theoretical ideas assume that, independent of the respondent's sex, only combinations of the categories same-sex siblings and opposite-sex siblings will have an effect on resources.

This thinking applies to the sex minority hypothesis and the revised sex minority hypothesis (see Chapter 2), which try to explain the relationship between sibship sex composition and parental resource allocation. Rosenberg's sex minority hypothesis (1965) assumes that if a child's gender is in the minority within the whole sibship, he or she will profit by receiving special attention from the parents (e.g., being a girl with two brothers or, conversely, being a boy with two sisters). However, empirical tests of this theory are rare with respect to not only parental time investments but also educational outcomes (Conley, 2000).

Similarly, Conley (2000) developed the revised sex minority hypothesis, which contradicts Rosenberg's assumptions by suggesting that it is not the sex minority child who profits but rather the child whose gender is in the majority. Conley explains this advantage in a way that is similar to the resource augmentation hypothesis (see Chapter 2). A combination of activities is easier for mothers to engage in if her children are all the same gender, provided that at least some of these activities are sex-specific or might be arranged to profit one sex more than another. For example, girls and boys might have different preferences when

choosing the book their mother will read out to them. So, as predicted by the revised sex minority hypothesis, it is profitable to have more siblings who are of the same sex as oneself in order for them to engage more frequently in activities with their parents. This is especially true for a sibship in which all children are of the same gender.

6.4 DATA

6.4.1 SAMPLE AND ANALYTIC STRATEGY

To understand the relationship between sibship sex composition and frequencies of maternal activities, analyses were conducted based on data from the SOEP as well as the FiD. The questionnaires are almost identical to each other, but the sampling and the years in which the surveys were conducted are not (see Chapter 3). Questions about maternal frequencies of activities with each individual child are available for the children in the age brackets 2 to 3 years and 5 to 6 years and in the SOEP from 2005 to 2012 and in the FiD from 2010 to 2013. For both datasets, a combined dataset was constructed consisting of pooled annual data for children 2 to 3 and 5 to 6 years old.

Only children were excluded from the analysis because they provide no values for the main independent variables. In addition, for tests of the sex minority and revised sex minority hypotheses, children with only one sibling are also excluded because minorities and majorities can only emerge when there are at least three children. For all tests, random-effects models are applied for the frequency of cognitively stimulating activities.

6.4.2 MEASURES

6.4.2.1 DEPENDENT VARIABLE

The dependent variable is a standardized sum index from the frequency of the following cognitively stimulating activities rated by mothers on a four-item scale (daily, several times per week, at least once a week, and never): singing children's songs with or to the child, painting or doing arts and crafts, reading or telling stories, and looking at picture books. These activities are assumed to be gender-neutral, meaning that boys and girls profit similarly from engaging in these activities (Kanazawa, 2001).

6.4.2.2 INDEPENDENT VARIABLE

The main explanatory variable is sibship sex composition. In the literature, sex composition has been operationalized in many different ways, but primarily, three different versions have been used: (1) as a dummy variable indicating whether or not any sisters are in the household, (2) as the percentage of sisters or relative share of boys (Jaeger, 2009), and (3) as the number of brothers and number of sisters. In addition, interaction terms are applied that consist of the sex of the respondent and the number of brothers and number of sisters (Conley, 2000) or with the use of dummy variables indicating the presence of only brothers or only sisters (Amin, 2009).

To test the economic hypothesis (M6.1), two different operationalizations are used (M6.1a and M6.1b). The number of brothers and the number of sisters are included in one model, and the number of siblings has to be excluded owing to collinearity. In addition, the percentage of sisters is also included as a continuous variable, ranging from 0 to 100, and interacted with sex of the child.

A test of the sex minority and revised sex minority hypotheses (M6.2) requires not only a different operationalization but also the exclusion of two-child families because the sibship sex composition when there are only two children does not

allow for a sex minority. Either both children have the same sex or they have the opposite sex, leading to equal numbers of boys and girls. To investigate the effect of sex minorities, two models are estimated using two different operationalizations of the main independent variable. On the one hand, a variable with three categories is included to measure whether the sibship sex composition of all children of the same mother has equal numbers of boys and girls, or whether it is dominated by boys (male majority) or by girls (female majority) (M6.2a). Note that to make interpretation easier, the whole sibship, as well as the target child, is included in this variable. On the other hand, a more specific test is used and again involved a variable with three categories to indicate whether a child is the absolute minority, that is, the only child of its sex. To be more precise, the categories of this variable are equal number of brothers and sisters, only brothers and only sisters, all from the perspective of the target child exclusive of itself (M6.2b). Both variants are interacted with the sex of the child to see if there are parental preferences for one sex.

6.4.3 Descriptive Statistics

Table 6.1 shows the means and standard deviations for all children and for those with at least two siblings. The sample size is reduced in the second variant by almost half, which can be explained by the smaller number of big families with at least three children and can be seen when comparing the mean values for number of siblings (1.73 for all children and 2.55 for children with at least two siblings).

Not surprisingly, the frequency of activities is slightly higher in the first variant because mothers engage in more of these activities when sibship sizes are small (Downey, 2001). Apart from this, the two samples do not differ significantly from each other in terms of their composition. Only the ages of the mother and of the child are higher for the subsample with bigger families, which is intuitively clear given that mothers need more time to give birth to three than to two children and that the first and second child have to reach a certain age for the mother to become pregnant with the third child.

Table 6.1 Summary statistics for M6.1 and M6.2

Variables	M6.1		M6.2	
	Mean /%	Standard Deviation	Mean /%	Standard Deviation
Mothers' frequency of activities with their children	−0.02	1.01	−0.10	1.03
Child's age (months)	50.91	17.88	53.07	18.03
Child's sex (boy = 1)	0.52	0.50	0.53	0.50
Child's health impairments (yes = 1)	0.18	0.38	0.14	0.35
Childcare (yes=1)				
…by partner	0.73	0.45	0.73	0.44
…by father	0.06	0.23	0.06	0.23
…by older siblings	0.16	0.37	0.27	0.44
…by grandparents	0.46	0.50	0.39	0.49
…by daycare	0.64	0.48	0.62	0.49
Time spend in childcare (% available time/week)	35.60 %		36.63 %	
Household type				
Single mother	10.14 %		9.54 %	
Couple	89.15 %		89.95 %	
Multigenerational household	0.71 %		0.50 %	
Household income (net, monthly in thousand euros)	3.48	2.13	3.73	2.38
Mother's age (in years)	35.68	5.68	36.87	5.81
Mother's education				
Up to general secondary school	24.03 %		28.08 %	
Intermediate secondary school	36.75 %		34.72 %	
Upper secondary school	14.51 %		13.11 %	
Tertiary school	24.71 %		24.09 %	
Working hours				
0-9	54.62 %		61.29 %	
10-29	24.47 %		20.68 %	
30 and more	20.91 %		18.03 %	
Age group				
2 to 3 years	55.39 %		49.14 %	
5 to 6 years	44.61 %		50.86 %	
Data source				
SOEP	28.73 %		21.40 %	
FiD	71.27 %		78.60 %	
Number of siblings			2.56	1.06
Number of brothers	0.88	0.87		
Number of sisters	0.85	0.87		
Percentage of sisters	49.35 %			
Majority of sibling's sex				
Equal			8.28 %	
Male majority			48.72 %	
Female majority			43.00 %	
N	5051		2379	

The higher average ages of children in the subgroup with at least two siblings may also explain why the mean value for childcare by siblings is also higher in that group. These siblings are, on average, older and therefore better able than their younger counterparts to take over some childcare tasks.

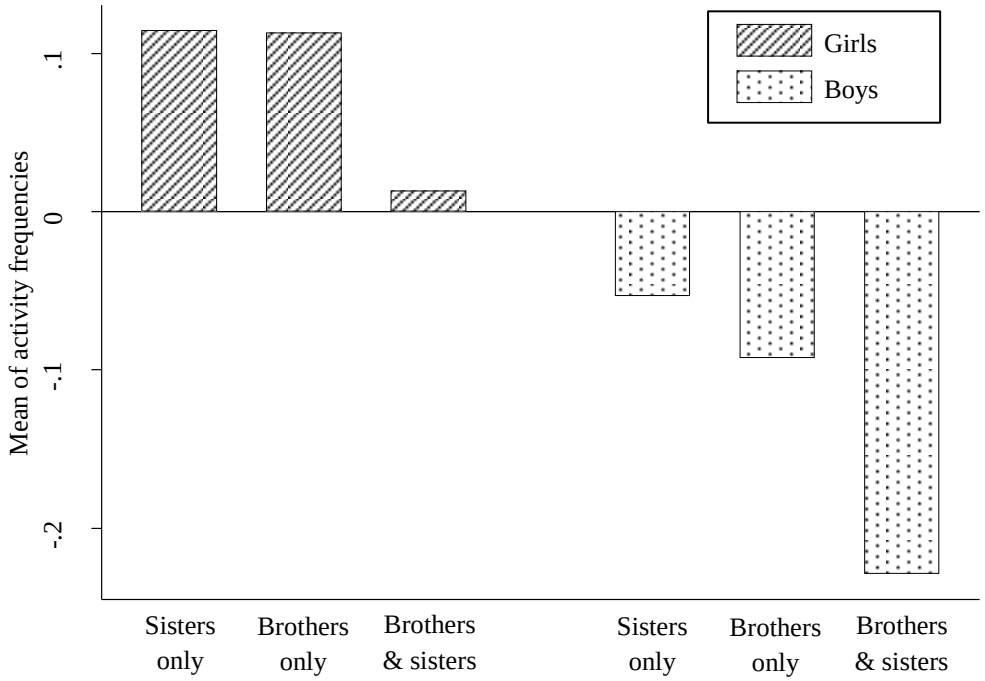
One more difference between the two samples needs to be mentioned, that is, the mothers' working time, which is lower in the subsample. In Germany, mothers with two children tend to continue working, but from the third child on, there is shift in favor of reducing working hours and staying at home (BMFSFJ, 2010). The mean values here differ for structural reasons because some argue that bigger families differ from smaller families because of certain factors that influence families to have more or fewer children and that would bias the analyses.

Figure 6.1 shows the mean values for activity frequencies for each sibship sex constellation for boys and for girls. For girls, each of the sibling sex constellations has a value above the mean for the whole population. But whereas having only brothers or having only sisters is more profitable (the two coefficients do not differ significantly from each other), having brothers as well as sisters seems to be significantly worse for girls.[45] For boys, a similar picture emerges. Having only brothers or only sisters is statistically less deleterious than having both, but mean values between only sisters and only brothers do not differ significantly from each other. However, in each sibling sex constellation, boys engage less frequently in activities with their mother as compared with the mean value for the overall population.

Since these statistics are only descriptive, they do not control for number of siblings. The lower activity frequencies for boys and girls if they have both brothers and sisters, as compared with having siblings of only one gender, might also be an effect of number of siblings. In the group of children who have only brothers or only sisters, the majority are children with only one sibling, whereas children who have brothers as well as sisters have at least two siblings. A further examination of this result using multivariate analyses seems to be needed.

[45] Statistical tests of similarity of coefficients (following an analysis of variance test) are not displayed.

