Parental resources, sibship size and educational performance in 20 countries: Evidence for the compensation model

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Abstract

We study whether having several siblings decreases the level of educational performance of the second generation and whether this phenomenon can be compensated by other factors such as the economic or cultural resources of the parents. Based on this compensation model, parental resources should be associated with children's educational attainments more strongly in families with a higher rather than a lower number of children. We analyzed the Program for International Student Assessment (PISA) data from 20 Western countries and found that better family wealth, an increased level of parental education and a higher parental occupational status were associated with increased educational attainments more strongly among 15-year-old children who have siblings than among children without siblings. The same effect was not found in the case of family cultural possessions. Although parental resources may matter more in larger families than in smaller families, some types of resources are more important than others regarding compensation.

Introduction

In recent decades, the influence of family-related factors on students' academic achievements have become a standard part of research in social stratification and mobility. Currently, a large number of studies from the United States (e.g., Blake 1989; Jaeger 2008), Europe (e.g., Lawson, Makoli and Goodman 2013; Sieben, Huinink and de Graaf 2001), Asia (e.g., Li, Zhang and Zu 2007; Post and Pong 1998), and Australia (e.g., Evans, Kelley and Warner 2001) show that when the number of siblings increases, educational performance tends to decrease. In addition, research has shown that when parental resources increase, educational attainment also tends to increase (e.g., Davis-Kean 2005; Hampden-Thompson 2009). However, there is a lack of cross-national studies that analyze whether parental resources have a distinct effect on families of different sizes. Here, we study whether different types of family resources compensate for the sibship size, i.e., are parental resources more strongly associated with 15-year-old children's educational scores in larger families than in smaller families.

The article produces novel information concerning the accumulation of advantage that focuses on sibship size, educational performance and the resource compensation model. Thus, the article gives new insights to mechanisms regarding why large families do not automatically designate the poor educational outcomes of children. The structure of the article is as follows. First, the previous studies concerning the negative effects of large sibship size and low parental resources are presented. Moreover, we present the main theoretical premise of the current study, i.e., the compensation model. Then, after a formulation of hypotheses and a description of the data and methods that are used, the results of our empirical analyses are reported. In the final chapter, the results are discussed with the reference of our theoretical considerations and previous empirical findings.

Sibship size and the parental resource compensation model

The negative effect of a large sibship size on children's educational performance is often explained by three different but partly overlapping theories: the resource dilution model, the sibling competition hypothesis and the confluence model. The parental *resource dilution model* (e.g., Coleman 1988; Downey 2001; Jaeger 2009) predicts that

parental resources should influence children's academic outcomes, and because parental resources are finite, all new children in the household decrease the parents' possibilities to invest resources in any particular child. Thus, the resource dilution model assumes that increasing the number of siblings is associated with a decreasing level of school performance.

A classic question in resource dilution literature is whether patterns of postsecondary education can be attributed to sibship size, since families with many children only able to support the university attendance of one or two children (Downey, 2001). Although one may assume that the resource dilution effect should be stronger in countries with lower levels of public spending on education, previous studies have shown that the resource dilution effect occurs also in countries with higher rates of public spending on families and education (e.g., Park, 2008). Moreover, preliminary findings from Finland show that also in a Scandinavian country characterized by free education from compulsory school to University level, parental involvement may still divide unequally between children, and influence children's educational careers (Danielsbacka & Tanskanen, 2015). In addition to analyzing the actualized entry to college, studies have also considered how anticipation of such future trajectories might affect short-run performance in secondary school (e.g., Downey, 1995; Kreidl & Hubatkova, 2014). The anticipatory effects are often observed by educational test scores as we do also in the present study. Educational test scores are good measures of child outcomes, since several studies have shown that educational achievements in childhood and adolescence strongly correlate with, for instance, higher educational level and better salary in later life (e.g., Card, 1999; Heckman, 2006).

In addition to the resource dilution model, the *sibling competition hypothesis* predicts that increased sibship size correlates with decreased intellectual achievements in children. The hypothesis notes that siblings compete with one another over parental resources, including time, energy, money and other resources (Trivers 1974). Although sibling competition over parental resources also exists in adult siblings (Danielsbacka and Tanskanen 2015), it tends to be most severe in childhood and adolescence when parental resources matter the most (Salmon and Hehman 2014). The sibling competition hypothesis argues that from the children's perspective, it is beneficial to obtain as many resources from their parents as possible, whereas from the parental perspective, it is more important to guarantee their children's well-being by investing resources in all

children, not only one child. These different perspectives between family members may create a conflict between parents and children and among siblings.

The *confluence model* is also used to explain the relation between sibship size and the educational outcomes of the second generation. The confluence model, which was originally applied in psychology, predicts that the primary channel through which sibship size has a negative effect on the educational success of children is through the creation of an inferior intellectual environment in families with many children (Jaeger 2009). The confluence model predicts that having many children produces an intellectually weaker climate that is harmful to schooling outcomes (Jaeger 2008; Zajonc and Markus 1975). The confluence model is not directly related to parental resources as is the case with the sibling competition hypothesis and the resource dilution model. Instead, the confluence model predicts that family environment changes when the number of children increases. However, a family's intellectual climate can be seen as partly produced by parental (e.g., cultural, human and social) resources.

