Public Policy and the Effect of Sibship Size on Educational Achievement: A Comparative Study of 20 Countries

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ABSTRACT

Using the international data of educational achievement among 15-year-olds in 20 OECD countries, I compare the effect of sibship size on reading literacy and link the cross-national variation in the sibship-size effect to differences in national contexts of public policies for families and children. Drawing from the resource dilution model, I develop a hypothesis delineating the processes through which public policies buffer the dilution of parental resources that positively influence educational success. Findings indicate that public policies mediate the relationship between number of siblings and educational achievement, resulting in less negative consequences of growing up in large families in countries with strong public policies than in countries with weak policies. In countries classified as the social democratic regime according to Esping-Andersen's (1990) typology, sibship size has a less detrimental effect on educational achievement than in other countries, especially southern European countries.

BACKGROUND

An inverse relationship between sibship size and educational outcomes has been one of the most robust patterns consistently found in literature of family and education (Powell, Werum, and Steelman 2004). Although a competing perspective argues that the negative relationship between the number of siblings and education may be spurious due to unobserved factors (Guo and VanWey 1999), the detrimental effect of increasing additional siblings has been observed across different measures of educational outcomes and in as many different contexts as the U.S. (Blake 1981, 1989; Downey 1995), Asia (Knodel and Wongsith 1991; Anh et al. 1998; Post and Pong 1998) and some countries in Africa (Lloyd and Gage-Brandon 1993).

However, evidence also indicates significant variation in the magnitude of the negative effect of sibship size across societies. In some developing countries, for instance, bigger sibship size is not necessarily associated with lower educational performance (e.g., see Buchmann 2000 for Kenya and Desai 1995 for other African countries). Some studies have shown that the extent to which additional siblings negatively affect educational outcomes may differ even among subgroups with different family arrangements within a society (e.g., Shavit and Pierce 1991). To explain the null or even positive effects of sibship size on educational outcomes, researchers have highlighted the role that the extended kinship structure plays in supporting the nuclear family. In societies where profamily norms prevail, other relatives and neighbors often provide substantial supports to parents with many children. Therefore, additional children do not necessary mean substantial reduction in resources available for a child, which may explain in part why the

inverse relationship between sibship size and educational outcomes is not apparent in those societies (Downey 2001).

Although these studies conducted outside of the United States have suggested significant impacts of family arrangements on the relationship between sibship size and children's education, they are usually based on the analysis of a single country or at most a few countries. It is difficult to draw firm conclusions on the cause of the variation in the effect of sibship size from a case study or a comparison of a few countries. For instance, we are not sure to what extent the less apparent inverse relationship between the number of siblings and educational outcomes observed in a particular country with strong family network is consistently found in other countries with similar family arrangements.

Another important limitation of previous literature that examines the effect of sibship size in contexts other than the United States is its exclusive focus on developing countries where extended kin structure still prevails (see Lloyd 1993). The attention to developing countries has enabled researchers to address the role of family arrangements in mediating the relationship between the number of siblings and children's educational outcomes. However, the question concerning how public policies, which has been considered as another potential factor mediating the effect of sibship size, shape the relationship between sibship size and educational outcomes has not been appropriately posed through previous studies of developing countries given the lack of welfare provisions in less industrialized societies along with lower levels of economic development.

Desai's (1995) study, which is one of a few studies that examine national conditions that may influence the relationship between sibship size and children's well-

being across a large number of societies, indeed addresses how public policies shape the effect of sibship size on children's outcomes by looking at the impact of government agricultural assistance. However, all the 15 countries included in the study are those located at the low to moderate end in terms of economic development. It is apparent that the meaning of public policies in this context of less industrialized countries is substantially different from it in industrialized societies.

Many researchers have pointed out the possibility that the extent of state's support and sponsorship of children's education and other institutions related with childbearing and rearing children affect the relationship between sibship size and children's educational success (Downey 2001; Steelman, Powell, Werum, and Carter 2002; Wolter 2003). In societies where the state takes a major role in providing financial support for children's education and in supporting larger families through distributional policies that particularly target large families (such as child and family allowances, parental leave, or public provision of child care), financial and other material burdens of larger families for their children' education will be substantially lower than in other societies with much less governmental supports.