Figure 6.1 Mean values of frequency of activities as a function of sibship sex composition



6.5 RESULTS

Predictive margins of the interaction coefficients are plotted for all four models. Regression results including coefficients for all variables can be found in Appendix D (see Table D1).

Models M6.1a and M6.1b are estimated to test economic hypotheses. Figure 6.2 shows the predictive margins for number of brothers and number of sisters up to four siblings (higher numbers are not shown owing to their lack of importance to improve comprehensibility of the figure) both for boys and for girls. Both graphs show not only a clear decrease in maternal activity frequencies with increasing numbers of siblings, but also that mothers engage in activities with girls more often than with boys across all sibship sizes. These effects are seen for both number of brothers and sisters and for boys and girls. But all in all, there is a very slight tendency for girls to be less negatively affected by increasing numbers of brothers than by increasing numbers of sisters, whereas for boys, sisters and

Figure 6.2 Predictive margins for frequency of activities as a function of number of brothers and number of sisters, respectively, for boys and for girls

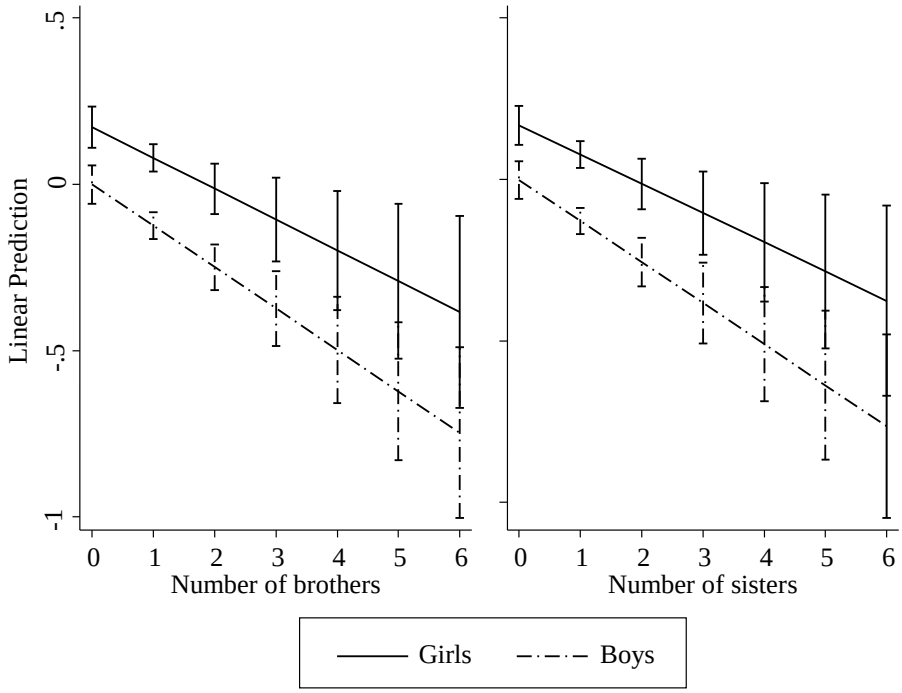
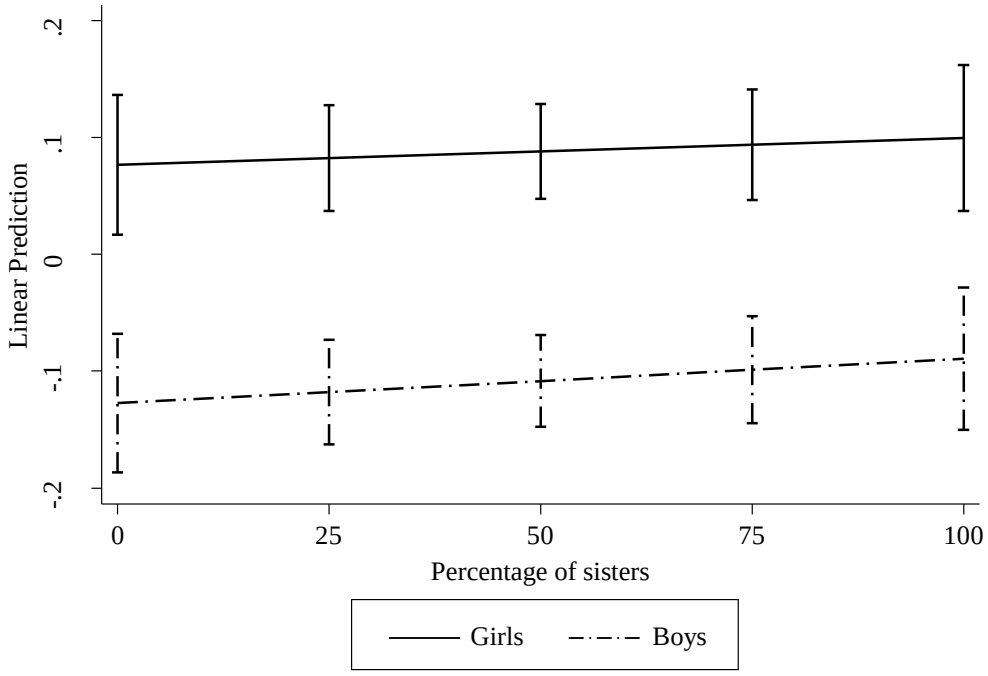


Figure 6.3 Predictive margins for frequency of activities as a function of percentage of sisters and sex of the child



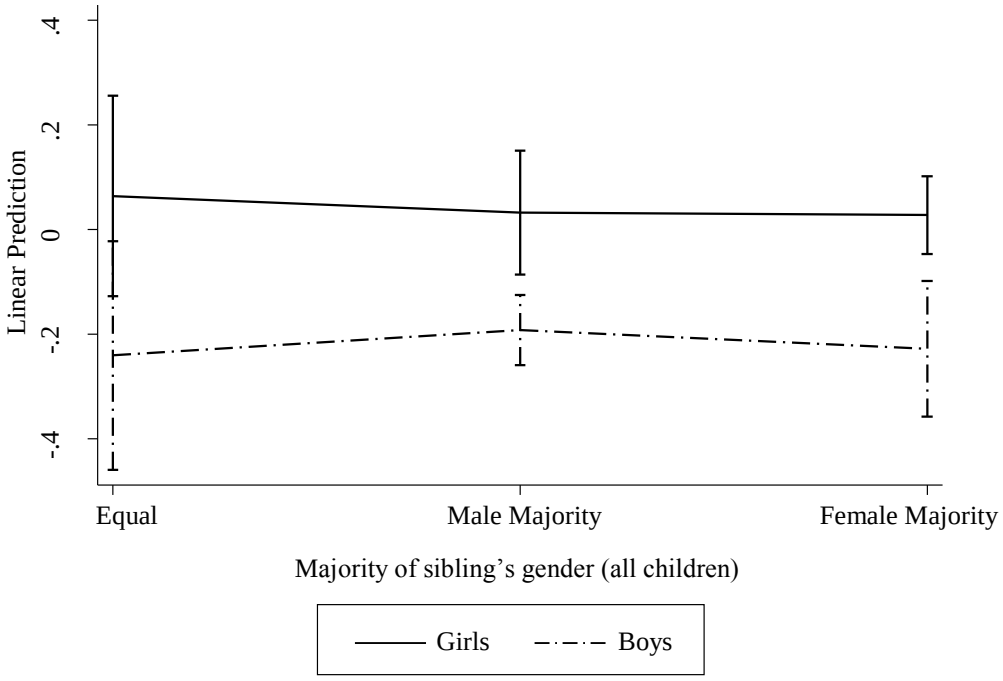
brothers seem to have almost exactly the same effect; nevertheless, for both sexes these differences are not statistically significant.

Figure 6.3 shows the predictive margins for model M6.1b, which includes the variable percentage of sisters within the sibship. Similar to the results for number of brothers and number of sisters, activities are more frequent for girls than for boys. Moreover, for girls, a positive effect of a higher proportion of sisters is hardly appreciable, and for boys it is at least mildly apparent, but it does not differ significantly between boys and girls.

Results of the tests of the sex minority and revised sex minority hypotheses are displayed in Figures 6.4 and 6.5. Reconfirming the virtual nonexistence of sibship sex composition effects on activity frequencies, statistically significant differences in the majority variables cannot be found in either model. However, both models confirm that girls engage in cognitively stimulating activities with their mothers more often than boys do, independent of the sex composition of their sibships. In model M6.2a, activities tend to be slightly more frequent for girls when living within a sex-balanced sibship versus living in a male- or female-dominated sibship. For boys, the opposite is true; activities are most frequent within sibship in which boys are the majority and are rare within sibships with equal numbers of boys and girls. These differences are not statistically significant.

Results do not change when a stricter version of opposite-sex siblings is applied, namely, if a child has either both brothers and sisters, only brothers, or only sisters. Predictive margins for this operationalization are shown in Figure 6.5. For girls, having both brothers and sisters is most profitable, and living only with sisters is the least profitable. But again, these are only slight tendencies based on marginal differences in the coefficients, and the differences are neither large nor statistically significant. For boys, however, sex composition does not matter.

Figure 6.4 Predictive margins for frequency of activities as a function of sex composition (majority of sexes) of the whole sibship and sex of the child

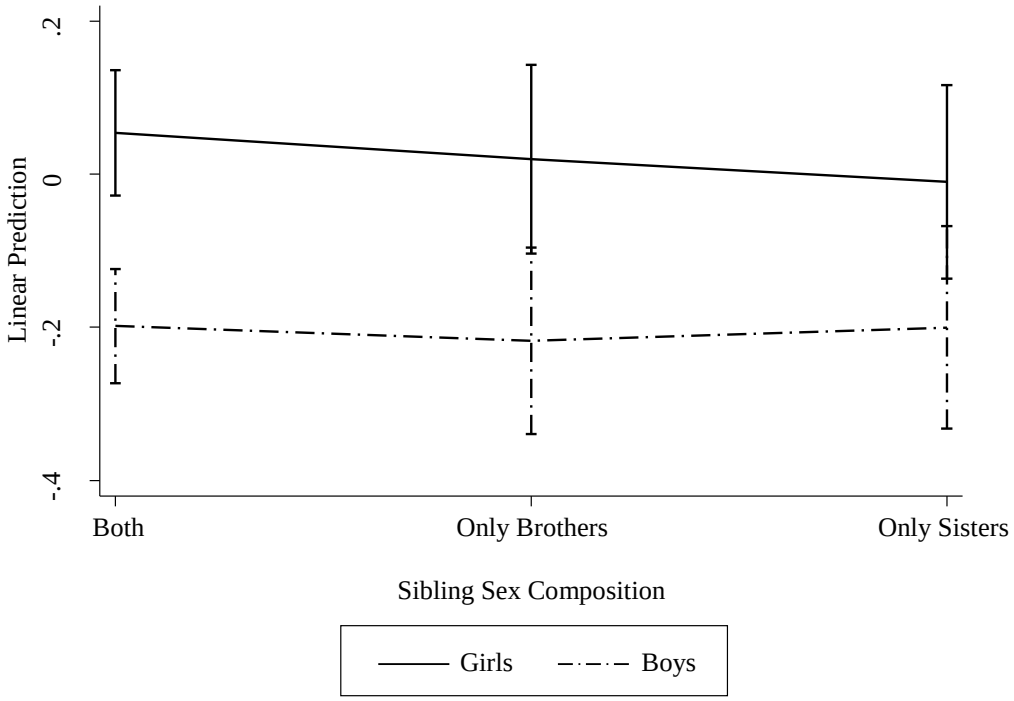


Other covariates also affect maternal activity frequencies. In the models with all observations, the FiD sample has a slightly more positive effect when compared with the SOEP sample; in addition, mothers who answered the questionnaire for their 5- to 6-year-old children spend more time in activities than do those who provide information about their 2-3-year-old children. In this context, the child's age in months has no effect, so it seems that it is not age per se that matters but rather age stages and the associated institutional contexts of each age.

