

Single-parent family forms and children's educational performance in a comparative perspective: effects of school's share of single-parent families

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Living in a single-parent family is negatively related with children's educational performance compared to living with 2 biological parents. In this article, we aim to find out to what extent the context of the school's share of single-parent families affects this negative relationship. We use pooled data from the Organisation for Economic Co-operation and Development (OECD), that is, the Programme for International Student Assessment (PISA) 2000 and 2003, which contain information on 209,300 students at 11,887 schools in 25 countries. We found that attending a school with more children from single-parent families affects the educational performance of all children negatively, but it particularly harms children from single-mother families. Furthermore, we have indications that in countries in which the number of single-parent families is higher, the negative effect of attending a school with a higher share of single-parent families decreases, except for the US.

Keywords: single-parent family; educational performance; cross-national comparison; PISA data

Introduction

Families fulfill an important function in every society: Most of the children in developed countries grow up in a family, although the form of that family might change during the life course. Generally, a family provides a child with opportunities to develop into a stable and independent person, for instance, through enabling the child to attend school. The future success of children thus greatly depends on the household they grow up in. Nevertheless, a child is not in the position to choose its own family and has to accept if its family is not capable of offering him or her the best opportunities.

Family structures have changed enormously during the second half of the 20th century (Martin & Kats, 2003). The Second Demographic Transition that occurred from the 1960s until the late 1980s in developed countries, involving dropped-off fertility rates, decreased marriage rates, and increased divorce rates and risen numbers of births to unmarried women (Lesthaeghe, 1994; Sorrentino, 1990), contributed directly to a growth of the number of single-parent families. The traditional male breadwinner model, which refers to a married couple with one or more children, assuming that father works to make a living while mother stays at home to run the household and to take care of the children, is hence not that obvious anymore in developed countries (Lewis, 2001; McDonald, 1997). This implies that more and more children grow up in an unstable family nowadays.

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The growth in the number of single-parent families implies that many children are confronted with the negative effects of single-parenthood every year, such as economic deprivation, a decrease in the quality and quantity of parental contact, and a decline in parental support and effective control (Amato, 2000; Amato & Keith, 1991). Not only divorce itself and the period following it have negative consequences for children, but also already prior to the divorce such families are often characterized by a smaller amount of financial resources and more conflicts (Fischer, 2007). Obviously, this has a detrimental effect on children's well-being and development and, accordingly, on their performance at school.

Previous research has already shown that children's educational achievement is negatively affected by parental divorce (Dronkers, 1994, 1999; McLanahan & Sandefur, 1994). This comes down to the fact that the loss of one parent from the family, which can be interpreted as a decrease in the number of family's financial, cultural, and social resources, leads to a deterioration of children's educational achievement. It is also argued that there might be unobserved heterogeneity between parents who divorce and parents who do not divorce, which partly explains the negative effect on educational performance of the involved children. In other words: Parents who divorce would have specific characteristics that parents who do not divorce do not have, and that are bad for children's development. However, there is no empirical evidence of such a spurious effect of this heterogeneity (Frisco, Muller, & Frank, 2007).

Prior research on the consequences of divorce for children's educational performance is mainly restricted to the family context. In this article, however, we go beyond this perspective by focusing on the school context. More specifically, we study how the single-parent family composition of schools affects the educational performance of children from single-parent and two-parent families. A similar approach was applied by Pong (1997, 1998), indeed finding a negative contextual effect of schools with high numbers of students from disrupted families. However, this important result only holds true for the United States, and it is unclear whether it also applies to other countries. The growing numbers of children in single-parent families in many developed countries due to divorce might hence not only negatively affect the children involved in these divorces – which is very bad by itself – but also impact the broader (school) community, in this case their fellow students.

We hence investigate the effect of the share of single-parent families at school on children's educational performance within 25 Organisation for Economic Co-operation and Development (OECD) countries. This also allows us to make sure that this effect is not in fact a country effect, by controlling for the share of single-parent families within the country. This is important, as Pong, Dronkers, and Hampden-Thompson (2003) and Garib, Martin Garcia, and Dronkers (2007) have shown that the achievement gap between children from single- and two-parent families is greater in countries that are characterized by more single-parent families. Finally, the strength of the relationship between school's share of single-parent families and children's educational outcomes may vary across countries with different shares of single-parent families, which we are able to investigate. The two research questions that we address are the following:

- (1) To what extent does the school's composition of children from single-parent families affect children's educational performance and how can we explain this?
- (2) Does this relationship differ between children from single-parent and two-parent families, and between countries with a different share of single-parent families?