Consistent with the resource dilution model, the sibling competition hypothesis, and the confluence model, several studies from different societies have found that when the number of siblings increases, the educational attainments tend to decrease, as discussed above. However, there could be differences on the effects of parental resources from the number of siblings. When parental resources are high, the effect of having siblings may not be as crucial as the situation when parental resources are scarce. For instance, if a child has no siblings at all, the child is not forced to distribute parental resources with other children. In this case, a lower level of parental resources may be sufficient. In contrast, when a child has several siblings, low parental resources may significantly weaken and high resources may significantly strengthen the child's educational achievements.

The *compensation model* in general means that missing parental resources can be replaced with other available resources; therefore, the outcomes of children should be better than missing resources give us reason to predict (e.g., Bernardi 2012; Bernardi and Grätz 2015). One factor (i.e., having several siblings) that may decrease the level of educational performance may be compensated by some other factor (i.e., high parental resources). Thus, according to the compensation model, parental resources should matter more in larger families than in smaller families. The compensation may take

place in several ways. For instance, a problem for parents with multiple children may be that they cannot spend enough time to helping their children. While richer parents cannot increase the number of hours in a day, what they can do is buy services (like tutoring) that compensate the lack of parental involvement. This is one reason why the effect of parental resources should be increased with the increasing number of children.

In this article, we assume that the compensation model is a theoretically useful tool to understand the educational outcomes of the second generation in large families. To our knowledge this question has not been previously studied with cross-country data using family level measures of parental resources. Perhaps the most comprehensive previous study on the topic is the work by Downey (1995), who investigated the school grades of US students with mixed results. Downey analyzed the interactions between parental resources and sibship size and found negative correlations in 5 of 9 models, which indicates that increased parental resources have more impact on school grades in larger families than in smaller families. Although Downey found that some parental resources (e.g., having educational objects in the home) have a more positive influence on test grades in larger families than in smaller families, other resources (e.g., having a computer in the home) do not. One of the main limitations of Downey's study was that he used data from only one country (i.e., the US). Thus, it is not known whether the findings are as the results of specific features of, for instance, the US educational system or other country specific features. In previous studies Americans are found to be unique among other Westerners in several ways, including educational and childbearing practices that emphasize high level of individualism, autonomy and independence (see Henrich et al., 2010 for review). This means that the results discovered from the US may not be generalizable to other Western countries.

Later, Park (2008) used cross-national data and investigated how financial resources were associated with children's school achievements by the number of siblings. In his country-level investigation, Park found that the negative influence of the number of siblings was smaller in countries with a higher level of public spending on families and education. In addition, the negative influence was higher in countries with lower rates of investment in families and education. Park, however, measured wealth by a national level rather than a family level and therefore focused the compensation model more on national policy than on a family resource perspective. Here, we use data from 20

countries and analyze several family and parental resource variables while investigating adolescents' educational achievements.

Parental resources

Parental resources can be measured by several factors, including parental education, occupation, family wealth and cultural capital. These factors often overlap with one another. For instance, individuals with a higher educational status are more likely to have high-skilled occupations, more financial resources and cultural capital than individuals with a lower educational status. Although different resources tend to correlate with one another, they do not measure exactly the same, and the magnitude of the effect to children's academic success may vary among different resource types (e.g., Hampden-Thompson, 2009). By concentrating on a single measure of parental resources, it is possible to oversimplify their impact regarding the outcomes of the second generation (Bukodi and Goldthorpe 2013; Erola, Jalonen and Lehti 2015).

In modern nations, parental education may be the most important family resource factor that explains children's academic success. This importance is because in contemporary Western societies, education plays an important role as a "gatekeeper" or "pathway" to higher occupational status and pay (Bäckman and Nilsson, 2011). High parental education can be transmitted from parents to children via socialization and involvement (Jeynes, 2007). Moreover, higher educated parents tend to have more knowledge about the school system that may benefit their children compared to their lower educated counterparts (Bourdieu, 1984; 1986). In addition, higher educated parents may provide significantly more help to their children than do their less educated counterparts, regardless of their occupational status or financial resources (Useem 1992).

Parental occupational position indicates parental social status. However, it may also measure both parental educational level that has led to any particular occupation and earnings that are linked to this occupation (Erola et al., 2015). Thus, parental occupation tends to reflect parental financial resources, which, in turn, have shown to be an important factor that influences children's school attainments for several reasons. First, parents with lower financial resources are less able to purchase educational materials for their children than parents with higher financial resources (Entwisle and Alexander

1995; McNeal 1999). Educational materials include, for instance, computers, books and newspapers. In addition, when parental financial resources are scarce, the housing condition may be poorer and, for instance, there may be a decreased likelihood that children have a silent place to study (Blake 1981; Teachman 1987). Finally, higher income parents may be more able to offer their children activities such as summer camps, travels abroad, music lessons or other hobbies that may improve child development (e.g., Blake 1989). Having access to these resources and activities may positively affect children's educational achievements.