The health indicator also has no effect in this sample, although the measure of health is only approximate. Interestingly, childcare by the partner of the mother has no influence on the frequency of her activities, nor does childcare by siblings. But childcare by the father, if he is not living within the household, and by grandparents is positively associated with maternal activity frequencies, whereas formal daycare has a negative effect. The coefficient for fathers who do not live within the same household is not statistically significant, mainly owing to the small number of families for which this is the case; however, within the group of childcare variables, it is the biggest coefficient. This conforms to the household

type, which is positive, high and significant if the child lives with parents who are a couple and is smaller and not statistically significant but still positive for multigenerational households, as compared with single mothers. Indeed, almost 90 percent of mothers live within a partnership, more than 10 percent are single mothers, and less than 1 percent live in a multigenerational household, which should explain the size of the standard errors. Increasing overall childcare time by mothers leads to an increase in activities for the children. Maternal education is positively associated with her activity frequencies, which is consistent with the assumption that better educated mothers engage in these activities with their children to enhance the children's skill levels. Moreover, the age of the mothers has no effect, but mothers' working hours are, as expected, negatively related to cognitively simulating activities, although the effect is primarily seen when mothers work more than 30 hours per week.

Figure 6.5 Predictive margins for frequency of activities as a function of sibship sex composition and sex of the child



The majority of covariates have similar effects within the models that include only sibships of at least three siblings, although standard errors are consistently larger

owing to the reduction in sample size by more than half. Two variables show divergent results: First, living in a multigenerational household seems to be the best constellation for children in this sample of big families. However, again, far less than 1 percent of children belong to this group. Second, whereas maternal working hours had a significant negative effect only if mothers work more than 30 hours a week for all observations, in big families even working fewer hours is significantly detrimental for children.

6.6 Discussion and Conclusions

According to economic theory, if parents prefer one gender over the other because they expect their children's future outcomes to be better, the preferred sex should be more deleterious than the other with regard to activity frequencies. In contrast, if parents prefer equity, the sex with fewer chances for future success should have an advantage because mothers would try to compensate for this structural disadvantage. Again, siblings of this gender should be more deleterious than those of the other gender. Although both theories predict that the effect of one sex should be more negative than that of the other sex, the results do not bear out this assumption. The number of brothers and the number of sisters have a comparable effect on both boys and girls, and the coefficients do not differ significantly from each other. The sex minority hypothesis predicts an advantage if a child is outnumbered by opposite-sex siblings (special child), whereas according to the revised sex minority hypothesis, same-sex siblings should be profitable for a child. Again, both operationalizations of opposite-sex siblings show no effect on activity frequencies. Neither do sex minority children in this sample take the role of a special child, nor do mothers seem to combine sex-specific activities. In addition, even individual variations (e.g., gender-specific books) do not reduce the frequency of activities with opposite-sex siblings. One reason could be that at an

early age, child's preferences do not differ according to gender[46]; another reason might be that mothers do not engage in gender-specific activities but instead engage in neutral activities and employ gender-neutral toys.

All in all, sibship sex composition does not seem to have an effect on frequency of cognitively stimulating activities. It seems that other variables influence maternal resource allocations. For one thing, consistent with previous research, the number of siblings is significantly negative in all models. In addition, the sex of siblings may not influence maternal activities but the children themselves. Young children may decide to engage or not engage in play with their siblings by virtue of the siblings' gender, and this may also lead to better skill development. Moreover, other studies that used the SOEP data have already shown that mothers engage in these activities based on children's skill endowments (Cardona & Diewald, 2014), so future research should try to include this factor in its analyses.

However, one result that is consistent throughout all models is that the frequency of activities is greater for girls than for boys. If mothers have a preference for girls, then increasing numbers of female siblings should be worse than increasing numbers of male siblings. But this is not the case. Boys and girls are likewise affected by increasing numbers of brothers as well as of sisters. Boys and girls do not seem to compete for scarce time resources. One explanation could be that mothers are able to combine activities better with girls than with boys, although this explanation is invalidated by the finding that girls do not profit from having sisters versus having brothers. How then can a sex effect be explained?

Mothers seem more often to engage with girls in activities that are not equally available for boys. One reason might be that fathers and mothers have a surplus of time that might be used according to parents' preferences. This might lead to fathers also being involved in childcare, but primarily for boys. Mothers have a basic amount of time available for sons and daughters, which might be increased if parents' gender preferences are met. As mentioned already in Section 6.3, parents might allocate their time depending on the child's gender, when both the mother and the father prefer the child of their own gender, that is, daughters for

[46] Lawson (2009) concluded from his study that childcare time is biased toward sons, but the effect is stronger when children are older.

mothers and sons for fathers (Zick & Bryant, 1996; Lawson, 2009). If this is true, the benefit girls receive does not have an effect on the amount of activities for boys because the time invested by mothers is taken from a surplus of time that both parents have. Boys might therefore similarly profit from the surplus time of fathers, which is not equally available for girls.

Another reason might be found in the nature of the dependent variable. Mothers are asked about their frequency of activities, not the exact duration. Therefore, mothers might engage in these activities more frequently with girls than with boys, but in turn may spend longer periods sharing activities with boys. For example, mothers might look at picture books on a daily basis with their daughters but for only for 30 minutes, whereas they might practice crafts with their sons only once a week but for 4 hours. Thus, although girls would have a higher coefficient in the models, the mother spends equal amounts of time with both boys and girls.

Some researchers point out that families with different sibling numbers may differ from each other in terms of the effect of sibship sex composition (see, for example, Conley, 2000). Although not the focus of this paper, the models estimated here are based on the one hand on all children and on the other hand on only those from families with at least three children. Indeed, there seems to be no relevant difference between the two groups. A comparison of coefficients of the covariates shows that almost all are of similar size. Surely, this is not a perfect operationalization of different family sizes but might show a tendency.

Still, to better understand the results presented in this chapter, some caveats must be mentioned. First, the measure of frequency of cognitively stimulating activities is only approximate. It would be preferable to have information based on time diaries showing the exact number of hours spend on these activities. This would lead not only to a more accurate measure instead of a proxy but also probably to less reporting bias. Unfortunately, the SOEP and the FiD lack this advantage.

The second point is associated with the first one. Other activities might stimulate cognitive development even more than this measure, and it is not obvious how other people spent their time with the child. Although controls for childcare by a partner, the father if he is not living within the household, grandparents, and siblings are included in the models, what exactly is included in childcare is wide and certainly not limited to cognitively stimulating activities.

Third, and even more important, is that children themselves have different characteristics and, based on those, need more or less attention from the mother. For example, as compared with a shy child who likes being read to, a very active child might prefer activities outdoors that are stimulating not just cognitively. The same is true for mother's characteristics, preferences, and norms, about which no information is available.

Fourth, the analyses here rely on cross-sectional data, which always implies the problem of causality. Even though the problem is comparatively small for sibship sex composition because a child's sex is random, mothers may decide to have more children to attain their optimal sex constellation. Models control for number of siblings, but to gain information on processes within families, it would be optimal to have information on parents' motivation of continuing or stopping childbearing or at least to have more siblings in the dataset, with information for two time points, who also have large sibships. It would then be possible to estimate fixed-effect models to control for all unobservable time constant factors.

Lastly, until now, it is not possible to estimate the effect of frequencies of cognitively stimulating activities, as operationalized in this paper, on child outcomes. Although research has shown that similar activities have a positive effect on outcomes, the exact relationship for Germany and the data used here remains an unanswered question because of the small sample sizes. In the future, it will be possible to investigate this relationship in more detail.

All in all, the sex of a child is an important predictor of the frequency of cognitively stimulating activities engaged in with the mother, but the sex of siblings plays no relevant role.

7 Number of Siblings, Birth Order, and Sex of a Child: How Do These Sibling Characteristics Interact with One Another?[47]

7.1 Introduction

The three previous chapters of this dissertation covered three variables and their relation to family resources and children's outcomes: number of siblings, birth spacing, and sibship sex composition. Although not the focus of the analyses, the connections among these individual sibling characteristics were consistently evident. For example, an important finding in Chapter 4 is that two factors had important effects on activity frequency: not only the birth of a new sibling, but also the number of older siblings a child had prior to the birth of a new sibling. But, as was discussed at the end of that chapter, the effects might have been related to birth order rather than to the number of siblings.

This chapter explores that possibility by investigating the interaction between number of siblings and birth order and its effect on the frequency of activities. Since, theoretically, birth order effects and gender effects should be based on

[47] A previous version of this chapter was coauthored by Andrés Cardona.

similar grounds, namely heuristics or norms and stereotypes, the sex of a child is also included in this interaction. It is plausible to assume that sibship size would have different effects on children whose gender or birth position influenced the frequency of activities engaged in with their mothers. For one thing, categories are relational. Being the first-born becomes a significant category only after younger children are born. Similarly, sex stereotypes might be more salient when parents have children of different genders. In both cases, the number of siblings is a confounding dimension.

7.2 CONTRIBUTIONS

This last of the four empirical chapters makes the following key contributions: First, research has until now investigated the various sibship characteristics independently (for an exception, see Black et al., 2004). However, the analyses in this dissertation have shown that most of these characteristics are interwoven with others in terms of their effect on the distribution of maternal resources. Therefore, this chapter examines how three of these characteristics – number of siblings, birth order, and sex of a child – work in tandem and interact with each other. Second, theories to explain parents' allocation of resources among siblings according to social norms, sex stereotypes, heuristics, or utility maximization calculations are again tested against the resource augmentation hypothesis. And third, sibling studies have rarely been carried out in Germany; specifically, interactions among different sibship characteristics based on German data have not been investigated until now.

7.3 BACKGROUND

7.3.1 THE SHRINKING PIECE OF THE PIE

Numerous studies have suggested a negative relationship between sibship size and the amount of resources each child in a family receives from his or her parents. Blake expressed this relationship in the resource dilution hypothesis (Blake 1981, 1989), which assumes that the amount of resources decrease with increasing numbers of siblings (see Section 2.2). Since then, empirical studies have supported the plausibility of the dilution hypothesis[48] (e.g., Downey, 1995; Stewart, 2005), which has been used to explain differences across families in which sibship size varies. However, when it comes to shedding light on how resources are distributed among siblings within families, the resource dilution hypothesis falls short. It tacitly postulates an egalitarian distribution rule that disregards within-family variations with respect to allocation rules. Moreover, it says nothing about children's birth order or gender. The following two additional explanations – one from a cultural perspective, the other from an economic perspective – explicitly deal with within-family variations and birth order as well as gender.