To answer these research questions, we pooled data from 25 industrialized countries on students' educational performance, as collected by the OECD, that is, the Programme for International Student Assessment (PISA) 2000 and 2003. PISA is a large-scale survey in which student's reading, mathematical and scientific literacy is being assessed, and many questions are asked on the student's family background (among other things). In addition, school characteristics have been gathered. PISA hence very well suits our research questions and allows using a multilevel research design discerning three levels, that is, the student, school, and country level. With respect to mathematical literacy, our analytical sample represents 209,300 individuals attending 11,887 different schools from 25 countries.

Theoretical framework and hypotheses

Family form and educational success

In order to adequately understand and examine the negative contextual effect of the number of children from single-parent families at school, we first briefly elaborate on the reason why children from single-parent families perform worse at school than children from two-parent families. McLanahan and Sandefur (1994) give an extensive description of the three types of resources (i.e., financial, parental, and social) that are important in explaining the impact of living with a single parent on children's chances of future success. First of all, they underline the importance of financial resources and the loss of income that generally goes together with family disruption. In short, this is due to the fact that after a divorce two households need to be supported instead of only one and thus a lot of household expenses cannot be shared any longer, which is also called a loss of economies of scale. The most direct effect of this loss of income on educational performance of children is the fact that the quality of the school they attend generally is lower. The higher the income of parents, the more possibilities they have to live in neighborhoods with good public schools or to send their children to a school of their preference. Income can also affect school outcomes through enabling a child to participate in extracurricular activities, like lessons after school, special trips, or summer camps. Such activities improve children's skills directly, but also indirectly via general intellectual stimulation, which affects subsequent learning.

In addition to a loss of financial resources, a loss of parental involvement is generally associated with a divorce or separation. Parental involvement is supposed to positively affect children's educational outcomes (Park, Byun, & Kim, 2011). It mainly comprehends the time parents spend with their children on reading, helping with their homework, or by listening to the stories about their experiences at school, as well as the ability and willingness of parents to monitor and supervise children's social activities outside school, which reduces their opportunities to get in trouble. In addition, it refers to activities in relation to schools such as volunteering at school events, attending a parent-teacher organization, or contacting teachers and school officials (Park et al., 2011). After a divorce or separation, the quality and quantity of parental involvement decreases. For instance, people are likely to experience high levels of stress and anxiety after the disruption. Also, single parents have to divide their time between work and home, and consequently can devote less time to their children compared to a situation in which two parents run a household. Moreover, they are not controlled and corrected in "parenting" by the other parent, which makes it less sure whether one is behaving in appropriate ways. Apart from the direct effect of the decreased quality and quantity of parental involvement on

children's school performance, simply because of the reduced educational support they receive, the divorce itself and the reduction of parental involvement afterwards will cause emotional and other related problems (e.g., problems of concentration) for the children involved and hence indirectly lead to worse school performance among children from single-parent families compared to children from two-parent families.

Finally, children from divorced or separated parents may experience a loss of social resources (McLanahan & Sandefur, 1994). After the divorce or separation, single parents may not find the time or energy to keep investing in personal relationships, because of stress or depression, and, consequently, lose friends without making new ones (immediately). Especially regarding former mutual friends, it may be difficult for both partners to maintain these relationships. Furthermore, it is likely that community ties weaken after a divorce or separation, due to a possible move to another neighborhood or town. This includes a reduction of social capital as emotional support and information about the broader community. Overall, the social network of divorced parents will thus decrease, which implies that, for instance, they have less information about which teachers are good and which are not, and they will be less familiar with extracurricular activities. This might negatively influence children's educational performance.

Single-parent family school composition effects and educational success

The rise in the number of single-parent families in the last decades of the 20th century implies that a growing number of children attend schools where a large part of students live in a single-parent family. In the literature, two explanations can be distinguished for the effect of school's single-parent family composition on children's educational performance: that is, the decline of the community network of the school and the lower amount of teaching and learning time at school and at home.