Despite a wealth of studies conducted within a country, especially United States, however, surprisingly there is little research that actually compares the effect of sibship size on educational outcomes across many industrial countries with different degrees of public policies for large families. Although a small number of comparative studies are available regarding the relationship between sibship size and individual outcomes (especially wages and educational attainment), most of them compared one industrial country to another or two other industrial countries without explicitly addressing the

linkage between cross-national differences in public policy contexts and the variations in

the sibship-size effect (e.g., Björklund and Jäntti 1998; Powell and Parcel 1999; Grawe

2003). Only recently, a study examined the effect of number of siblings on educational

achievement in six countries – Belgium, Canada, Finland, France, Germany, and

Switzerland (Wolter 2003), but neither had it investigated systematically the relevance of

public policy contexts for explaining the variation in the relationship between sibship size

and education. In order to extend our understanding of the ways in which public policies

mediate the relationship between number of siblings and children's educational outcomes,

therefore more research is needed to compare various industrial countries where public

policy is an essential part of state's roles in different degrees.

THE RESOURCE DILUTION MODEL AND CROSS-NATIONAL VARIATIONS
IN THE EFFECT OF SIBSIZE

As an effort to explain the negative effect of sibship size on educational success,

the resource dilution model posits that parental resources assumed to matter for children's

educational success are finite and thus additional siblings reduce the share of parental

resources by an individual child (Downey 2001; Blake 1981, 1989). The dilution model

suggests that the relationship between size and educational performance can vary across

societies if parental resources are diluted in different degrees across societies as sibship

size increases. As extended kin structure enables the dilution of parental resources to

occur less substantially by drawing economic resources from other relatives, significant

welfare provisions to large families may reduce the extent to which parental resources are

diluted as sibship size increases. This reasoning implies that the negative consequence of

additional siblings for a child's educational achievement should be attenuated in countries that have strong public supports for children's education and help economic conditions of large families through various policy programs.

Specifically, public policy may work to prevent the significant dilution of parental resources along with the increase of sibship size among large families in two different ways. First, public policies that particularly target large families such as child and family allowances, tax benefits or other benefit entitlements are expected to help increase a large family's disposable income. In other words, large families in countries with strong public policies have more favorable economic conditions relative to their counterparts in countries with weak policies. Therefore, even if parental resources are diluted in similar degrees, bigger pies among large families in countries with strong policies than among their counterparts in countries with weak policies may enable students from large families in the former to less suffer from the dilution of parental resources than students from large families in the latter.

Second, public policies attenuate the dilution of parental resources not only by increasing the overall levels of family socioeconomic conditions but also by making economic resources less sensitive to changes in sinship size even at comparable levels of family socioeconomic conditions. For example, studies in the United States have shown that children with few siblings receive more financial support for college from parents or they have more money saved by parents for their educational future than children with more siblings even when family socioeconomic status is controlled for (Steelman and Powell 1989; Downey 1995). Moreover, the dilution in the two economic resources

available to a child along with the increase in sibship size has been found to mediate the relationship between sibship size and educational outcomes.

However, these economic resources should not matter as in contexts where college education is free with the state's financial supports and thus neither the dilution processes should occur as sibship size increases. Similarly, if the state provides free child care, large families can use corresponding money to invest on their children's education so that every child in a large family can get benefits. Large families in countries where child care is expensive, in contrast, have relatively small investment on children's other educational activities and the dilution along with the increase in sibship size should be more substantial. In short, given family economic conditions, large families in countries where children's education and child care are strongly supported by state face a budget constraint in much lesser extent than their counterparts in countries where families should take financial responsibility.

RESAERCH QUESTIONS

In this study, I compare the effect of sibship size on educational achievement among 20 industrial countries. Although as OECD (Organization for Economic Cooperation and Development) countries all the 20 nations included in this study are more or less industrial countries, they show significant differences in the degrees of overall welfare provisions and particularly of state involvement in supplementing children's education and in providing economic supports for large families. The large number of countries compared and the substantial variation among them in public policy enable this study to examine the impacts of public policy on the relationship between

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sibship size and educational success much effectively than did previous research with only a few countries included. Moreover, the focus on industrial countries with relatively similar economic levels provides an excellent context in which the impact of public policy on the relationship between sibship size and education can be tested within a more or less similar economic condition.