7.3.2 THE PRIVILEGED AND THE RATIONALIZED PIECES OF THE PIE

Guided by stereotypes and norms, parents tend to give unequal amounts of resources to siblings along categorical lines such as gender or birth order (see Chapter 2). Widespread cultural norms such as primogeniture benefit first-born children (Hrdy & Judge, 1993). Research has shown that the preferential treatment of the first-born includes material resources but also extends to other, non-

[48] See Chapter 4 for a discussion of empirical results pertaining to the resource dilution hypothesis.

material resources such as parenting style or the quality of the interaction between mother and child (Baydar et al., 1997; Kendrick & Dunn, 1980). But even in the absence of these categorical preferences, older siblings may receive more than younger siblings. Price (2008) showed that despite an increase in the number of siblings, first-borns still received more parental time. His explanation is simple. Even if time resources are allocated equally among siblings, parent–child interactions in general tend to decrease over time, which means that the first child benefits more than the children born later. In addition, the sex of a child has been shown to affect parents' decisions about how to distribute their resources among siblings.

These inequalities might also be caused by cultural norms that are internalized by parents (see Chapter 2). One obvious but extreme example of a parent's reaction to an undesirable birth would be infanticide (Hesketh et al., 2011), but the more common reaction would be parents' prenatal desire to have either a boy or a girl or their wish to have a certain sex mix among their children (Dahl & Moretti, 2008). Such preferences might then persist throughout children's lives if parents continue to treat their children differently depending on a child's gender sex. The trend in research on the differential treatment of children based on gender indicates that fathers in particular are likely to spend unequal amounts and qualities of time with their children based on gender. But it has also been shown that both mothers and fathers tend to favor the children who are the same sex as they are; so, according to Lawson (2009), mothers favor daughters and fathers favor sons.

From an economic perspective, time spent by mothers with their children is seen as an investment decision (see Chapter 2). As Becker and Tomes (1976, 1986) have argued, parents invest differently in their children to maximize the family's utility, not only according to their own preferences and income but also according to their children's endowments. The maximization process implies a quantity–quality trade-off, meaning that larger sibship sizes (the quantity of children) lead to lower average levels of child "quality" (child well-being). This causal connection does not always result in the same predictions as those made according to the resource dilution theory. When parents act in a rational way to maximize the future outcomes of their children, inter alia, the patterns of resource distribution may vary with circumstances. One can imagine some parents trying to maximize the outcome of the child who seems destined to reach the best outcomes

(a reinforcing strategy), while others invest in the less well-endowed child as a way to bring all the children's outcomes into line (a compensating strategy) (Behrman, 1982).

In order to predict resource allocation within families, one must be aware of the family's resources, the children's endowments, and parents' general investment strategies. Because such information is not available for this study, only three characteristics have been considered as the basis for investment decisions and the development of hypotheses: the number of siblings, birth order, and sex of the child. Thus, independent of the parents' investment strategy, increasing numbers of siblings should lead to decreasing amounts of resources (the quantity–quality tradeoff, Becker, 1981). However, this decrease might be weakened or strengthened by birth order and sex of the child. For parents guided by the reinforcing strategy, first-born children should have a privilege because they alone receive all the parental resources until a second child is born. The second sibling cannot "catch up" in terms of resources allocated because he or she is born into a family with two children, and resources simply must be divided when families have more than one child. In this case, parents should reinforce the investments they have made before the birth of the second child. Such reinforcement should diminish for each additional child,[49] but, generally speaking, a child who comes later in the birth order should presumably be at a disadvantage.

A child's gender should also play a role in decisions about resource allocation. In Germany, there is still an income gap between men and women who are in similar or even identical positions (i.e., on average, men earn more than women).[50] With this in mind, reinforcing parents should invest more in boys than in girls. However, the conclusion is reversed for compensating parents whose aim is equality for children whose outcomes are less promising. In this case, on the one hand, last-born children should get most of parental resources because parents want them to have a better chance at success in life. On the other hand, girls

[49] See Figure F1 in the Appendix.

[50] See Chapter 6.

should receive more than boys as a way to increase the likelihood of their success in the labor market.

From the economic perspective, therefore, the higher the number of siblings, the greater the decline in the amount of parental resources. For reinforcing parents, first-born boys should receive the most, and for compensating parents, last-born girls should be privileged.

As summarized above, cultural norms and stereotypes may influence parental allocation decisions just as much as parental maximization of family utility does. Thus, the simple observation that, for example, first-born children receive more attention than those born last tells nothing about whether this bias is the consequence of social norms concerning birth order or whether it is the outcome of parents' family utility calculations using birth order as a proxy for children's future payoffs. The only way to disentangle both cultural and economic explanations and predict the effects on children would be to measure parental attitudes and stereotypes as well as parental decision strategies. Unfortunately, the existing data provide none of this information.

7.3.3 The Growing Piece of the Pie

Besides all the previously discussed hypotheses that predict a decrease of activities, children might also experience an increase in resources, as predicted by the resource augmentation hypothesis.[51] In Chapter 4, it was shown empirically that children with more siblings might engage in activities with their mother more frequently than would children with fewer siblings. This is possible through maternal efficiency gains, the public good of certain activities, rescheduling of the mother's time for routine activities, and childcare provided by older siblings. In light of these mechanisms, children may profit from having younger siblings and can thus engage more often in activities with their mothers only because they have siblings.

[51] See Section 2.3 for a detailed description of the resource augmentation hypothesis.

Nevertheless, birth-order position might also play a role. First-borns might profit from younger siblings through efficiency gains, spillover effects, and a rescheduling of maternal activities, but the relationship for last-born children is not so clear. On the one hand, they might also profit from efficiency gains and spillover effect, whereas on the other hand, a combination of activities by mothers does not necessarily include cognitively stimulating activities. For example, mothers might combine feeding of the younger child with supervising of the older children while they paint; in this case, only older children would profit from the mother's extra time. The same is true for maternal rescheduling. Mothers might find more time for childcare but then invest that time in activities with only the older children and meet only the basic childcare needs of the younger children. Finally, help with childcare by the older siblings might result in less frequent activities with the mother simply because the younger child is already being cared for so she sees no need to spend time caring for the child herself. Middle-born children, however, should be somewhere in the middle between these predictions concerning the youngest and the oldest children. They might profit from having younger siblings, but in contrast, they might also lose maternal attention for the reasons mentioned with regard to last-born children.

All in all, increasing numbers of siblings might also result in a resource gain, but the effect should depend on the birth order of the child.

7.4 DATA

7.4.1 SAMPLE AND ANALYTIC STRATEGY

The data used for the analyses are, again, a pooled dataset obtained from the SOEP and the FiD on children 2 to 3 and 5 to 6 years of age.[52] Three models are

[52] See Chapter 3 for a detailed description of the data.

estimated. The first, which includes all variables except birth order, was already estimated in Chapter 4 and serves only for the comparison with the second model, to which birth order is added. Contrasting the first model, the second provides information about what happens to the number of siblings when birth order is included. Then, in the third model, an interaction term among birth order, number of siblings, and child's sex is included. To make the models comparable, children who have missing values on any of the independent variables were excluded from the analysis, resulting in 6,223 observations.

All models are specified as random-effects models with robust standard errors and are applied to test the assumptions about the relationships among number of siblings, sex of the children, and birth order.

7.4.2 Measures

7.4.2.1 Dependent variable

As in Chapters 4 through 6, the dependent variable is the frequency of cognitively stimulating activities[53] (singing children's songs with or to the child, painting or doing arts and crafts, reading or telling stories, and looking at picture books).

7.4.2.2 Independent variables

The main explanatory variables – birth order, number of siblings, and sex of the child – are obtained from the information reported by mothers about their biological children. To determine the frequency distribution of these variables for the entire sample, the children in the two age brackets are combined and divided according to gender; the majority of children have one sibling (N = 2,665),[54] and

[53] See Chapter 3 for more information on the dependent variable.

[54] See the summary statistics in Appendix E (Table E1).

there are approximately the same number of only children (N = 1,198) and children with two siblings (N = 1,571) (see Table 7.1).

Table 7.1 Frequency distribution of birth order, child's sex, and number of siblings

Child's sex	Number of siblings	Birth order				
Girl		No siblings	Youngest	Middle	Oldest	Total
	0	596				596
	1		740		570	1310
	2		595	43	85	723
	3		204	40	9	253
	4 or more		98	32	2	132
Total		596	1637	115	666	3014
Boy		No siblings	Youngest	Middle	Oldest	Total
	0	602				602
	1		752		603	1355
	2		700	47	101	848
	3		198	55	6	259
	4 or more		100	45		145
Total		602	1750	147	710	3209

To make birth order amenable to quantitative comparisons across families, this variable is transformed into a relative rank scale with four categories of children: no siblings, youngest, middle, and oldest. The position of the first-born children is unambiguous, but the classification "second-born child" depends on the size of the sibship; for example, in a family of two children, the second-born would be classified as the "youngest" child, whereas in a family of four, he or she would be classified as the "middle" child). Despite the small size of the families in the sample, in which most of the children are either the youngest or the oldest, it is possible to identify a fair number of middle children for the analyses (N = 262). The sex of the child as boy or girl was evident from the data. Concerning

covariates, the same variables and operationalizations are included as in the previous three chapters.[55]

7.4.3 Descriptive Statistics

Table 7.2 shows the median values for frequency of activities as a function of number of siblings and birth order for girls and boys. The subcategories are sometimes sparsely manned,[56] in particular for middle children and for higher numbers of siblings for oldest children. Within each subcategory, girls seem to engage more frequently in activities with their mothers than boys do. But for both sexes, being the oldest is associated with the highest activity frequencies. The median values are even higher than the median values for children who have no siblings. Except for oldest children, higher numbers of siblings tend to be related to fewer activities for boys and girls. However, oldest children seem to profit from having more siblings.[57]

7.5 Results

Three variations of model M7.1 are specified. Model M7.1a controls only for number of siblings living in the household, model M7.1b adds birth order, and model M7.1c includes an interaction term among number of siblings, birth order, and sex of the child. All three models share the same covariates, including family resources and other control variables.

[55] See Chapter 3 for a detailed description of the operationalizations applied.

[56] See Table 7.1.

[57] The subsamples of oldest children with more than two siblings include only 2 to 10 persons, so the median values might be biased.

In model M7.1a (see Table 7.3), a higher number of siblings is associated with less frequent cognitively stimulating activities.[58] The coefficient is negative and statistically significant. Being male leads to lower frequencies of activities than being female. Again, the effect is statistically smaller than zero.