According to Pong (1997) and Sun (1999), parental influence on children extends beyond their own child and reaches the communities in which they live and the schools belonging to these communities. As previous research has shown, the type of student attending the school appears to be one of the most important factors influencing the effectiveness of the school (Pong, 1997, 1998). Schools with a large concentration of children from single-parent families are usually characterized by a lower socioeconomic status and by less social capital (i.e., indicated by parents' social relations and networks with other parents). Therefore, all children attending such schools will perform less well, compared to children at schools with a smaller concentration of single-parent families.

In addition to this community network explanation for the negative contextual effect of family disruption on children's educational performance, Dronkers (2010) emphasizes the more difficult teaching and learning conditions in schools with a high proportion of students from single-parent families. The effectiveness of education depends on the amount of time that is available for both teaching and learning, which can be greatly diminished in schools where children have problems inside or outside the home that interrupt the teaching and learning process. As previously described, children of divorced parents have on average more emotional and other problems related to their parents' divorce. If there are more students in a class with such problems, more learning and teaching time of the whole class might be used for non-academic goals. Garriga (2010) found that children from single-parent families are more often too late at school. A higher percentage of pupils from single-parent families in a school might thus lead to more pupils arriving too late at school and hence disturbing teaching and learning of the whole class. As a consequence, insufficient learning and teaching time needed to reach a certain

educational performance by all pupils might remain. Conversely, in student populations with none or few children from single-parent families, there might be less loss of teaching and learning time and thus a higher chance on sufficient time. In fact, the real learning and teaching time might differ in these two situations, despite identical class schedules, and thus educational performance will differ between both situations.

Both lines of arguments described above lead to the hypothesis that *children from schools with a large concentration of students from single-parent families perform less well than children from schools with a small concentration of students from single-parent families* (Hypothesis 1).

Although we expect a negative contextual impact of the number of children from single-parent families at school on all students attending that school, we do expect differences in the strength of this effect on children from single-parent families versus children from two-parent families. As we previously pointed out, students from single-parent families have fewer resources at home. Therefore, they are in general more vulnerable for a lack of education or deficits in schooling. There is an analogy with the effect of the summer holidays, in which mostly the educational performance of children with few parental resources fall back, while children with abundant parental resources can maintain the level of their educational performance during the summer holidays (Cooper, Nye, Charlton, Lindsay, & Greathouse, 1996; Entwisle, Alexander, & Olson, 1997). Accordingly, we expect that *the negative relationship between school's share of single-parent families and children's educational performance is larger for children from single-parent families than for children from two-parent families* (Hypothesis 2).

As briefly described above, Pong (1997) argues that the negative effect of the school's composition of children from single-parent families on educational performance can be (partly) explained by the fact that schools predominantly attended by students from single-parent families are, on average, likely to be characterized by a lower socioeconomic status. This is because single-parent families are usually poorer than two-parent families, but they also more often live in neighborhoods with a low socioeconomic status, where schools are poorly financed (in countries as the US) and have fewer physical resources for learning, such as computers, which negatively affects students' educational performance (Pong, 1997). Moreover, the socioeconomic composition of schools is an important determinant of educational achievement, as a new meta-analysis has concluded again (Van Ewijk & Slegers, 2010). According to this explanation, *the negative relationship between school's share of single-parent families and children's educational performance is due to the lower socioeconomic composition of schools with a large concentration of students from single-parent families* (Hypothesis 3).

In contrast to the decline of the school's community network explanation, the lower teaching and learning time explanation would assume that the socioeconomic composition of the school would hardly explain the effect of the single-parent families' share in schools. Irrespective of the socioeconomic composition of the school, it can be expected that teachers at a school with more children with emotional problems at home are likely to have lower expectations regarding the students (Scheerens & Bosker, 1997). These schools will also have more problems in hiring qualified teachers, even in countries with equal funding of schools. This leads to the hypothesis that *the negative relationship between school's share of single-parent families and children's educational performance is due to the lack of resources of schools with a large concentration of single-parent families, like a shortage of qualified teachers and a high student-staff ratio* (Hypothesis 4).