Specifically, I address two research questions guided by the resource dilution model: (1) To what extent do countries differ in the effect of sibship size on educational achievement? (2) Is the cross-national variation in the relationship between sibsip size and educational achievement systematically linked to differences across countries in public policy contexts? In other words, is the negative consequence of growing up in large families attenuated in countries with strong public policies?

DATA

Data

For this comparative study, I use data from the Program for International Student Assessment (PISA). PISA was initially conducted in 2000 in 32 countries – 28 OECD countries and four non-OECD countries, resulting in a total sample of 265,000 students. The primary focus of the first round PISA was to assess reading literacy of young people at age 15, although mathematical literacy and scientific literacy were also tested (OECD 2001). The target population in PISA is defined as 15-year-olds enrolled in schools regardless of the grade level, the type of institution (i.e., vocational or academic schools) in which they were enrolled, or whether they were full-time or part-time students. The two-stage stratified sampling design was used to select PISA samples. At the first stage,

individual schools in which 15-year-old students were enrolled were selected

systematically with probabilities proportionate to size, the size being a function of the

estimated number of eligible (15-year-old) students enrolled. At the next step, students

within sampled schools were selected with equal probability from a list of 15-year-old

students in each selected school. PISA achieved overall high quality of the coverage of

the national desired target population.[1]

In addition to literacy assessment, PISA asked students a series of questions to

collect information on student's individual characteristics and family's socioeconomic

and cultural environments. A major advantage of PISA over previous international

surveys of student achievement is its collection of detailed information on various aspects

of family background including parental occupation and education, father's and mother's

working status, and family structure.[2]

Selection of Countries

From PISA, I select 20 Western industrial countries that can be grouped into four

different categories by the Esping-Andersen's (1990, 1999) typology of welfare states:

social democratic, liberal, Continental conservative, and Southern European countries.

This framework for classifying welfare states emphasizes contrasts in the level and the

pattern of public welfare provisions across countries. In particular, de-familiarization,

which indicates the extent to which the state takes a responsibility for family welfare

(Esping-Andersen 1999), is an important indicator for the Esping-Andersen's

classification of welfare states. Therefore, the framework is useful for the purpose of the

current study that examines the role public policies play in shaping the consequence of growing up in large families.

Originally Esping-Andersen (1990) proposed three different regimes of welfare state. In *social democratic* countries, strong public policies for welfare provision exist on the basis of principles of universalism. In PISA, there are four countries belonging to this category: Denmark, Finland, Norway, and Sweden. In countries of the *liberal* regime, state's welfare provision is minimized, favoring market economy. I include six countries representing the liberal regime: Australia, Canada, Ireland, New Zeeland, the U.K. and the U.S. The *conservative* regime is characterized by relatively strong state's intervention on welfare provision similarly to the social democratic regime. However, the primary purpose of the intervention is to maintain social status differences rather than to eliminate them. Still, the male bread-winner model of social protection prevails and thus the family is considered as the most important agency for the well-being of members. The state will intervene only when the family is not able to function properly.

Since Esping-Adnersen's original framework, researchers have suggested further distinction within the conservative regime into *Continental conservative* and *Southern European* countries, particularly given the substantial difference in the overall levels of governmental provisions of welfare between the two groups of countries (Hampden-Thompson and Pong 2003). Southern European conservative countries have comparatively lower levels of public welfare provision with a stronger emphasis on family for welfare assistance. I include six Continental conservative countries: Austria, Belgium, France, Germany, Luxembourg, and Switzerland. Four countries – Greece, Italy,

Portugal, and Spain – are included in the current study as representing the Southern European regime.

Although PISA includes other developing countries as well, limiting focus on Western industrial countries has some advantages. First, these countries share similar Western cultural tradition, which provides a useful context to examine the impact of public policy with cultural influence controlled (Pong et al. 2003). Second, by selecting advanced industrial countries that display almost universal enrollment in secondary education, I can avoid biases associated with selective population enrolled in secondary education in developing countries where less than half or at most half of school-aged population go to secondary schools. As described earlier, one important feature of PISA is that its sample consists of those aged 15 who were in schools at the time of survey. Therefore, the results can be biased for developing countries with substantially high levels of school dropout before the age of 15.