Finally, access to cultural possessions has been shown in previous studies to correlate with academic achievements (e.g., Andersen and Jaeger 2015; DiMaggio 1982; Dumais 2002; Xu and Hampden-Thompson 2012). In his classical works Bourdieu (1977, 1984, 1986) have argued that cultural resources measure immaterial types of capital that should be notice similarly than socioeconomic types of capital. In practice, cultural capital can be measured by objectified cultural possessions, including artworks, classical literature and books (Evans, Kelley, Sikora & Treiman, 2010). According to Bourdieu (1977, 1984, 1986) children from high cultural resource backgrounds are socialized to increase knowledge, for instance, by reading books and participating in highbrow cultural activities, including classical music concerts and operas. In turn, this kind of cultural capital benefit them in the academic environment and thus help children from high cultural resource families to achieve better educational success.

According to the resource compensation model, there are differences among parental resources on how easily they can be shared and whether this sharing decreases the total amount of family resources. Parents' material and economic resources that are difficult to share among siblings dilute rapidly when the number of children in the family grows (Downey, 2001). In contrast, cultural resources do not dilute as rapidly (Jaeger 2009). Considering the resource compensation model, parental education, occupation and family wealth should compensate for the negative effect of sibship size. The effect of cultural possessions, on the other hand, should not depend on the number of siblings. This is because several children may benefit from the same cultural possessions like art works and books. In contrast, socioeconomic resources are more difficult to re-use. For instance, the beneficial effects of parental educational resources are strongly related to parental investment of time in their children (Jeynes, 2007) and time of any individual is always limited. Thus, when number of children in the household increases the amount

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of time parents are able to invest in any particular child decrease. Moreover, if parents invest a certain amount of money in one child, the same money cannot be invested again in another child. Therefore, based on the compensation model, compared with cultural possessions, socioeconomic resources should more strongly relate to the school performance of children in larger families than in smaller families.

Hypotheses

The objective of the present study is to investigate how the number of siblings and parental resources influence the academic achievements of children. Based on the dilution model, the sibling competition hypothesis, the confluence model and previous findings, we predict the following.

> H1) When the level of parental resources *increases*, the educational test scores *increase*.
>
> H2) When the number of siblings *increases*, the educational test scores *decrease*.

In addition, based on the resource compensation model, we predict that

> H3) Parental socioeconomic resources (i.e., parental education, occupation and family wealth) compensate for the negative impact of large sibship size, meaning that the parental resources are more strongly associated with the educational test scores in families with a higher number of children than in families with a lower number of children.
>
> H4) Parental cultural possessions does not compensate for the negative impact of large sibship size, meaning that the parental cultural resources are similarly associated with the educational test scores both in families with a higher number of children and a lower number of children.

Data and methods

In this study, we used first-round data from the Program for International Student Assessment (PISA) that was collected in 2000, which has been recently used in several social mobility and stratification studies (e.g., Andersen and Jaeger 2015; Kreidl and Hubatkova 2014; Park 2008). The goal of the PISA was to collect cross-national data on 15-year-old adolescents' school attainments. In addition, in an adolescents' survey, students were asked information concerning their family structure and parental socioeconomic factors. In this study, the first round of the PISA data was used because it contains more information on the adolescents' household composition (i.e., number of siblings) than do the more recent rounds.

In 2000, the PISA data were gathered from 32 countries (28 OECD countries and 4 non-OECD countries). In this study, however, analyses included 20 Western countries, namely, Greece, Luxembourg, Italy, Spain, Germany, Belgium, Ireland, Australia, the UK, the US, Portugal, Switzerland, Austria, France, Canada, New Zealand, Finland, Norway, Sweden and Denmark. The Netherlands did not reached the sampling standards of PISA and, thus, it is recommended to exclude from cross-country studies (OECD, 2000). We restricted our analyses to industrialized Western countries for three reasons. First, we wanted to include countries with more similar rates of social, political and economic development to accurately measure the possible effect of family resources and sibship size on educational attainment. Second, by including only industrialized Western countries, we attempted to control for the biases that are based on cultural differences. Third, the PISA data included only the children who were in school at age 15, and in developing countries, half of the population or less tended to attend secondary schools. Therefore, by selecting only more developed industrial countries in the analyses, we attempted to avoid the biases that are based on school dropouts. These selections left us with a sample of approximately 110,000 adolescents.

Child outcome

In the present study, reading literature was selected to measure child outcome. In the PISA, adolescents' school attainments were measured through three indicators, i.e., reading literature, mathematical literacy and scientific literacy. In every PISA round, one of these themes was selected as the main theme; in the PISA 2000, the main theme

was the adolescents' reading literature skills. In the PISA 2000, the adolescents' mathematical and scientific literacy were tested, although not all of the adolescents participated in these tests. In the PISA, reading literature measures adolescents' capability to use, understand and reflect written text (OECD, 2001). This measure of children's educational attainments has been widely used in previous studies (e.g., Andersen and Jaeger 2015; Kreidl and Hubatkova 2014).