Country variation in the relationship between school's single-parent family composition and educational success

Single parenthood has different implications in varying countries, which might subsequently result in cross-national differences in the consequences of single-parenthood (Pong et al., 2003). It is expected that the negative effect of growing up in a single-parent family is less strong in societies or cohorts where nontraditional family forms are more common, as single-parent families will be less stigmatized by a hostile environment and children experience divorce or separation of their parents as a less unusual event (Wolfinger, 2003). Schools in countries with more children from single-parent families may also be more experienced in handling the negative consequences resulting from single parenthood for their students, especially as the number of students of single-parent families at school grows. We therefore expect that *the negative relationship between school's share of single-parent families and children's educational performance is less strong in societies with a higher share of single-parent families* (Hypothesis 5).

Methods

Data

To test our hypotheses, we use data of the Programme for International Student Assessment (PISA). PISA is a collaborative effort among countries that are member of the OECD and assesses in how far students near the end of compulsory education (at age 15) have acquired some of the knowledge and skills that are essential for full participation in society (OECD, 2005). The main purpose of PISA is hence not to measure the extent to which students have mastered a specific school curriculum, but rather to examine to what degree they are able to apply their knowledge and skills to meet challenges in real life. The first PISA survey was conducted in 2000, and it is repeated every 3 years. In this article, we use pooled PISA data of 2000 and 2003.¹ Each school in each wave is treated as a different school, although there might be some unknown overlap.

The PISA data have been criticized from many different points of view. The most important points include the validity of the ranking of countries on their average score on the (reading, mathematics, or science) literacy test, the unproven policy implications of the PISA reports, the weak relation between curriculum taught in schools of a country and the content of the literacy test, the poor measurement of the educational processes within schools, and the compromises in the measurement to make an internationally comparable measurement between different national educational traditions possible. We do not have space enough to discuss all these critical points, but we will return to several of these points in the conclusion and discussion section. Another disadvantage of PISA, especially relevant for the empirical analysis of this article, is that it lacks information about the cause of single parenthood or guardianship of one of the parents. Although we assume that in most developed countries divorce or separation is the most common reason for single parenthood of parents of 15-year-old children, there might be other reasons for growing up in a single-parent family (with or without a guardian), that is, birth out of wedlock without a following marriage or cohabitation and death of one of the parents. However, parents of 15-year-old children are generally still too young to die, and the number of people that (intentionally or unintentionally) become single parents already prior to childbirth will be rather low. Finally, the cross-sectional nature of the PISA data is an important weakness, which makes these data more vulnerable for unobserved differences between children from various family forms and between students at schools with

different shares of single-parent families. One way to overcome this problem of causal inference would be to use longitudinal cross-national data, which would allow to add preliminary indicators of early scholastic ability, or causes and timing of single-parent family form, and to control for an important part of the unobserved variance. Such internationally comparative longitudinal data, however, do not exist.

Notwithstanding the criticisms on the PISA data, PISA is the only internationally comparative dataset available for analyzing the level of knowledge and skills of 15-year-old students, which enables a more reliable estimation of the impact of measurable features of contexts of schools and nations than by analyzing national datasets. An important advantage of the measurement of family form in PISA, moreover, is that students were asked with whom they regularly live at home, and they were offered a number of possible persons, whom they could all tick.² This way, the real family form in the eye of the students is measured instead of the formal situation, as reported by interested parents or authorities. Parents who separated after cohabitation (instead of marriage) before the child reaches the age of 15 are measured in the same way as formally divorced parents. This feature is especially relevant for the northwestern European countries with high levels of cohabitation with children (OECD, 2008), and it makes PISA more valid than data containing only children from divorced, and not from separated, parents. Since separation after cohabitation has more or less the same effect on children as compared to divorce after marriage (Dronkers & Härkönen, 2008; Härkönen & Dronkers, 2006), the PISA data provide a more accurate picture in countries where cohabitation with children is common. Married parents, who stopped living together before the 15-year-old student participates in the PISA survey, are also treated in the same way as formally divorced parents. This feature is especially relevant for Catholic countries like Italy, Ireland, Portugal, and Spain, where separation without divorce is still common and divorce still difficult to obtain. The formulation of the family-form question contains a risk, however, of reporting parental divorce or separation by the 15-year-old students, if in fact the father or mother is only away for work for a long period (e.g., fishermen). We believe, however, that this risk is small, as students will mostly indicate that their father or mother still lives at home, due to the undesirability of parental divorce or separation in the eyes of children.