METHODS

Measures

<u>Reading literacy</u>

The main outcome variable in this study is students' performance on reading literacy. *Reading literacy* is defined in PISA as "the ability to understand, use, and reflect on written texts in order to achieve one' goals, to develop one's knowledge and potential, and to participate effectively in society (OECD 2001: 21)." As indicated by the definition, reading literacy measured in PISA is a broader concept than simply 'decoding written material and literal comprehension' (OECD 2003: 25). Reading literacy was measured in

a single composite scale that has an average score of 500 and a standard deviation of 100 across all students of the OECD countries in PISA. Instead of a fixed value for the reading literacy scale, PISA provides five plausible values for each student, which should be used simultaneously to obtain the estimates of population parameters.

Sibship Size

In this study, sibship size is defined as the total number of brothers and sisters that the respondent reported to have. PISA does not specify whether brothers and sisters are natural-, step-, or adoptive siblings. Neither is clear whether those siblings currently live together with the respondent. A linear form of number of siblings is used in the analysis. I also estimated the models with dummy variables for 0, 1, 2, 3, 4, and 5+ siblings. For some countries, students with one sibling did not show lower achievement than students with no siblings or even the former outperformed the latter. However, the linear presentation of number of siblings with 0 and 1 sibling combined produced very similar results as the linear form of number of siblings separating 0 and 1 sibling.

Family Socioeconomic Status

Four variables are used to indicate family socioeconomic status. *Parental education* is the higher level of educational attainment between the parents and it has four categories: primary or less (the reference category), lower secondary, upper secondary, and tertiary education. *Parental occupation* indicates parents' current or last main job and is measured by the International Socio-Economic Index of Occupational Status developed by Ganzeboom, de Graaf and Treiman (1992). The higher status occupation between

mother's and father's occupation is used. Finally, *mother's current working status* distinguishes students whose mothers are currently working (full-time or part-time) and those whose mothers are not working.

Individual Control Variables

Since the number of parents living with student is related to parental economic and social resources available to student, I control for family structure by distinguishing students who live with two-biological parents and those in other types of family structure. I also include gender as a control variable.

Public Policy Variables

Four country-level variables are used to indicate the extent to which countries provide public welfare supports for children's education and helps families with costs associated with raising children. Drawn from the data source of the World Development Indicator complied by the World Bank, public expenditure on education is the percentage of GDP accounted for by public spending on public education plus subsidies to private education at the primary, secondary, and tertiary levels (WDI 2003). I use the 10-year average of public expenditure on education from 1991 to 2000.

The second country-level policy variable is public expenditure on family as the percent age of GDP, which indicates public supports for families often related to the costs associated with raising children or with the support of other dependants. Specifically, public expenditure on family includes cash benefits given to families with children and other benefits in-kind. Cash benefits, in turn, include child or family allowances and other

cash benefits related to maternity and parental leave. The data come from the OECD

Social Expenditure Database (OECD 2004) that provides internationally comparable

statistics on public expenditure in each main social policy area such as family, health,

unemployment, and housing. I use the five-year average from the year of 1996 to 2000.

The third public policy variable is the level of non-mean-tested child benefits and

countries are scored 0 (low), 1 (medium) or 2 (high) depending on their levels of

provision (Bradshaw et al. 1996, Table 5.7).[3] Non-means-tested child benefits refer to

cash payments to families with children regardless of parental income (Kamerman and

Gatenio 2002). Some countries such as the United States supplement family disposable

income by providing tax allowances or tax benefits to families with children, although

they do not provide non-means-tested child benefits. Therefore, providing no or low

levels of non-means-tested child benefits does not necessary mean the overall low levels

of public supports for families with children. However, the existence of universal child

benefits regardless of parent's working status signals strong governmental involvement in

family welfares. In addition, family benefits through tax benefits are usually less

substantial for helping families with children because tax benefits are often limited to

working families and require a family to understand the tax system to apply for the

benefits (Kamerman and Gatenio 2002). Therefore, the level of non-means-tested child

benefits is an important indicator of governmental commitment to public supports for

families.

The final variable of public policy is the availability of public and

private/subsided childcare. Similar to the variable of the level of non-mean-tested child

benefits, countries are ranked into three categories: high, medium, and low. The data come from Bradshaw et al. (1996: Table 4.4).