The PISA sample contains five plausible values for reading literature for each respondent with a mean score of 500 and a standard deviation of 100. These plausible values were constructed by using Item Response Theory, and they represented a selection of probable attainment for the adolescents (see OECD, 2000 for more detailed information). In the sample, the mean score of reading literature was 509.

Number of siblings

In the survey, the respondents were asked to report how many sisters and brothers they have. In the questionnaire, biological, step and adopted siblings were not separated from one another. For the analysis, we constructed a dummy variable that has five mutually exclusive classes, namely, 0, 1, 2, 3 and 4 or more siblings.

Parental resource variables

We used four variables that measured parental resources indirectly rather than directly. The family wealth variable was calculated by adding children's reports on the availability in the household of a dishwasher, one's own room, educational software and access to the Internet, as well as the number of televisions, computers, cellular phones, cars and bathrooms in the household. Cultural possessions were measured by asking whether children have artwork, classical literature and books of poetry in their home. The family wealth and cultural possessions indexes were standardized using Warm's (1985) estimates by the PISA project team. In these indexes, negative values indicate a lower level of resources, and positive values indicate a higher level of resources. The variable constructions are described in more detail elsewhere (OECD, 2000).

Parental socioeconomic status measured the highest status of occupation, and parental education measured the highest level of education between the parents. In the questionnaires, the children were asked to report their mothers' and fathers'

occupations. The parental occupation index ranges from 16 to 90 where lower scores indicate lower occupational status, and higher scores indicate the opposite (see Ganzeboom, de Graaf and Treiman, 1992 for more detailed information). In addition, the children were asked to classify their mothers' and fathers' highest educational level. Later, the PISA project team classified these responses in six internationally comparable classes of parental educational attainment by using the ISCED 1997 classification (see OECD, 1999). The distribution of parental resource variables are presented in Table 1.

Table 1. Family resource variables (mean) (n = 109,843)

	mean	SD
Parental education	4.90	1.30
Family wealth	0.22	0.87
Cultural possession	-0.06	1.01
Parental occupation	49.97	16.36

Control variables

In the analyses, we controlled for several potential confounding variables, which have been shown to correlate with educational attainment in previous studies (e.g., Jaeger 2008; Xu and Hampden-Thompson 2012). These variables included the children's gender, age (in months), birth order, family structure, the language spoken at home (i.e., whether the children were speaking the test language at home or otherwise) and parental involvement. The parental involvement variable was constructed by summing up the answers in six questions (Cronbach's alpha = 0.66). These questions measured two dimensions of parental involvement, namely cultural communication and social communication. Index for cultural communication included children's answers to three questions: How often they have discussed social or political issues with parents? How often they have discussed about books, films or television programs with parents? How often they have listened classical music with parents? Social communication index also included responses to three questions: How often they have discussed with parents how well children are doing at the school? How often children and parents eat the main meal together around the table? How often parents spend time to just talking with the child? These index scale scores were standardized by Warm estimates (see OECD, 2000 for full description). These scores range from -7.13 to 6.85 and higher scores indicate

higher parental involvement and lower scores opposite. The sample descriptive statistics are presented in Table 2.

Analytical strategy

The objective of the present study was to investigate whether family resources were more strongly associated with adolescents' educational attainments in families with more children than in families with less children. Further, the purpose of the study was

Table 2. Descriptive statistics (%/mean) (n = 109,843)

	%/mean	SD
Number of siblings (%)		
None	7.8	
1	40.8	
2	28.9	
3	12.4	
4+	10.1	
Child's gender (%)		
Girl	50.9	
Boy	49.1	
Child's age in months (mean)	189	3.44
Child's birth order (%)		
First born	41.6	
Later born	58.4	
Family structure (%)		
Single-parent family	14.7	
Nuclear family	75.2	
Mixed family	7.7	
Other	2.5	
Language spoken at home (%)		
Otherwise	9.4	
Speak test language at home	90.6	
Parental involvement (mean)	-0.01	2.12

to analyze whether there are differences among distinct parental resources regarding compensation and sibship size. Linear regression models with fixed effects that control for between-country variation (OLS with country dummies) were employed. We used the statistical software Stata's pv package to analyze five plausible values of reading literature. The analyses of these reading literature scores were conducted five times, i.e., once with each variable. The results indicated that the average score of the five plausible values and the variation among them was adjusted when calculating statistical significance. In the analyses, several of the potential confounding variables that were described above were controlled for.

Results

We present our empirical results in Tables 3 and 4. Our first hypothesis predicts that when the level of parental resources increases, the educational test scores among children should also increase. Table 3 shows what we assumed: when parental resources increase, adolescents' test scores also increase. This result is it in the case with all parental resource variables studied. Thus, we can conclude that parental education, occupation, family wealth and cultural possessions all correlate with improved educational achievements in children. Our second hypothesis predicts that when the number of siblings increases, the educational test scores should decrease. The results of our empirical analyses show support also for this prediction (Table 3).