Variables

An overview of the descriptive statistics of the variables included in the empirical analysis is presented in [Table 1](#). Originally, the sample of PISA 2000 and 2003 included information on 504,949 students. We only analyzed students with a valid score on one of the family forms of our interest, that is, a two-parent family, a single-mother family, and a mother plus guardian family, which implied a loss of 19% of the total sample. Additionally, we only selected students with valid information on the relevant variables for the empirical analysis and living in OECD countries that participated both in PISA 2000 and 2003, which reduced the sample almost by half. We could include the following 25 countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, The Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.³ Finally, we only selected students with a valid score on the dependent variable (mathematical literacy), resulting in an analytical sample of 209,300 students, attending 11,887 different schools. All schools are included in our sample, also schools with only students living together with two biological parents.

Table 1. Descriptive statistics for independent variables and mathematical literacy.

	Range	Original Range	Mean (<i>SD</i>)
<i>Dependent Variable</i>			
Mathematical Literacy	48.18–824.38	–	514.59 (90.07)
<i>Student-Level Independent Variables (N = 209,300)</i>			
Family Form			
Mother & Father	0–1	–	0.79
Single Mother	0–1	–	0.15
Mother & Guardian	0–1	–	0.06
Sex			
Boy	0–1	–	0.49
Girl	0–1	–	0.51
Educational Level			
Lower Secondary Education	0–1	–	0.44
Higher Secondary Education	0–1	–	0.48
Unknown	0–1	–	0.08
Immigrant Status			
Native	0–1	–	0.79
Second Generation	0–1	–	0.12
First Generation	0–1	–	0.06
Unknown	0–1	–	0.03
ESCS Index	–0.63–0.37	–4.61–2.96	0.00 (0.12)
<i>School-Level Independent Variables (N = 11,887)</i>			
School's % Single-Parent Families	–0.15–0.85	0–100	0.00 (0.12)
School's ESCS Index	–0.51–0.48	–2.10–2.12	0.00 (0.13)
School Size	–0.11–0.89	3–6000	0.00 (0.07)
School's % Immigrants	–0.22–0.78	0–100	0.00 (0.22)
Community			
Village/Small Town	0–1	–	0.34
Town	0–1	–	0.27
City	0–1	–	0.16
Big City	0–1	–	0.08
Other	0–1	–	0.15
Teacher Shortage	–0.25–0.75	–1.20–3.47	0.00 (0.20)
Student–Staff Ratio	–0.18–0.82	0.10–70	0.00 (0.06)
<i>Country-Level Independent Variable (N = 25)</i>			
Country's % Single-Parent Families	–0.36–0.64	10.02–20.61	0.00 (0.25)

Source: Pooled PISA 2000 and 2003.

Dependent variable

To measure the student's educational performance, we use mathematical literacy as the dependent variable in our study. Mathematical literacy is defined as “an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that

meet the needs of that individual's life as a constructive, concerned and reflective citizen" (OECD, 2003, p. 15). Mathematical literacy can be divided into four concepts, that is, quantity, space and shape, change and relationships, and uncertainty (OECD, 2003). The observed responses on the items of these scales have been used to construct five plausible mathematical values for each student by means of item response modeling (OECD, 2002). These five plausible scores provide an unbiased estimate of the answers on all items, although in reality the students have only answered a random selection of the items. We calculated the mean score⁴ on the five plausible mathematical values as the dependent variable *Mathematical Literacy*.⁵ The average score on this variable is 514.59 with a standard deviation of 90.07.

Predictor variables

As described earlier, *Family Form* is measured by asking who usually lives at home with the student, that is, a mother, female guardian, father, male guardian, or others. We created dummy variables indicating a two-parent family (mother and father) (79%), a single-mother family (15%), and a family consisting of a mother plus guardian (6%). We have chosen to exclude other single-parent family forms, as they were not very common in the countries involved.