Analytic Approach

The Impacts of Public Policy Variables

To take into account the data structure that students are nested within a country, I employ a two-level hierarchical linear model (HLM) technique with pooled data of 20 countries (Bryk and Raudenbush 1992). In student-level equation, the reading literacy score for student i in country j is predicted as follows;

$$(\text{Reading literacy})_{ij} = \beta_{0j} + \beta_{1j}(\textit{Sibship Size})_{ij} + \sum_{2}^{k} \beta_{kj} X_{kij} + r_{ij} \qquad (1)$$

where $\boldsymbol{\beta}_{0j}$ represents average reading literacy of country j adjusted for student background characteristics included in the model. $\boldsymbol{\beta}_{1j}$ is the slope of sibship size affecting student reading literacy in country j and $\mathbf{r}_{ij}$ is the student-specific error. The effects of other individual-level control variables including gender, family structure, and family socioeconomic status are represented through $\boldsymbol{\beta}_{2j}$ to $\boldsymbol{\beta}_{kj}$.

The country-level equations are

$$\boldsymbol{\beta}_{0j} = \boldsymbol{\gamma}_{00} + \boldsymbol{\gamma}_{01}(\text{Public Policy})_j + \boldsymbol{\gamma}_{02}(\text{National Average of Sibship Size})_j + \mathbf{u}_{0j} \qquad (2)$$

$$\boldsymbol{\beta}_{1j} = \boldsymbol{\gamma}_{10} + \boldsymbol{\gamma}_{11}(\text{Public Policy})_j + \boldsymbol{\gamma}_{12}(\text{National Average of Sibship Size})_j + \mathbf{u}_{1j} \qquad (3)$$

$$\boldsymbol{\beta}_{kj} = \boldsymbol{\gamma}_{k0} + \mathbf{u}_{kj} \qquad (4)$$

In HLM, the coefficients in the first-level equation serve as dependent variables in the second-level equation. In order to examine how public policy variables at the country level shape the relationship between sibship size and student reading performance, I

model the slope of sibship size (β_{1j}) to be predicted by each of the three country-level policy variables. Representing the impact of a public policy variable on the sibship size slope, γ_{11} indicates the extent to which public policy mediates the relationship between sibship size and reading literacy. Each country's mean achievement (β_{0j}) of reading literacy is also modeled to vary across countries as a function of each public polity variable.

I include another country-level variable of the national average of sibship size as a control in the country-level equation in order to better estimate the impacts of public policy variables. The average number of siblings in a country and its public policy are likely to be conversely related. In countries with less public supports for families, couples may not want to have many children given relatively high costs associated with raising children. On the other hand, generous provisions to families with children may encourage fertility. Since the 20 countries included in this study do not show significant variation in the average number of siblings the respondent has, controlling for the variable may not affect the results substantially. However, it is still useful to control for the average sibship size for better estimation of the public policy effects.

γ_{k0} represents the overall effect of the kth control variable at the student level and u_{kj} indicates a random effect associated each country. I center all individual-level and country-level variables around their corresponding grand means so that the intercept can be interpreted as the predicted reading literacy for a student who has characteristics equal to corresponding grand means in a country with the average levels of public policy and sibship size (Bryk and Raidnebush 1992).

Comparisons across Four Different Welfare Regimes

In addition to assessing the impact of each public policy variable, I conduct a complementary analysis that compares the effects of sibship size on reading literacy across the four different welfare regimes: social democratic, liberal, Continental conservative, and Southern European conservative regimes. Instead of examining the impact of a specific public policy variable, the analysis links variations in the effect of sibship size across the four groups of countries to differences in the overall level of public supports for families that each regime of countries has. The student-level equation for this analysis is the same as the equation (1) and the country-level equations are:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Liberal})_j + \gamma_{02}(\text{Continental Conservative})_j + \gamma_{03}(\text{Southern Europe})_j + u_{0j} \quad (5)$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{Liberal})_j + \gamma_{12}(\text{Continental Conservative})_j + \gamma_{13}(\text{Southern Europe})_j \quad (6)$$