Table 7.2 Median values for frequency of activities as a function of birth order, child's sex, and number of siblings

Child's sex	Number of siblings	Birth order			
Girl		No siblings	Youngest	Middle	Oldest
	0	0.48	-	-	-
	1	-	0.23	-	0.48
	2	-	0.23	0.35	0.51
	3	-	0.18	0.42	0.51
	4 or more	-	-0.10	0.18	0.94
Boy		No siblings	Youngest	Middle	Oldest
	0	0.23	-	-	-
	1	-	-0.08	-	0.35
	2	-	-0.10	-0.08	0.49
	3	-	-0.42	0.01	0.02
	4 or more	-	-0.42	-0.49	-

Model M7.1b includes birth order. Whereas the effect of children's sex remains almost the same when compared with model M7.1a, the inclusion of birth order leads to a small decline in the magnitude of the coefficient for number of siblings. However, its statistical significance persists. Birth order itself also proves to make a difference. Although statistically there is no difference between being an only child and a middle child or between being the youngest child and a middle child, being the oldest sibling is on average associated with a higher frequency of

[58] See Chapter 4 for a discussion of the coefficient for number of siblings as well as the covariates.

Table 7.3 Parameter estimates for frequency of activities (random-effects models)

	M7.1.a	M7.1.b	M7.1.c
Child's age	-0.001 (0.004)	-0.004 (0.004)	-0.004 (0.004)
Child's sex (boys)	-0.212*** (0.025)	-0.211*** (0.025)	-0.244*** (0.053)
Child's health impairments	0.011 (0.028)	0.014 (0.028)	0.015 (0.028)
Childcare			
…by partner	0.066** (0.033)	0.058* (0.033)	0.057* (0.033)
…by father	0.074 (0.058)	0.073 (0.058)	0.074 (0.058)
…by siblings	0.014 (0.041)	0.055 (0.042)	0.058 (0.042)
… by grandparents	0.076*** (0.025)	0.068*** (0.025)	0.067*** (0.025)
…by daycare	-0.036 (0.027)	-0.034 (0.026)	-0.032 (0.026)
Time spend in child care (% of available time/week)	0.282*** (0.063)	0.251*** (0.063)	0.248*** (0.063)
Household Type			
Single mother (ref.)			
Couple	0.188*** (0.053)	0.173*** (0.054)	0.173*** (0.054)
Multigenerational family	-0.164 (0.192)	-0.150 (0.193)	-0.147 (0.193)
Household's net income	0.012* (0.006)	0.012* (0.006)	0.012* (0.006)
Mother's age	0.002 (0.003)	0.006** (0.003)	0.007** (0.003)
Mother's education			
Up to general secondary school (ref.)			
Intermediate secondary school	0.257*** (0.038)	0.247*** (0.038)	0.246*** (0.038)
Upper secondary school	0.279*** (0.047)	0.250*** (0.047)	0.250*** (0.047)
Tertiary school	0.424*** (0.042)	0.385*** (0.043)	0.380*** (0.043)
Mother's working hours			
0-9 (ref.)			
10-29	-0.054* (0.031)	-0.026 (0.031)	-0.022 (0.031)
30 and more	-0.151*** (0.035)	-0.129*** (0.035)	-0.128*** (0.035)
Age group (5 to 6 years)	0.083 (0.125)	0.128 (0.125)	0.129 (0.125)
Data source (FiD)	0.060* (0.031)	0.068** (0.031)	0.068** (0.031)

(continued)	M7.1.a	M7.1.b	M7.1.c
Child's number of siblings	-0.117*** (0.014)	-0.085*** (0.019)	0.071 (0.089)
Sibling rank			
No siblings (ref.)			
Youngest		-0.159*** (0.045)	-0.181*** (0.068)
Middle		-0.056 (0.091)	-0.020 (0.275)
Oldest		0.107** (0.044)	-0.101 (0.117)
Child's sex (Boys) Sibling rank*			
Youngest			0.062 (0.093)
Middle			0.060 (0.354)
Oldest			0.112 (0.160)
Child's sex (Boys) * Number of siblings			-0.046 (0.123)
*Sibling rank * Number of siblings*			
Youngest			-0.159* (0.094)
Middle			-0.131 (0.124)
Oldest			(-)
Child's sex (Boys) Sibling rank * Number of siblings*			
Youngest			0.039 (0.129)
Middle			-0.032 (0.162)
Oldest			(-)
Constant	-0.438*** (0.153)	-0.427*** (0.153)	-0.419*** (0.155)
N	6223	6223	6223

Standard errors in parenthesis. *** p < .01, ** p < .05, * p < .10.

activities engaged in with the mother. However, the coefficient for middle siblings is the only coefficient of birth order that is not statistically significant and is the smallest in magnitude. The coefficient for oldest children is twice as large, and for youngest children it is three times as large. Interestingly, being the oldest secured higher frequencies than having no siblings. However, the magnitude of the positive effect favoring the first-born is, however, rather small. Model M7.1c adds

the interaction term among number of siblings, birth order, and children's sex. As expected, the number of siblings interacts with birth order and sex. To visualize the interaction, predicted values for the frequency of activities for different sibship sizes are computed (Figure 7.1).

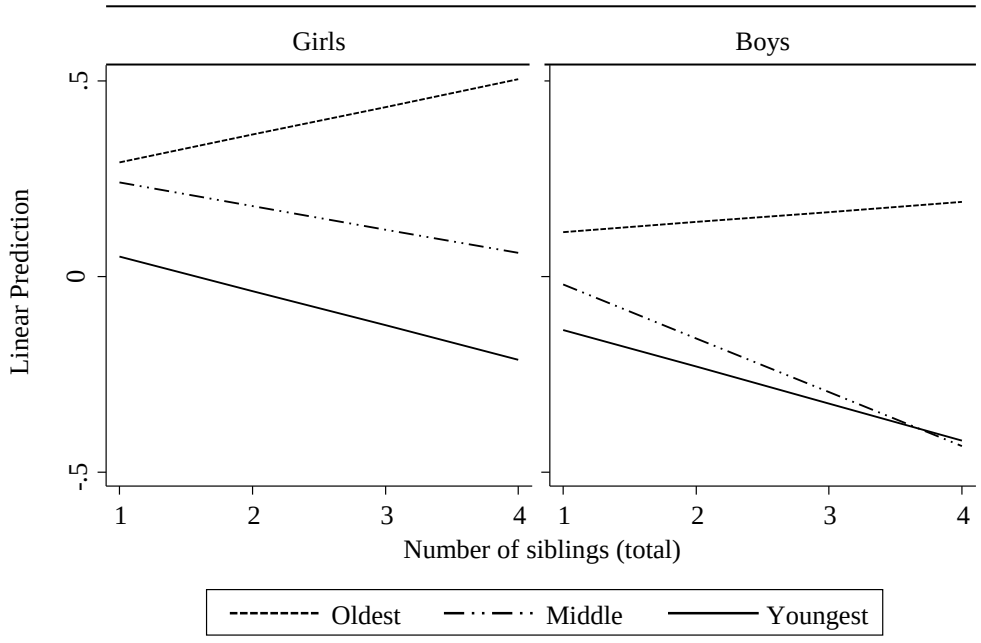
For girls as well as boys, and consistent with the results of model M7.1b as well as those described in Chapter 4, the frequency of activities undertaken with oldest siblings tends to be higher and even tends to grow as the number of siblings increases. However, for girls, higher numbers of siblings lead to a stronger increase in the frequency of activities than for boys, and first-born girls always engage more often in activities with their mothers than do the boys. Being the youngest child and the middle child interacts negatively with number of siblings, for both boys and girls. Whereas the middle and youngest birth positions have a similar effect on activity frequencies for boys, however, for girls it is profitable to have both older and younger siblings instead of being the youngest. Although activity frequencies decrease with increasing numbers of siblings for middle as well as youngest girls and boys, middle-born girls still engage in more frequent activities than do the youngest. Again, within each birth-order position, girls always engage more often in activities with their mothers than boys do. The worst case concerning frequency of activities is to be a youngest boy with many siblings. Broad confidence intervals (not displayed on the graphs) can be explained by the relatively small number of children in each combination of the characteristics sex, sibship size, and number of siblings.

Other covariates are almost the same for all three model variations. In short, the following situations all led to higher activity frequencies: belonging to the FiD sample; being cared for by grandparents, the partner of the mother, or the father (if the father is not living in the same household); living in a household where the parents live as a couple instead of living with a single mother; and having a mother who is better educated and who spends much time in overall childcare.[59] In contrast, if the mother works many hours, the effect is negative. All other

[59] Only a short summary of the coefficients of other than the main covariates is given here because model M7.1a was already described in Chapter 4 and effect sizes do not vary relevantly between all model variations. Therefore, see Chapter 4 for a more detailed description of the covariates.

covariates are either not statistically significant and/or very small. However, two coefficients must be emphasized because their magnitudes change between M7.1a and M7.1b/M7.1c. The inclusion of birth order leads to an increase in the coefficient for childcare by siblings. Without birth order in the model, the effect was, although statistically significant, almost zero (0.007). The extension with birth order leads to a coefficient size of 0.06, which is very small but is almost nine times higher than in model M7.1a. Similarly, the coefficient for living in a multigenerational household is negative but almost zero in model M7.1a but increases to 0.15 with the inclusion of birth order.

Figure 7.1 Predictive margins for activity frequency as a function of birth order, child's sex, and number of siblings



7.5.1 Sensitivity Analysis

The results remain virtually unchanged when single items are used for each activity instead of the additive standardized index. When the number of siblings is changed from categorical to continuous in random-effects models, the gist remains the same but the results, as shown by the predictive margins (see Figure

7.1), are more complex and, owing to small sample sizes, have large confidence intervals. However, number of siblings still plays the same important role.

7.6 Discussion and Conclusions

Based on data drawn from the SOEP and the FiD in Germany, the results here show that the activities children engage in with their mothers, both in quantity and kind, not only are dependent upon the family's resources (such as maternal education and partner support in childcare), but also are affected by the number of siblings, a child's sex, and birth order. Contrary to the resource dilution hypothesis (Blake, 1981, 1989), which insists on a negative relationship between sibship size and mother's time and attention, the results here suggest that increasing the number of siblings has only a small effect on the frequency of activities that mothers engage in with their children, and that birth order and sex of the child do affect how resources are allocated within the family. In fact, children with younger siblings, both boys and girls, most notably first-borns, experience substantially higher frequencies of activities as the number of siblings increases.

The aim of this chapter was to investigate differences in the frequency of activities as a function of more than one sibship characteristic, namely the number of siblings, birth order, and sex of the child. The results indicate that the investigation of the effects of sibship size on different activities engaged in by mothers with their children is only fruitful if birth order and sex of the child are considered as moderating factors. Bringing theoretical assumptions and empirical results together, the favoritism for girls over boys can only be explained by the parents' wish to bring child outcomes into line.

According to the economic explanation (Behrman et al., 1982), parents should compensate for less well-endowed children. In the German context, girls are at a disadvantage with regard to later incomes, so it might be plausible for parents to invest in girls rather than in boys. However, according to this logic, parents should also invest in the last-born child because at the time of his or her birth, their older

siblings have already received investments from the parents, and parents should compensate for this difference by investing more in the last-born child. But the data show that this is not the case. First-born children, independent of gender, are always favored by mothers. This was predicted by economic theory, however, for reinforcing parents who do not aim to produce equality between their children.