Moreover, Table 3 shows that in addition to family resources and number of siblings, several other factors correlate with the adolescents' educational performance. Girls receive higher scores than boys, and as the children's age increases, educational attainment increases. Later-born children received lower scores than first-born children. The children who speak the test language at home received better test results than the children who do not speak the test language at home. The children from intact families received better scores and the children from the groups "mixed" and "other" received worse scores compared with the children from single-parent families. Finally, when parental involvement increases so do educational scores among children.

Next, we test our third hypothesis. According to this hypothesis, parental socioeconomic resources should be associated with educational test scores more

strongly in families with a higher number of children than in families with a lower number of children. The results are presented in Table 4 (Models 1, 2, 4 and 6). First, we included interaction term between family wealth and number of siblings. We found that compared with children without siblings, family wealth increases the scores of children who have at least one sibling. Next, we included an interaction term between parental occupation and the number of siblings and finally, between parental education and sibship size. These investigations show that a higher parental occupational and educational status increases the achievements more in children with one or more

Table 3.Associations between independent variables and children's educational attainment (country fixed effects) (n = 109,843)

	Parental education			Family wealth		
	Model 1			Model 2		
	β	SE	p	β	SE	p
Family resource variable	15.52	0.23	< 0.001	12.31	0.35	< 0.001
Number of siblings						
None	ref			ref		
1	0.96	1.15	0.408	0.53	1.17	0.650
2	-1.02	1.27	0.422	-1.90	1.29	0.144
3	-5.56	1.38	< 0.001	-7.46	1.40	< 0.001
4+	-18.53	1.45	< 0.001	-21.83	1.47	< 0.001
Child's gender						
Girl	ref			ref		
Boy	-29.43	0.54	< 0.001	-29.42	0.55	< 0.001
Child's age	1.81	0.08	< 0.001	1.77	0.08	< 0.001
Child's birth order						
First born	ref			ref		
Later born	-11.02	0.61	< 0.001	-13.81	0.62	< 0.001
Family structure						
Single-parent family	ref			ref		
Nuclear family	11.34	0.77	< 0.001	6.93	0.80	< 0.001
Mixed family	-3.99	1.21	0.001	-7.72	1.23	< 0.001
Other	-24.97	1.90	< 0.001	-29.00	1.92	< 0.001
Language spoken at home						
Otherwise	ref			ref		
Speak test language at home	36.60	0.97	< 0.001	39.90	0.97	< 0.001
Parental involvement	9.42	0.17	< 0.001	10.52	0.17	< 0.001
R2		0.18			0.16	

(Table 3 continue)

	Cultural possession Model 3			Parental occupation Model 4		
	β	SE	p	β	SE	p
Family resource variable	20.70	0.29	< 0.001	1.59	0.02	< 0.001
Number of siblings						
None	ref			ref		
1	2.49	1.15	0.032	1.14	1.13	0.315
2	-0.13	1.27	0.918	-0.10	1.25	0.938
3	-5.97	1.38	< 0.001	-3.79	1.36	0.006
4+	-21.64	1.45	< 0.001	-16.07	1.43	< 0.001
Child's gender						
Girl	ref			ref		
Boy	-24.98	0.54	< 0.001	-29.44	0.53	< 0.001
Child's age	1.68	0.08	< 0.001	1.76	0.08	< 0.001
Child's birth order						
First born	ref			ref		
Later born	-14.95	0.61	< 0.001	-12.07	0.60	< 0.001
(Table 3 continued)						
Family structure						
Single-parent family	ref			ref		
Nuclear family	11.10	0.77	< 0.001	10.19	0.76	< 0.001
Mixed family	-2.25	1.21	0.062	-3.33	1.19	0.005
Other	-24.94	1.90	< 0.001	-24.96	1.87	< 0.001
Language spoken at home						
Otherwise	ref			ref		
Speak test language at home	38.43	0.96	< 0.001	35.64	0.95	< 0.001
Parental involvement	7.17	0.18	< 0.001	8.64	0.17	< 0.001
R^2		0.19			0.22	

siblings than in children with no siblings. Thus, the findings support the third hypothesis.

Our fourth hypothesis predicts that parental cultural possessions should not compensate for the negative impact of large sibship size. Thus, next we analyzed the interaction between cultural possessions and sibship size. Results presented in Table 4 shows that there are no significant interactions. Thus, these findings provide support for the fourth hypothesis.

Finally, we ran sensitivity analyses, and we controlled for parental education while studying associations between family resource factors (i.e., parental occupation, family

wealth and cultural possession), number of siblings and educational test score in children. The results are presented in Models 3, 5 and 7 in Table 4. However, based on these findings controlling for parental education does not change the results.

Conclusions

In this study, we have investigated the associations among sibship size, parental resources and academic achievements in 15-year-old adolescents in 20 Western countries. First, we found that when family resources increase, children's test scores also increase. Second, when the number of siblings increases, educational achievements decrease. These results are consistent with the prediction that is based on the dilution model, the sibling competition hypothesis, the confluence model and several previous empirical analyses.