$$\beta_{kj} = \gamma_{k0} + u_{kj} \quad (7)$$

where γ_{01} indicates the average reading score in the reference group of countries (social democratic countries) and γ_{01}- γ_{03} represent the differences in the average reading score between the group of social democratic countries and the corresponding groups of countries, respectively. γ_{10} represents the average slope of sibship size on student reading performance in countries of the social democratic regime and γ_{11}- γ_{13} indicate the differences in the strength of the sibship size effect between countries in the social democratic regime as a reference and countries in the liberal, Continental conservative, and Southern European regimes, respectively. Note that equation (6) has no random errors associated with each country. Because each dummy variable of the welfare regime

is assumed to contain all relevant but unspecified effects associated with each welfare regime, it is nature to assume that all the variations in the effect of sibship size are explained by the regime dummy variables. For comparison, I also estimated the model with random errors and the result was very similar to that from the model without random errors. As in the specification of the earlier analysis of public policy variables, the effects of other individual control variables are assumed to be random in equation (7).

RESULTS

Cross-National Differences in Public Policy Context

TABLE 1 ABOUT HERE

Table 1 presents statistics of the four public policy variables for each country and also averages for each welfare regime as a group. The average number of siblings the respondent has is also presented in the table. In most countries, the average number of siblings is 1.5 to 2.0. Students aged 15 in countries of the liberal regime, particularly in Ireland (2.59), New Zealand (2,23), and the United States (2.41) have relatively larger numbers of siblings, whereas those in countries of the Southern European regime have smaller numbers of siblings. Although the smaller number of siblings in the Southern European regime or in the Continental conservative regime than the number in the social democratic regime seems to be related to the overall weaker public policy in the former than in the latter, the larger number of siblings in the liberal regime with lower levels of public provision suggests that the relationship between the average number of siblings and strong public supports for families may not be necessary.

Turning to the four public policy variables, the high levels of public provisions for children's education and families in the social democratic regime countries are in sharp contrast to the low levels of public supports in countries of the Southern European regime. The social democratic countries, for instance, allocate the largest percentages of GPD to public spending on education (about 7 percent) and on family (about 3 percent) and all of them have high levels of not-means-tested child benefits and public-funded childcare. Contrastingly, the southern European regime countries spend the smallest percentages of GDP on education and family and they don't have universal child benefits at all. The public provision of childcare is minimal. The liberal regime and the Continental conservative regime countries show intermediate levels between the social democratic regime and the Southern European regime.

It is important to note that there are some variations in the level of welfare provision within each regime, particularly among the liberal regime countries. United States is outstanding with its low level of public expenditure on family services and also in that it does not provide any types (universal or income-related) of child benefits. In contrast, the United Kingdom has a number of family policies such as universal child benefits that are similar to those programs in social democratic countries. Similarly, within the Continental conservative regime, Austria and Luxembourg appears to be closer to social democratic countries with high levels of public supports for families, while Germany and Switzerland display relatively low levels of public provision.

The Impacts of Public Policy

TABLE 2 ABOUT HERE

Table 2 presents the results of two-level HLM models that predict student's reading literacy by sibship size and other individual-level variables at the student-level. At the country level, the models postulate the slope of sibship size as a function of a public policy variable. Each row shows the effect of a public policy variable on the slope of sibship size estimated separately for each public policy variable. Two results are presented before and after another country-level variable of the national average number of siblings is controlled for.

Although the effects are reduced after the national average sibship size is taken into account, all the four public policy variables are significantly associated with the slope of sibship size. Because the regression slope of sibship size at the student level has a negative sign, the positive coefficients of the public policy variables suggest that the effect of sibship size on student reading performance becomes less negative as the levels of public supports increase. For instance, the coefficient 1.28 of public expenditure on family indicates that one percent increase in public expenditure on family as percentage of GDP leads to a 1.28 increase in the negative effect of sibship size when the national average number of siblings is held constant. In short, the results suggest that the negative consequence of growing in large families for educational achievement is attenuated in contexts where there are strong public supports for children's education and family benefits.