In addition, social norms and stereotypes might also explain the advantage conferred on first-born children. Unfortunately, it is not clear which theoretical perspective explains the relationship. On the contrary, even within economic theory, results are in accord in part with both reinforcing and compensating strategies, so it is not clear whether parents try to maximize the wealth of the most promising child or they want to equalize all children's outcomes. Whereas the number of siblings and birth order interact with each other, however, the sex of the child has an effect only on the intercept and not on the slope of this interaction. So the sex of a child matters, but for the specific gender, the effect of number of siblings and birth order is very similar.

All in all, the effect of sibship size is multifaceted. There appears to be evidence for resource dilution or the quantity – quality tradeoff with growing sibship size for middle and last-born children but not for first-born children. Quite the contrary: on the one hand, oldest children – with younger siblings – engage in activities more frequently than only children do, and on the other hand, the data suggest that a larger number of siblings may even be associated with a higher frequency of activities.

These puzzling results call for an explanation, which can be found in the resource augmentation hypothesis. Efficiency gains, the public-good character of maternal activities, and reallocations of the mother's daily tasks might cause this relationship. If children have no siblings, they cannot profit from the advantages a younger child brings. For example, if the youngest child asks the mother to read a story, older siblings might also benefit from the reading session even if they would not have asked for it themselves. Thus, it seems that the advantage does not stop after the addition of one younger sibling but grows with increasing numbers of children. But middle and youngest children do not profit from siblings. Even if a combination of activities or a rescheduling of mothers' daily routine takes place, it does not have to be to the advantage of the younger siblings. Maybe mothers combine activities of different qualities. For example, they might supervise the painting of the older

child while feeding a younger child. And the extra time gained by rescheduling might be invested in cognitively stimulating activities for the oldest children, but for the youngest children, again, basic childcare needs are fulfilled.

This fundamental distinction between parental inputs and outputs as experienced by the child has been neglected in previous theories on the distribution of resources within families and should be included in any further explanations.

Future research should test cultural and economic perspectives on sibling differences by explicitly investigating parental attitudes toward social norms and sex stereotypes as well as child and parent characteristics that potentially condition investment strategies. Moreover, the augmentation hypothesis should be investigated in more detail, taking into consideration the quality of activities. In general, combining the frequency with the quality of certain activities should lead to more differentiated results concerning activity allocation within families as well as the effects on child outcomes. The connection between the frequency of activities engaged in with children in their early life stages and later individual outcomes (such as child development, educational attainment, and labor market success) should be studied further. For example, Price (2008) suggested that reading to children has a positive effect on their development as well as on their performance in school, but time spent watching television has a negative effect on child outcomes, or at least takes time away from more stimulating activities. Only by unveiling the causal connection between activities with children and later life outcomes will the study of resource allocation within the family prove its relevance for understanding the emergence and persistence of social inequality.

8 CONCLUSIONS

8.1 SUMMARY OF RESEARCH

This dissertation investigates the effect of various sibship characteristics on parents' allocation of cognitively stimulating activities. The introduction includes a general overview of the relevance of sibling studies, the situation in Germany, and the main contributions of the study. Chapter 2 integrates different theories and hypotheses regarding the distribution of resources within families to superordinate categories (economics, heuristics, and norms) and discusses the importance of the life-course perspective. It also introduces the "resource augmentation hypothesis"`. Chapter 3 provides information about the data and operationalizations of the variables, as well as an overview of the value of these data and where they are constrained.

Chapter 4, the first of the four empirical chapters, investigates the role of number of siblings on the frequency of cognitively stimulating activities. The main independent variables are the number of siblings and overall time spent on childcare. The results suggest that increasing numbers of siblings lead to fewer activities undertaken with the mother; however, if a mother has more overall childcare time available, her children will profit from it even if the number of siblings increases. The advantage is not the same for all children and depends on the age composition of the sibship; it will work only if a child has younger but not older siblings. All in all, resource diluting as well as resource augmenting processes seem to be true.

In Chapter 5, the effect of birth spacing on the distribution of maternal time is analyzed for first-born and last-born children. Birth spacing is included in the

study as a categorical variable. The main result is that very close spacing is positive or at least not disadvantageous for children, and growing age gaps lead to a decrease in activity frequency. However, children in young ages profit more from being close in age. It seems that resource augmentation is also at work as long as children are not yet in school.

Chapter 6 deals with the relationship between the sex composition of the sibship and the activity frequency. Various operationalizations of the sex composition are applied, but all in all, the sex of siblings seems to have no significant effect on the distribution of a mother's time. However, independent of the sex of siblings, girls engage in activities with their mothers more often than boys do. This effect cannot be explained theoretically but might be attributable either to sex-specific surplus investments by fathers as well as mothers or to the nature of the dependent variable.

Then, in Chapter 7, the interaction among number of siblings, birth order, and sex of a child is investigated to determine their combined effects on the frequency of cognitively stimulating activities. The main assumptions about each individual characteristic described in the three preceding chapters are confirmed: an increasing number of siblings is negatively related to activity frequency but might be reversed when a younger sibling is present. Therefore, the effect is a function of birth order because the positive effect is valid only for first-born children. The effects are similarly true for boys and for girls, albeit to different degrees; however, within each birth-position group, girls engage in activities with their mothers more often than boys do.

8.2 Discussion and Suggestions for Future Research

When all the results are taken together, a clear picture emerges. The number of siblings is a persistent negative factor in sibling inequality, both between and within families. In accordance with previous research (Blake, 1981; Downey, 1995), the comparison of families with different numbers of children reveals that in larger families, children receive fewer resources from their parents. The same is

true for children who experience the birth of a sibling over their life course, but the effect can be reversed depending on the age composition of the sibship and the birth order of the children. Finally, mothers spend more time with daughters than with sons, but the sex of siblings does not play an important role.

Theoretically, the economic model (Becker, 1981) seems to be partly true: if parents do not expect different outcomes for their children, then the number of siblings should be negatively correlated with the frequency of activities (which is also the main assumption of the resource dilution hypothesis). This hypothesis is empirically verified; however, the other part of the economic model, which predicts compensating and reinforcing behavior of parents based on expected future payoffs for their children, cannot be confirmed.

Similarly, the predictions based on Behrman et al.'s (1982) equality preference model are also not supported by the data; in contrast, heuristic explanations seem to fit the data better. The resource dilution hypothesis might also be part of a heuristic, the 1/N rule, and the assumptions could be verified by the data. However, because both economic and heuristic decision-making predict the negative effect of number of siblings, it is unclear which of the explanations is really at work. Data on decision strategies of parents would be a great help for identifying the true underlying theoretical idea. But independent of economic or heuristic explanations, the negative effect can be transformed into a positive effect if children are close in age, if they are not already attending school, and particularly if they are first-borns.

Resource augmenting processes seem to play opposite resource dilution. Mothers are able to transform their time into cognitively stimulating activities even if they have more children, but only if the children are younger than about 6 years of age; at that stage they profit from the similar interests and needs of young children who do not already attend school if they are close in age. Mothers can combine the activities and become more efficient in carrying them out. For example, a mother can read one book aloud to all the children and therefore garner scale effects, from which all children profit.

What is evident – and the resource augmentation hypothesis in part considers this – is the special role of siblings or children in general. Yet most theories ignore the fact that children might also be active parts of families and have the power to

shape their environment themselves, at least to some extent (Behrman, 1997). Children are not passive objects exposed to parental input without reacting to what is happening in their environment; on the contrary, they react to their parents and to other siblings and might also demand parental attention for themselves (Hsin, 2008).

Certainly, parental resource investments play a crucial role in children's development, but the amount of these investments might depend on the children themselves, who have their own wills and preferences, which in turn might affect parental behavior. Similarly, not all children need the same amount of activity. A hyperactive child may demand more attention from the mother than a passive child. But some activities might emerge only through the presence of siblings; for example, one sibling might ask for an activity that would not have been done without such a request, and all the other siblings can share in it. Moreover, mothers can engage in different activities with more than one child, which also benefits the children. To have more time available for childcare, which includes cognitive stimulating activities, mothers could also reorganize their daily schedule in favor of childcare time, such as sleeping less or doing less housework (Bianchi, 2011).

The resource augmentation hypothesis assumes that different mechanisms are available that will help mothers give more attention to their children even as the number of children increases. Each individual mechanism would be consequential; one might be distinctly helpful, or they all might be applied simultaneously. However, questions such as how exactly the augmentation of resources works, how the mechanisms interact with one another, and which mechanism is the most effective remain unanswered.

Unfortunately, it was not possible to disentangle the effects discussed in this dissertation in more detail. Future research should focus on explaining the mechanisms underlying these effects and should produce data that will allow families to be analyzed more thoroughly. The majority of assumptions in the resource augmentation hypothesis could be investigated using detailed time-budgeting data that reveal a mother's daily activities and who else was involved, be it actively or passively. In addition, the data should include who initiated the activity and whether the mother or the children (individually or as a group) asked for it. More information is needed about what exactly was done and which utilities

were chosen – for example, if the mother chose to read a book to her child, the nature of the book should also be noted. Even better analyses could be performed if longitudinal data were available – what is done with whom at what age of the child, and how does the situation change if more siblings are added to the household. With these data, a more extensive investigation of the resource augmentation hypothesis would be possible.

In general, the ages of the children and their siblings seem to be the most important factor in any of these analyses. Even the birth order effects are actually age-related effects. In the data used in this dissertation, the first-born child is never above 6 years of age, meaning he or she is probably not yet at school[60] or has just been enrolled. The middle children are between 2 and 6 years old, meaning that the older sibling is already enrolled in school, and the same is true for the youngest children. Therefore, for first-born children, who profit most from having (younger) siblings, attending school might be conferring the advantage, and the results described in Chapter 5 confirm this idea.

The life course perspective, which embeds individuals in age-specific environments, should be more integrated into this type of research because it seems to influence what happens within families. For children, these environments include kindergarten, external childcare settings, and school. However, a direct test of this hypothesis is not feasible based on the data used in this dissertation because information on school attendance is available only for those children for whom an age-specific questionnaire is answered; even within this group, many values are missing, greatly reducing the sample size. Future research needs to investigate the effect of school attendance in more detail based on appropriate data.

Childcare by other persons might also have a considerable effect on a mother's time spent with her children as well as on children's cognitive development. Given the scope of the data in this dissertation, it is not possible to observe to

[60] In Germany, children are enrolled to school between ages 5 to 7, although the enrollment with 5 years has only recently been established. According to the month of a child's birth, which varies by the federal state a family belongs to, a child has to go to school at a certain age. The majority of children are enrolled with six or seven years.

what extent developmentally stimulating activities are part of the childcare time provided by fathers, grandparents, other relatives, peers, and even siblings – in other words, the overall amount of activities the child engages in. Future research should analyze the exact interplay between maternal childcare and childcare by others. For example, as was already mentioned in the resource augmentation hypothesis, children who play with their siblings might thus stimulate not only the child's development (through the play itself or through the mother's increased time budget) (Downey & Condron, 2004), but the older siblings' development as well (Brody, 2004; Downey & Condron, 2004[61]). To investigate this possibility in more detail, qualitative studies on the interactions between siblings might be in order, but such information is not available in the datasets used here.