Table 4. Associations between family resource variables and children's educational attainment by sibship size (country fixed effects) (n = 109,843)

	Parental education		
	Model 1		
	β	SE	p
Family resource variable	13.28	0.78	< 0.001
Number of siblings			
None	ref		
1	-7.06	4.10	0.085
2	-16.82	4.41	< 0.001
3	-23.14	4.86	< 0.001
4+	-27.29	4.89	< 0.001
Parental resource variable × number of siblings			
Parental resource × 0	ref		
Parental resource × 1	1.65	0.82	0.043
Parental resource × 2	3.23	0.87	< 0.001
Parental resource × 3	3.61	0.96	< 0.001
Parental resource × 4+	1.78	0.97	0.066
R^2		0.19	

(Table 4 continue)

	Family wealth					
	Model 2			Model 3		
	β	SE	p	β	SE	p
Family resource variable	9.16	1.28	< 0.001	4.50	1.27	< 0.001
Number of siblings						
None	ref			ref		
1	0.58	1.18	0.626	0.42	1.16	0.718
2	-2.03	1.29	0.119	-1.73	1.27	0.177
3	-7.94	1.44	< 0.001	-6.33	1.41	< 0.001
4+	-22.12	1.48	< 0.001	-18.54	1.46	< 0.001
Parental resource variable × Table 4						
number of siblings						
Parental resource × 0	ref			ref		
Parental resource × 1	2.60	1.37	0.059	2.54	1.35	0.062
Parental resource × 2	3.31	1.40	0.019	3.22	1.38	0.020
Parental resource × 3	4.77	1.57	0.003	4.57	1.54	0.004
Parental resource × 4+	4.50	1.59	0.005	3.86	1.56	0.014
R2		0.16			0.19	

	Cultural possession					
	Model 4			Model 5		
	β	SE	p	β	SE	p
Family resource variable	20.32	1.04	< 0.001	16.65	1.03	< 0.001
Number of siblings						
None	ref			ref		
1	2.49	1.16	0.033	1.86	1.14	0.106
2	-0.08	1.28	0.949	-0.28	1.26	0.825
3	-5.89	1.39	< 0.001	-4.86	1.38	< 0.001
4+	-21.65	1.45	< 0.001	-18.58	1.43	< 0.001
Parental resource variable ×						
number of siblings						
Parental resource × 0	ref			ref		
Parental resource × 1	0.02	1.11	0.987	-0.08	1.10	0.941
Parental resource × 2	0.85	1.15	0.457	0.88	1.13	0.440
Parental resource × 3	0.94	1.30	0.474	0.76	1.29	0.556
Parental resource × 4+	0.13	1.29	0.923	0.04	1.28	0.973
R2		0.19			0.21	

	Parental occupation					
	Model 6			Model 7		
	β	SE	p	β	SE	p
Family resource variable	1.40	0.06	< 0.001	1.14	0.06	< 0.001
Number of siblings						
None	ref			ref		
1	-5.81	3.51	0.098	-6.59	3.49	0.060
2	-12.73	3.61	< 0.001	-13.56	3.59	< 0.001
3	-15.89	3.93	< 0.001	-16.19	3.91	< 0.001
4+	-28.97	4.29	< 0.001	-27.75	4.27	< 0.001
Parental resource variable × number of siblings						
Parental resource × 0	ref			ref		
Parental resource × 1	0.14	0.07	0.036	0.15	0.07	0.023
Parental resource × 2	0.25	0.07	< 0.001	0.26	0.07	< 0.001
Parental resource × 3	0.24	0.07	0.001	0.25	0.07	< 0.001
Parental resource × 4+	0.26	0.08	0.001	0.26	0.08	0.002
R2		0.22			0.23	

Models 2, 4 and 6 control for child's gender, age, birth order, family structure and language spoken at home. In models 3, 5 and 7 also parental education is controlled for.

The main objective of the present study was to analyze whether parental resources are associated with adolescents' educational achievements more strongly in larger families than in smaller families. Further, we were interested whether there are differences among distinct parental resources considering the compensation of the negative effect of large sibship size. We found that better family wealth, an increased level of parental education and higher parental occupational status were associated with increased educational attainments more strongly in children who have siblings than in children without siblings. These results provide support for the predictions derived from the compensation model. In addition, we found that parental cultural possessions does not compensate for the negative impact of large sibship size.

Similarly, using data from the US, Downey (1995) found that some parental resource types increased children's school grades more in larger families than in smaller families, whereas other resources did not. In addition, consistent with our results, Downey found that cultural classes and activities were not associated with school grades more strongly in larger families than in smaller families. It seems that the amount of cultural resources may matter less for the compensation of sibship size than parental socioeconomic resources. We argue that this decreased importance is because of the scalability of

cultural resources. Several children may benefit from parental cultural possessions, e.g., children can read the same books, whereas socioeconomic resources are more difficult to "re-use" (see also Jaeger, 2009 for discussion). If parents use 5,000 euro for the educational costs of one child, the same money cannot be used again for the educational costs of another child. Moreover, the positive influences of high parental education tend to be strongly related to parental involvement, i.e., parental opportunities to give time to children. Since the time is always finite, when the number of children increases the likelihood to give time to any particular child decrease. Moreover, parental education can be a proxy for parental income and also in this case it should play a role regarding to compensation. Overall, we believe that the inability to re-use resources is the main reason why resource compensation exists in the case of parental socioeconomic resources but not in the case of cultural possessions.