Comparing the Effect of Sibship Size across the Four Welfare Regimes

TABLE 3 ABOUT HERE

The results of the HLM models of comparing the effect of sibship size across the four welfare regimes are presented in Table 3. The first model shows the differences in the slope of sibship size between the social democratic regime and each of the other three regimes only with gender and family structure controlled. The coefficient (-4.336) associated with a dummy variable of the liberal regime indicates that the coefficient of the sibship-size effect among the liberal regime is more negative by -4.336 than the coefficient among the social democratic regime (the reference category), which means that it should be -10.203 (-5.867-4.336). In other words, among the liberal regime countries an additional sibling is associated with 10-point decrease in reading literacy score. The corresponding decrease in reading literacy associated with an additional sibling is 13 points in the Continental conservative regime and 16 points in the southern European regime.

The second model includes at the student-level three additional variables of parental education, parental occupation and mother's working status to control for family socioeconomic status. Although the differences in the effect of sibship size between the social democratic regime and the other three regimes are substantially reduced with family socioeconomic status taken into account, the differences remain statistically significant. In Model 2, the effect of sibship size among the social democratic regime countries is -3.668 reduced from -5.867 in Model 1. Among the liberal regime countries, an additional sibling is associated with 6-point decrease in reading literacy (-3.668-2.413). The corresponding decreases in the Continental conservative regime and in the southern European regime are 7 points and 12 points, respectively. For illustration, Figure 1 presents decrease in reading literacy per one-sibling increase across the four welfare

regimes before and after variables of family socioeconomic status are controlled (i.e., Model 1 and Model 2).

FIGURE 1 ABOUT HERE

CONCLUSION

Recent international comparative studies have highlighted the roles that macro factors such as public policy contexts or institutional features of education and family systems play in shaping the influences of family background on educational outcomes. For example, some studies have compared educational gaps between children from single-parent and two-parent families across different countries and identified the systematic cross-national variation in the effect of single-parenthood linked to differences in family policies or family arrangement across countries (Park 2004; Hampden-Thompson and Pong 2004; Pong et al. 2003;). The current study extends this line of research by examining sibship size, which is another important factor of family background influencing children's education.

Although growing up in large families has a negative consequence for a child's education in many countries, the magnitude of the negative effect varies significantly across countries. The results of this study suggest that the cross-national variation in the effect of sibship size is in part explained by differences in national contexts of public policy for children's education and other family benefits. The negative relationship between sibship size and educational performance is much attenuated in countries with strong policies. Social democratic countries that have strong public supports for families

show less negative effects of sibship size on educational performance than do other countries, especially southern European countries with weak public policies.

International comparative data of student achievement like PISA used in this study allow researchers to compare the relationship between sibship size and educational performance across many countries with significant variations in various aspects of social contexts. However, cross-sectional features of large-scale international data should be taken into account as an important limitation to establish the casual relationship between sibship size and educational performance. As widely pointed out, both sibship size and children's educational success may be affected by parental characteristics of which only a part can be measured (Downey 2002). As various longitudinal data become available in several countries, it would interesting to examine the relationship between sibship size and children's education using longitudinal data in each country and to see if the results regarding cross-national differences are consistent with the results based on cross-sectional data.

Finally, in this study I did not consider other effects associated with sibling configuration such as birth order, sibling spacing, and sibling sex composition despite extensive literature on the issues (see Steelman et al. 2002). This is an important limitation of this study, which is partially due to relatively small number of samples in each country. Future comparative research should consider the effects of other factors associated with sibling configuration and how they interact with sibship size to influence children's educational success.

ENDNOTES

[1] For detailed information on PISA, see the report of the first results of PISA 2000 (OECD 2001). For sampling, survey procedures, and methods, in particular, see the technical report (OECD 2002).

[2] Buchmann (2002) provides a useful overview of family background variables that PISA and other international surveys of student achievement try to measure.

[3] The data source (Bradshaw et al. 1996) does not have information on Canada and Switzerland for this policy variable and another variable of the availability of public-funded childcare. The medium level (i.e., 1) was assigned to Canada and Switzerland for these two variables.