Similarly, the role of fathers is only incidentally investigated in this dissertation, but the more dominant focus on mothers was not intended to disregard the fathers' influence on their children.[62] Fathers' involvement in childcare has recently increased in Germany (see Seiffge-Krenke, 2009, or Footnote 3) and their role has changed (at least for some segments of the population) from the male breadwinner to a more influential part of a children's life. In Germany, not only has the legislature made it easier and financially more attractive for fathers to take part in child-rearing, but also the society has become more accepting of a father's desire to spending more time with his children (Vogt & Pull, 2010).

All these developments also influence maternal time allocations, but this information could not be captured by the covariate when the partner or father also is involved in childcare. For example, as described in the Discussion section of Chapter 6, fathers might invest surplus time in sons but not in daughters, but this factor cannot be measured based on the data available. Although it is assumed that boys engage less frequently in activities with their mothers and are therefore disadvantaged in their skill development, activities undertaken with fathers might also be cognitively stimulating. Moreover, mothers and fathers who share

[61] For a discussion on the development of social or interpersonal skills, see Downey & Condron (2004).

[62] See Sarkadi, Kristiansson, Oberklaid, & Bremberg (2008) for a review of studies on the effects of fathers' involvement in childcare.

childcare develop routines based on different factors, such as attitudes toward traditional roles, the family income, or more generally the couple's respective employment situations (Röhr-Sendlmeier & Bergold, 2012). Therefore, the processes that take place between parents are much more complex and require deeper probing[63] than is possible within this context. Detailed information about fathers' involvement is needed, preferably with time-budgeting data (as mentioned above).

The sources of the data used in this study also warrant some explanations. The data are obtained from the SOEP and the FiD and are merged. As described in Chapter 3, the FiD sample consists of the following samples: families with low income, single parents, and large families with more than two children. On average, these group characteristics tend to be associated with lower social class (e.g., Keddi, Zerle, & Lange, 2010; Eggen & Leschhorn, 2004), and according to class theory, such families are less often likely to engage in cognitively stimulating activities with their children because their parenting practices are geared to the "accomplishment of natural growth" (Lareau, 2011). However, even if all models control for the socioeconomic situation of families (e.g., family income, education, household type, and number of siblings), the coefficient for the data source is still negative for the SOEP; in other words, mothers who answered the FiD questionnaires stated consistently, throughout all the analyses and all the subsamples included in the analyses, that they engage in cognitively stimulating activities with their children more frequently than do mothers drawn from the SOEP sample.

So there seems to be a factor that causes mothers from the FiD sample to say they engage in these activities more often. This factor is still present if models are estimated without controlling for household type, household income, and mother's educational level.[64] One reason might be that the FiD and SOEP

[63] See the multidisciplinary book edited by Cabrera and Tamis-LeMonda (2013).

[64] If the hypothesis that the SOEP and FiD samples differ from each other because of class differences, a model without these variables should result in a positive SOEP effect – that is, mothers from higher classes (which are assumed to be represented to a greater extent in the SOEP sample) would engage in cognitively stimulating activities more frequently. A comparison of two variations of, for example, Model 1 – one including the independent variables household type,

questionnaires differ from each other. For example, the FiD questionnaire for 2- to 3-year-old children consists of 10 pages, whereas the SOEP equivalent has only 4 pages. The question about activities is one of the last questions in both questionnaires, but the mothers from the FiD sample had to answer many more questions on specific children than mothers from the SOEP did. In addition, the title of the FiD questionnaire is "Families in Germany", whereas the SOEP title is "Living in Germany", so it is possible that these titles triggered certain associations that resulted in different answering patterns.

Another reason for the difference in responses to the questions on activities might be that some mothers were more experienced at completing the questionnaires, engendering a selection effect. Mothers from the FiD sample had not participated in a survey because they are newly added to the population with the appearance of the FiD and therefore might have been more motivated and excited about taking it. On the contrary, the bulk of mothers from the SOEP has filled out the questionnaires before. Although these are mere speculations, the main conclusion is that the two samples differ from each other in more than socioeconomic terms.

Future research should place an emphasis on the mechanisms by which resources are distributed within the family. By unveiling disparities within and between families, this dissertation has contributed to continually expanding the focus of inequality research both beyond between-family comparisons and toward early stages of the life course. At the same time, by pinpointing differences in the frequencies of mothers' activities, this study has revealed interfamily as well as intrafamily processes that are most likely responsible for the correlations that are observed – and have been documented in previous research – between number of siblings, birth order, and children's later life outcomes.

All in all, families do not have a homogeneous influence on all their members; on the contrary, siblings are treated differently by their mothers (McHale et al., 2000). Time spent with children in cognitively stimulating activities has been

household income, and mother's educational level, and the other without these variables (not displayed here) – shows that the coefficient of the sample (SOEP or FiD) changes from 0.06 in the complete model to 0.05, which is only a marginal decrease. These samples seem not to be determined by class but by another factor that is causing mothers from the FiD to report higher activity frequencies.

shown to have an effect on children's future outcomes (see Section 2.1 and Cunha, & Heckman, 2008; Hackman et al., 2010; Hsin, 2006). However, parental resources are not necessarily divided equally among siblings, but mothers decide whom to prefer based on a child's gender, the number of siblings, and birth spacing. Therefore, sociological theories, the great majority of which have predicted a general effect of families on children but did not differentiate between divergent effects among siblings, strongly need to consider family dynamics in their assumptions. Because, as Harris has noted, "growing up in the same home does not make children more alike" (Harris, 2011: 32).

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APPENDICES

APPENDIX A (CHAPTER 3)

Table A1.a Mokken scale analysis for 2- to 3-year-olds (both SOEP and FiD data) (N=4244)

Variable	Mean	Loevinger H coefficient	Z-Statistic
Painting	2.29	0.42	42.37
Singing	2.64	0.46	47.14
Reading	2.98	0.50	51.22
Picture books	3.16	0.54	54.77

Table A1.b Factor analysis for 2- to 3-year-olds (both SOEP and FiD data) (N=4244)

Variable	Factor	Uniqueness
Painting	0.55	0.61
Singing	0.62	0.55
Reading	0.76	0.36
Picture books	0.79	0.34

Table A1.c Mokken scale analysis for 2- to 3-year-olds (SOEP data only) (N=1658)

Variable	Mean	Loevinger H coefficient	Z-Statistic
Painting	1.88	0.35	20.23
Singing	2.21	0.38	22.86
Reading	2.45	0.47	28.23
Picture books	2.64	0.47	28.64

Table A1.d Factor analysis for 2- to 3-year-olds (SOEP data only) (N=1658)

Variable	Factor	Uniqueness
Painting	0.44	0.74
Singing	0.51	0.67
Reading	0.78	0.36
Picture books	0.75	0.41

Table A1.e Mokken scale analysis for 2- to 3-year-olds (FiD data only) (N=2586)

Variable	Mean	Loevinger H coefficient	Z-Statistic
Painting	2.56	0.34	26.20
Singing	2.91	0.40	31.23
Reading	3.31	0.40	31.32
Picture books	3.49	0.45	34.34

Table A1.f Factor analysis for 2- to 3-year-olds (FiD data only) (N=2586)

Variable	Factor	Uniqueness
Painting	0.49	0.66
Singing	0.60	0.57
Reading	0.68	0.46
Picture books	0.71	0.45

Table A2.a Mokken scale analysis for 5- to 6-year-olds (both SOEP and FiD data) (N=3037)

Variable	Mean	Loevinger H coefficient	Z-Statistic
Painting	2.24	0.43	30.47
Singing	2.16	0.45	31.77
Reading	2.94	0.39	26.97

Table A2.b Factor analysis for 5- to 6-year-olds (both SOEP and FiD data) (N=3037)

Variable	Factor	Uniqueness
Painting	0.64	0.58
Singing	0.70	0.51
Reading	0.52	0.71

Table A2.c Mokken scale analysis for 5- to 6-year-olds (SOEP data only) (N=1026)

Variable	Mean	Loevinger H coefficient	Z-Statistic
Painting	1.86	0.41	16.01
Singing	1.69	0.41	17.00
Reading	2.43	0.31	11.99

Table A2.d Factor analysis for 5- to 6-year-olds (SOEP data only) (N=1026)

Variable	Factor	Uniqueness
Painting	0.63	0.58
Singing	0.71	0.49
Reading	0.41	0.80

Table A2.e Mokken scale analysis for 5- to 6-year-olds (FiD data only) (N=2011)

Variable	Mean	Loevinger H coefficient	Z-Statistic
Painting	2.44	0.38	21.59
Singing	2.40	0.40	22.52
Reading	3.20	0.33	18.46

Table A2.f Factor analysis for 5- to 6-year-olds (FiD data only) (N=2011)

Variable	Factor	Uniqueness
Painting	0.60	0.63
Singing	0.66	0.56
Reading	0.47	0.77

APPENDIX B (CHAPTER 4)

Table B1 Summary statistics for the random-effects models

Variable	Mean / %	Standard Deviation	Min	Max	N
Mothers' frequency of activities with their children	0.01	0.99	−4.00	1.71	6251
Child's age (months)	49.38	17.72	26	80	6251
Child's sex (boy = 1)	0.52	0.50	0	1	6251
Number of siblings	1.40	1.18	0	11	6251
Child's health impairment (yes=1)	0.19	0.39	0	1	6251
Childcare (yes=1)					
…by partner	0.71	0.46	0	1	6251
…by father	0.06	0.25	0	1	6251
…by older siblings	0.13	0.34	0	1	6251
…by grandparents	0.49	0.50	0	1	6251
…by daycare	0.64	0.48	0	1	6251
Time spent in childcare (% available time/week)	34.79 %				6251
Household type					
Single mother	12.59 %				787
Couple	86.66 %				5417
Multigenerational household	0.75 %				47
Household income (net, monthly in thousand euros)	3.33	2.07	0.15	35.00	6251
Mother's age (years)	35.12	5.86	19	75	6251
Mother's education					
Up to general secondary school	22.84 %				1428
Intermediate secondary school	37.67 %				2355
Upper secondary school	15.18 %				949
Tertiary school	24.30 %				1519
Mother's working hours/week					
0-9	50.86 %				3179
10-29	25.13 %				1571
30 or more	24.01 %				1501
Age group					
2-3 years	59.33 %				3709
5-6 years	40.67 %				2542
Data source					
SOEP	32.49 %				2031
FiD	67.51 %				4220