It is not totally clear why we found support for the compensation effect also in the case of parental occupation. If one predicts that occupational level indicates parents' social status, there should be no compensation effect, since social status does not dilute rapidly and thus high parental occupational status should benefit several children (as was the case with cultural resources). In contrast, if parental occupational status is a proxy for parental income it should play a role regarding compensation. Thus, based on the present results it seems that parental occupation indicates rather parental income than social status. Unfortunately, PISA data does not include direct information on parental income and thus we call for future studies to respond this question.

The results fit well with the findings of previous studies on the compensation model (Bernardi & Boado, 2014; Bernardi & Grätz, 2015; Grätz, 2015). These studies have shown the importance of compensation for the better-off parents to overcome the potential disadvantages of their children in attainment. This importance also appears to be the case here because having more siblings is a relative disadvantage, and parents may also be at least partially aware of this. The finding also explains why and how advantages accumulate and multiply even more in well-off families (c.f., DiPrete & Eirich 2006). Having sufficient family resources gives both parents and children more possibilities to use them; it may be sufficient to address the problem of dilution just by exhausting these resources more efficiently than is necessary in the well-off families with fewer children. The intergenerational effects that are observed as multiplication (rather than just accumulation) at the top end of stratification may thus occur just

because of the variation in the efficiency of utilizing family resources, not because these resources would have stronger multiplicative qualities.

Compared with previous research, our study has several strengths. Because we have used cross-national data, our results tend to be more generalizable than the results of studies that use data from single countries only (see Henrich et al. 2010 for discussion). In addition, we were able to study several parental resource variables and control for several potential confounding variables that have been shown to influence academic achievements in previous studies. Our study also has some limitations. First, here, we have used a snapshot rather than longitudinal data. We call for further research that analyzes whether parental resources matter more in larger families than in smaller families by using longitudinal data from several countries. Second, we have measured child outcomes by the reading literature index, but in the future, other educational outcome variables should be explored. For example, there is room for studies that investigate whether children with more rather than fewer siblings benefit more from parental resources concerning access to a university-level education. Finally, here, we have analyzed adolescents' educational scores, but it is important to study whether some parental resources matter more for younger children than for older children.

To conclude, the present study lends support to the previous results that show that when the number of siblings increases, the educational achievements tend to decrease. Moreover, in accordance with several previous studies, we have shown that parental resources are associated with improved educational achievements in children. Most importantly, however, the present study showed that consistent with the prediction based on the compensation model, the effect of parental socioeconomic resources tend to vary by the number of siblings. Thus, we hope that the present findings stimulate studies to explore social mobility by considering the compensation perspective.

References

Andersen, Ida Gran and Jaeger, Mads Meier. 2015.Cultural capital in context: Heterogeneous returns to cultural capital across schooling environments. Social Science Research 50: 177–188.

Bernardi, Fabrizio and Cebolla-Boado, Hector. 2014. Previous school results and social background: Compensation and imperfect information in educational transitions. European Sociological Review, 30: 207–217.

Bernandi, Fabrizio and Grätz, Michael. 2015. Making Up for an Unlucky Month of Birth in School: Causal Evidence on the Compensatory Advantage of Family Background in England. Sociological Science 2: 235–251.

Blake, Judith. 1989. Family Size and Achievement. Los Angeles: University of California Press.

Bourdieu, Pierre 1977. Reproduction in Education, Society, and Culture. Sage, Beverly Hills.

Bourdieu, Pierre 1984. Distinction. A Social Critique of the Judgement of Taste. Harvard University Press, Cambridge, Mass.

Bourdieu, Pierre 1986. The forms of capital. In: Richardson, J.G. (Eds.), Handbook of Theory and Research in the Sociology of Education. Greenwood Press, New York, pp. 241–258.

Bukodi, Erzsebet and Goldthorpe, John. 2013. Decomposing "social origins": the effects of parents' class, status, and education on the educational attainment of their children. European Sociological Review 29: 1024–1039.

Bäckman, Olof and Nilsson, Anders. 2011. Pathways to Social Exclusion –A Life-Cource Study. European Sociological Review 27: 107–123.

Card, D. 1999. The causal effect of education on earnings. In O. Ashenfelter & D. Card (Eds.), Handbook of labor economics (Vol. 3, pp. 1801–1863). Amsterdam, the Netherlands: Elsevier.

Danielsbacka, Mirkka and Tanskanen, Antti. 2015. The Association between Unequal Parental Treatment and the Sibling Relationship in Finland: The Difference between Full and Half-Siblings. Evolutionary Psychology 13: 492–510.

Davis-Kean, Pamela. 2005. The Influence of Parent Education and Family Income on Child Achievement: The Indirect Role of Parental Expectations and the Home Environment. Journal of Family Psychology 19: 294–304.

DiMaggio, Paul. 1982. Cultural capital and school success: the impact of status culture participation on the grade of U.S. high school students. American Sociological Review 47: 189–201.