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Table 1. Public Policy Contexts across 20 Countries

	Average Number of Siblings[a]	Public Expenditure on Education as % of GDP[b]	Public Expenditure on Family as % of GDP[c]	Level of Not Means Tested Child Benefits[d]	Availability of Public and Private/Subsidised Chidcare[e]
Liberal Regime					
Australia	2.04	5.03	2.72	1	1
Canada	1.85	6.28	0.75	1	1
Ireland	2.59	4.90	1.76	1	0
New Zealand	2.23	6.68	2.41	0	0
UK	1.98	5.03	2.23	2	0
US	2.41	5.08	0.47	0	0
Average	**2.18**	**5.50**	**1.72**	**0.83**	**0.33**
Continental Conservative Regime					
Austria	1.56	5.64	2.93	2	1
Belgium	1.80	4.74	2.34	2	2
France	1.83	5.78	2.99	1	2
Germany	1.58	4.62	1.92	1	0
Luxembourg	1.64	3.54	3.08	2	1
Switzerland	1.65	5.58	1.24	1	1
Average	**1.68**	**4.98**	**2.42**	**1.50**	**1.17**
Southern European Regime					
Greece	1.48	3.01	1.88	0	0
Italy	1.32	4.47	0.88	0	0
Portugal	1.49	5.23	1.00	0	1
Spain	1.51	4.53	0.50	0	0
Average	**1.45**	**4.31**	**1.07**	**0.00**	**0.25**
Social Democratic Regime					
Denmark	1.92	7.88	3.77	2	2
Finland	1.98	6.76	3.42	2	2
Norway	2.05	7.56	3.39	2	2
Sweden	2.17	7.65	3.05	2	2
Average	**2.03**	**7.46**	**3.41**	**2.00**	**2.00**

a The author's own calculation using the PISA data

b Ten-year average from 1991 to 2000. The data come from World Development Indicator 2003.

c Five-year average from 1996 to 2000. The data come from OECD Social Expenditure Database (2004).

d Higher numbers indicate higher levels of not-means-tested child benefits. The data come from Bradshaw et al. (1996: Table 5.7)

e Higher numbers indicate higher levels of public and private/subsidized childcare provisions. The data come from Bradshaw et al. (1996: Table 4.4)

Table 2. Effects of Public Policy Variables on the Slope of Sibship Size

	Effects on the slope of sibship size *before* controlling for the national average sibship size	Effects on the slope of sibship size *after* controlling for the national average sibship size
Public Expenditure on Education	1.209 (0.447)*	0.835 (0.445)^
Public Expenditure on Family	1.957 (0.542)**	1.275 (0.626)*
Level of Not Means Tested Child Benefits	3.346 (0.494)***	3.084 (0.484)***
Public and Private/Subsidized Childcare	2.262 (0.605)**	1.828 (0.601)**

Note: Each row indicates the effect of a public policy variable derived from the two-level HLM model that includes gender, family structure, and three indicators of family socioeconomic status at the student-level equation.

*** $p < .001$ ** $p < .01$ * $p < .05$ ^ $p < .10$

Table 3. The HLM Analysis of Variation in the Effect of Sibship Size across the Four Welfare Regimes

	Model 1	Model 2
Student-Level Equation		
Number of Siblings	-5.867 (0.557)***	-3.668 (0.517)***
Gender (reference: Male)		
Female	33.320 (1.614)***	33.375 (1.583)***
Family Structure (reference: Others)		
Two Parents	22.049 (2.122)***	16.095 (1.512)***
Parental Education (reference: Primary or Less)		
Lower Secondary		20.202 (3.602)***
Upper Secondary		36.102 (4.561)***
Tertiary		38.054 (4.902)***
Parental Occupation (Index of Socioeconomic Status)		1.555 (0.071)***
Mother's Working Status (reference: Not Working)		
Working		3.069 (1.337)*
Intercept	513.997 (8.264)***	517.905 (6.278)***
Country-Level Equation		
Effect on Intercept (reference: Social Democratic countries)		
Liberal countries	12.517 (10.490)	4.868 (6.278)
Conservative countries	-19.894 (10.456)^	-17.317 (7.700)*
South-European countries	-34.347 (11.532)**	-51.100 (7.424)***
Effect on the Slope of the Number of Siblings (reference: Social Democratic countries)		
Liberal countries	-4.336 (0.675)***	-2.413 (0.633)***
Conservative countries	-6.741 (0.720)***	-3.149 (0.678)***
South-European countries	-9.959 (0.882)***	-7.894 (0.821)***

*** p <.001   ** p<.01   * p<.05   ^ p<.10

Figure 1. The Effects of Sibship Size on Reading Literacy in Each Welfare Regime

M1: Sibship Size, Gender, Family Structure □ M2: M 1 + Family Socioeconomic Status