Table B2 Summary statistics for the fixed-effects models

Variable	Mean / %	Standard Deviation	Min	Max	N
Mothers' frequency of activities with their children	-0.01	1.00	-4.00	1.71	2463
Child's age (months)	51.29	18.30	26	79	2463
Child's sex (boy=1)	0.51	0.50	0	1	2463
Number of siblings	1.23	1.18	0	11	2463
Child's health impairments (yes=1)	0.19	0.39	0	1	2462
Childcare (yes=1)					
…by partner	0.73	0.45	0	1	2463
…by father	0.06	0.25	0	1	2463
…by older siblings	0.13	0.34	0	1	2463
…by grandparents	0.51	0.50	0	1	2463
…by daycare	0.68	0.47	0	1	2463
Time spend in child care (% available time/week)	32.61 %				2463
Household type					
Single mother	11.86 %				292
Couple	87.21 %				2148
Multigenerational household	0.93 %				23
Household's income (net, monthly in thousand euros)	3.31	2.08	0.15	35.00	2463
Mother's age (years)	35.22	5.80	19	56	2463
Mother's education					
Up to general secondary school	22.01 %				542
Intermediate secondary school	38.37 %				945
Upper secondary school	14.82 %				365
Tertiary school	24.81 %				611
Working hours					
0-9	48.96 %				1206
10-29	26.72 %				658
30 and more	24.32 %				599
Age group					
2-3 Years	52.13 %				1284
5-6 Years	47.87 %				1179
Data source					
SOEP	58.79 %				1448
FiD	41.21 %				1015

APPENDIX C (CHAPTER 5)

Table C1 Summary statistics for 2- to 3-year-olds

Variable	Mean / %	Standard Deviation	Min	Max	N
Mothers' frequency of activities with their children	-0.04	1.01	-4.00	1.21	2336
Child's age (months)	35.32	3.98	26	45	2336
Child's sex (boy=1)	0.51	0.50	0	1	2336
Number of siblings	1.56	0.96	1	11	2336
Age spacing	2.99	1.27	1	5	2336
Child's health impairments (yes=1)	0.18	0.39	0	1	2336
Childcare (yes=1)					
…by partner	0.75	0.43	0	1	2336
…by father	0.05	0.21	0	1	2336
…by older siblings	0.12	0.32	0	1	2336
…by grandparents	0.48	0.50	0	1	2336
…by daycare	0.58	0.49	0	1	2336
Time spend in child care (% available time/week)	37.67 %				2336
Household type					
Single mother	7.62 %				178
Couple	91.57 %				2139
Multigenerational household	0.81 %				19
Household's income (net, monthly in thousand euros)	3.41	2.08	0.33	35.00	2336
Mother's age (years)	34.32	5.32	19	54	2336
Mother's education					
Up to general secondary school	23.67 %				553
Intermediate secondary school	36.47 %				852
Upper secondary school	14.43 %				337
Tertiary school	25.43 %				594
Working hours					
0-9	61.52 %				1437
10-29	20.38 %				476
30 and more	18.11 %				423
Data source					
SOEP	29.02 %				678
FiD	70.98 %				1658

Table C2 Summary statistics for 5- to 6-year-olds

Variable	Mean / %	Standard Deviation	Min	Max	N
Mothers' frequency of activities with their children	0.01	1.00	-3.20	1.71	1880
Child's age (months)	70.33	3.81	62	80	1880
Child's sex (boy=1)	0.52	0.50	0	1	1880
Number of siblings	1.68	0.93	1	11	1880
Age spacing	3.09	1.24	1	5	1880
Child's health impairments (yes=1)	0.14	0.34	0	1	1880
Childcare (yes=1)					
…by partner	0.71	0.45	0	1	1880
…by father	0.05	0.23	0	1	1880
…by older siblings	0.16	0.37	0	1	1880
…by grandparents	0.45	0.50	0	1	1880
…by daycare	0.72	0.45	0	1	1880
Time spend in child care (% available time/week)	32.66 %				1880
Household type					
Single mother	11.44 %				215
Couple	88.09 %				1656
Multigenerational household	0.48 %				9
Household's income (net, monthly in thousand euros)	3.58	2.14	0.60	35.00	1880
Mother's age (years)	36.64	5.50	22	75	1880
Mother's education					
Up to general secondary school	21.76 %				409
Intermediate secondary school	37.77 %				710
Upper secondary school	15.90 %				299
Tertiary school	24.57 %				462
Working hours					
0-9	44.73 %				841
10-29	31.22 %				587
30 and more	24.04 %				452
Data source					
SOEP	23.51 %				442
FiD	76.49 %				1438

APPENDIX D (CHAPTER 6)

Table D1 Results for models M6.1a, M6.1b, M6.2a, and M6.2b

	M6.1a	M6.1b	M6.2a	M6.2b
Child's age (in months)	-0.001 (0.004)	-0.001 (0.004)	0.004 (0.006)	0.003 (0.006)
Child's sex (boys)	-0.140** (0.058)	-0.202*** (0.043)	-0.305** (0.147)	-0.252*** (0.057)
Child's health impairments	0.003 (0.032)	0.003 (0.032)	0.006 (0.047)	0.003 (0.046)
Childcare				
…by partner	0.030 (0.036)	0.030 (0.036)	-0.088* (0.053)	-0.089* (0.053)
…by father	0.082 (0.071)	0.082 (0.071)	0.055 (0.093)	0.054 (0.093)
…by grandparents	0.073*** (0.028)	0.073*** (0.028)	0.073* (0.042)	0.074* (0.042)
…by daycare	-0.062** (0.030)	-0.062** (0.030)	-0.068 (0.044)	-0.069 (0.044)
…by siblings	0.020 (0.042)	-0.020 (0.042)	0.027 (0.051)	0.023 (0.051)
Time spend in child care (% of available time/week)	0.255*** (0.071)	0.254*** (0.071)	0.268** (0.103)	0.261* (0.103)
Household Type				
Single mother (ref.)				
Couple	0.240*** (0.067)	0.242*** (0.067)	0.258*** (0.094)	0.258*** (0.094)
Multigenerational household	0.053 (0.238)	0.058 (0.238)	0.797*** (0.299)	0.793*** (0.299)
Household's income (net, monthly in thousand euros)	0.007 (0.007)	0.007 (0.007)	0.015* (0.009)	0.015* (0.009)
Mother's age	0.001 (0.003)	0.001 (0.003)	-0.001 (0.004)	-0.002 (0.004)
Mother's education				
Up to general secondary school (ref.)				
Intermediate secondary school	0.238*** (0.043)	0.238*** (0.043)	0.262*** (0.060)	0.263*** (0.060)
Upper secondary school	0.303*** (0.051)	0.304*** (0.051)	0.350*** (0.075)	0.356*** (0.075)
Tertiary school	0.461*** (0.046)	0.461*** (0.046)	0.430*** (0.069)	0.431*** (0.069)
Mother's working hours				
0-9 (ref.)				
10-29	-0.057* (0.035)	-0.058* (0.035)	-0.151*** (0.055)	-0.151*** (0.055)
30 and more	-0.196*** (0.041)	-0.195*** (0.041)	-0.142** (0.063)	-0.141** (0.063)

(continued)	M6.1a	M6.1.b	M6.2.a	M6.2.b
Age group (5-6 years)	0.111 (0.141)	0.111 (0.141)	-0.013 (0.205)	-0.009 (0.205)
Data source (FiD)	0.047 (0.036)	0.047 (0.036)	-0.033 (0.057)	-0.033 (0.057)
Number of brothers	-0.092*** (0.028)			
Child's sex * Number of brothers	-0.032 (0.036)			
Number of sisters	-0.090*** (0.029)			
Child's sex * Number of sisters	-0.037 (0.038)			
Percentage sisters		-0.000 (0.000)		
Child's sex * Percentage sisters		-0.000 (0.001)		
Number of siblings		-0.108*** (0.017)	-0.114*** (0.024)	-0.118*** (0.024)
Majority of sibling's sex				
Equal (ref.)				
Male majority			-0.031 (0.114)	
Female majority			-0.036 (0.106)	
Child's sex (Boys) Majority of sibling's sex*				
Male majority			0.079 (0.161)	
Female majority			0.049 (0.165)	
Sibling sex composition				
Both (ref.)				
Only brothers				-0.035 (0.076)
Only sisters				-0.064 (0.078)
Child's sex (Boys) Sibling sex composition*				
Only brothers				0.016 (0.104)
Only sisters				0.062 (0.109)
Constant	-0.649*** (0.216)	-0.630*** (0.214)	-0.193 (0.311)	-0.188 (0.298)
N	5051	5051	2379	2379

Standard errors in parenthesis. *** p < .01, ** p < .05, * p < .10.

APPENDIX E (CHAPTER 7)

Table E1 Summary statistics

Variables	Mean /%	Standard Deviation	Min	Max	N
Mothers' frequency of activities with their children	0.01	0.99	−4.00	1.71	6223
Child's age (months)	49.37	17.71	26	80	6223
Child's sex (boy=1)	0.52	0.50	0	1	6223
Number of siblings	1.39	1.17	0	11	6223
Child's health impairments (yes=1)	0.19	0.39	0	1	6223
Sibling rank					
No siblings	19.25%				1198
Youngest	54.43%				3387
Middle	4.21%				262
Oldest	22.11%				1376
Childcare (yes=1)					
…by partner	0.71	0.46	0	1	6223
…by father	0.06	0.25	0	1	6223
…by older siblings	0.13	0.34	0	1	6223
…by grandparents	0.49	0.50	0	1	6223
…by daycare	0.64	0.48	0	1	6223
Time spend in child care (% available time/week)	34.82%				6223
Household type					
Single mother	12.55%				781
Couple	86.76%				5399
Multigenerational household	0.69%				43
Household's income (net, monthly in thousand euros)	3.33	2.07	0.15	35.00	6223
Mother's age (years)	35.09	5.82	19	75	6223
Mother's education					
Up to general secondary school	22.77%				1417
Intermediate secondary school	37.75%				2349
Upper secondary school	15.14%				942
Tertiary school	24.35%				1515
Working hours					
0-9	50.80%				3161
10-29	25.15%				1565
30 and more	24.06%				1497
Age group					
2-3 years	59.36%				3694
5-6 years	40.64%				2529
Data source					
SOEP	32.41%				2017
FiD	67.59%				4206

APPENDIX F (RESOURCE DISTRIBUTION)

Figure F1 Distribution of equal resource distribution between siblings based on number of siblings and birth order

Year	Only child	Two children		Three children		
		1st born	*2nd born*	*1st born*	*2nd born*	*3rd born*
1						
2						
3						
4						
5						
6						
Cumulated resources	100%	63%	63%	54%	42%	54%

Figure based on Hertwig et al. (2002: 731).

Amount of resources received by each child within a 6-year period based on equal resource distribution among siblings. Note that in this example, earlier born children move out of the household after 4 years.

DECLARATION OF HONESTY

Hiermit erkläre ich,

a) dass ich die eingereichte Arbeit selbständig verfasst habe, und nur die namentlich genannten Personen an der Arbeit mitgewirkt haben,

b) dass ich die Dissertation selbst angefertigt habe (Selbständigkeits-erklärung), keine Textabschnitte von Dritten oder eigenen Prüfungsarbeiten ohne Kennzeichnung übernommen und alle von mir benutzten Hilfsmittel und Quellen in meiner Arbeit angegeben habe,

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f) dass ich nicht die gleiche, eine in wesentlichen Teilen ähnliche oder eine andere Abhandlung bei einer anderen Hochschule als Dissertation eingereicht habe,

g) dass ich mit einer elektronischen Überprüfung der Dissertation (Plagiatsprüfung) einverstanden bin.

Bielefeld, den 27.05.2015 _____