DiPrete, Thomas A. and Eirich, Gregory M. 2006. Cumulative Advantage as a Mechanism for Inequality: A Review of Theoretical and Empirical Developments. Annual Review of Sociology 32: 271–297

Downey, Douglas. 1995. When Bigger is not Better: Family size, parental resources, and children's educational performance. American Sociological Review 60: 746–761.

Dumais, Susan. 2002. Cultural capital, gender, and school success: The role of habitus. Sociology of Education 75: 44–68.

Entwisle, Doris R., Alexander, Karl L. 1995. A parent's economic shadow: family structure versus family resources as influences on early school achievement. Journal of Marriage and the Family 57: 399–409.

Evans, M.D.R., Kelley, J., Sikora,, J. & Treiman, D.J. 2010. Family scholarly culture and educational success: Books and schooling in 27 nations. Research in Social Stratification and Mobility, 28, 171–197.

Evans, Mariah, Kelley, Jonathan and Wanner, Richard. 2001. Educational Attainment of the Children of Divorce: Australia, 1940–90. Journal of Sociology 37: 275–297.

Erola, Jani, Jalonen, Sanni and Lehti, Hannu. 2015. Fathers first, Mothers More? The Intergenerational influence of parental socioeconomic status during children's early life course. Research in Social Stratification and Mobility, 44: 33–43.

Ganzeboom, H.B.G., de Graaf, P.M. and Treiman, D.J. 1992. A standard international socioeconomic index of occupational status. Social Science Research 21: 1-56.

Grätz, Michael. 2015. When Growing Up Without a Parent Does Not Hurt: Parental Separation and the Compensatory Effect of Social Origin. European Sociological Review (Advance Access).

Heckman, J. J. 2006. Skill formation and the economics of investing in disadvantaged children. Science, 312, 900–1902.

Henrich, Joseph, Heine, Steven, and Norenzayan, Ara. 2010.The weirdest people in the world?. Behavioral and Brain Sciences 33: 61–83.

Jaeger, Mads Meier. 2008. Do Large Sibships Really Lead to Lower Educational Attainment? New Evidence from Quasi-Experimental Variation in Couples' Reproductive Capacity. Acta Sociologica 51: 217–235.

Jaeger, Mads Meier. 2009. Sibship Size and Educational Attainment. A joint test of the Confluence Model and the Resource Dilution Hypothesis. Research in Social Stratification and Mobility 27: 1–12.

Jeynes, W. H. 2007. The Relationship Between Parental Involvement and Urban Secondary School Student Academic Achievement: A Meta-analysis. Urban Education, 42, 82–110.

Kreidl, Martin and Hubatkova, Barbora. 2014. Does coresidence with grandparents reduce the negative association between sibship size and reading test scores? Research in Social Stratification and Mobility 38: 1–17.

Lawson, David, Makoli, Arijeta and Goodman, Anna. 2013.Sibling Configuration Predicts Individual and Descendant Socioeconomic Success in a Modern Post-Industrial Society. PLoS ONE 8: e73698. doi:10.1371/journal.pone.0073698.

Li, Hongbin, Zhang, Junsen and Zhu, Yi. 2007. The Quantity–Quality tradeoff of Children in a Developing Country: Identification Using Chinese Twins. IZA Discussion Paper No. 3012.

McNeal, Ralph B., 1999. Parental involvement as social capital: differential effectiveness on science achievement, truancy, and dropping out. Social Forces 78: 117–144.

OECD. 1999. Classifying Educational Programmes Manual for ISCED-97 Implementation in OECD Countries. Paris: OECD.

OECD. 2000. PISA 2000 Technical Report. Paris: OECD.

OECD. 2001. Knowledge and Skills for Life: First Results from PISA 2000. Paris: OECD.

Park, Hyunjoon. 2008. The varied educational effects of parent-child communication: a comparative study of fourteen countries. Comparative Education Review 52: 219–243.

Post, D., Pong, S. 1998. The waning effect of sibship composition on school attainment in Hong Kong. Comparative Education Review 42: 99–117.

Salmon, Catharine, and Hehman, J. A. 2014. The evolutionary psychology of sibling conflict and siblicide. In T. K. Shackelford and R. D. Hansen (Eds.), The evolution of violence, (pp. 137–157). New York: Springer.

Sieben, Iinge, Huinink, Johannes and de Graaf, Paul. 2001. Family Background and Sibling Resemblance in Educational Attainment. Trends in the Former FRG, the Former GDR, and the Netherlands. European Sociological Review 17: 401–430.

Useem, Elisabeth. 1992. Middle schools and math groups: Parent's involvement in children's placement. Sociology of Education 65: 263–279.

Warm, T.A. 1985. Weighted maximum likelihood estimation of ability in Item Response Theory with tests of finite length. (Technical Report CGI-TR-85-08). Oklahoma City: U.S. Coast Guard Institute.

Xu, J. and Hampden-Thompson, G. 2012. Cultural reproduction, cultural mobility, cultural resources, or trivial effect? A comparative approach to cultural capital and educational performance. Comparative Education Review 56: 98–124.

Zajonc, Robert and Markus, Gregory. 1975. Birth order and intellectual development. Psychological Review 82: 74–88.