At the school level, we calculated the *School's Percentage of Children from Single-Parent Families* by counting all students at a certain school with a single mother or father, compared to the total number of students at school. Students with one parent and a guardian or with other combinations with two adults were not considered as children with a single mother or father. Subsequently, we transformed this variable into a variable ranging from 0 to 1, after which we mean centered it. This way, a scale remains ranging from -0.15 to 0.85. School's socioeconomic composition is measured by computing the average *Index of Economic, Social, and Cultural Status* (ESCS) of all children at school who participated in PISA. This is a scale, combining the highest level of parental education (International Standard Classification of Education [ISCED]) and occupation (International Socio-Economic Index of Occupational Status [ISEI]; Ganzeboom, De Graaf, & Treiman, 1992) and the amount of home possessions (OECD, 2003). Also, this variable is transformed into a 0–1 scale and mean centered. The new scale ranges from -0.51 to 0.48. Through a principal questionnaire, two other school characteristics are measured in PISA: *Shortage of Qualified Teachers* (a scale based on shortages in different subjects) and *Student–Staff Ratio*. Again, both indicators have been transformed into a 0–1 scale and are mean centered (respectively ranging from -0.25 to 0.75 and from -0.18 to 0.82).

At the country level, we calculated the *Country's Percentage of Children from Single-Parent Families* by counting all students in a country with a single mother or father, compared to the total number of students in that country. Students with one parent and a guardian or with other combinations with two adults were not considered as children with a single mother or father. We transformed this variable into a variable ranging from 0 to 1, after which we mean centered it (i.e., range of -0.36 to 0.64).

Control variables

To control for the two different survey years, we used the dummy *Year of Survey* distinguishing between 2000 (reference) and 2003. At the student level, we first included *Sex* (boys is reference). As a control for selectivity, we also included the *Level of*

Education attended by the students. We distinguish two levels within secondary education according to the ISCED (United Nations Educational, Scientific, and Cultural Organization, 2006): lower secondary (reference) and higher secondary education, and a category of unknown educational level. This control variable takes into account the possible early selection of children of single parents into a lower educational level, as a consequence of lower earlier performance. The result of controlling for educational level might be that the relationship between family form and school's percentage of single-parent families is underestimated. However, we prefer this risk of underestimation above a too easy confirmation of our hypotheses. *Immigrant Status* is measured as native (reference), second generation, first generation, and unknown. To control for the family background of students, we included the family's ESCS (standardized and mean centered). This is a combined index of parental educational level, occupational status, and cultural and material resources in the parental home.

At the school level, we included *School ESCS index* (the average of the parental ESCS), *School Size* (number of students), *School's Percentage of Immigrants* (aggregated number of nonnative students at school), and *Type of Community* in which the school is located (village/small town (reference), town, city, big city, or other). The School ESCS index is thus a broad composite measurement of school composition as advised by Van Ewijk and Slegers (2010).

Results

Descriptive analysis

In [Figure 1](#), we present what kind of school (with regard to the percentage of students from single-parent families) is generally attended by children from two-parent families (M&F), children with a single mother (SM), and children with a mother plus guardian (M&G) among the different countries. In addition, the percentage of single-parent families in the country is shown. From this figure, we can derive that, compared to children living with both parents, children from single-mother families attend schools with higher percentages of single-parent families in all countries included in our study. This suggests that the results, which Pong (1997, 1998) found for the US, might also be relevant for other countries. From [Figure 1](#), we can also derive that the relative number of single-parent families is highest in the US (21%). However, Australia, New Zealand, and the Scandinavian countries follow closely.

Multivariate analysis

Model design

Since we hypothesized relationships at the individual (student) level and the contextual (school) level, as well as cross-level interaction effects with the country level, we apply multilevel analysis (Snijders & Bosker, 1999). We distinguish three levels: the student level (Level 1), school level (Level 2), and country level (Level 3). [Table 2](#) represents the multilevel regression models.

We start by estimating a model including only the dummy variables of single-parent family form (i.e., single mother and mother plus guardian) with the two-parent family as reference category, controlled for year of survey (Model 1). In the second model, we also include all individual background characteristics, and we control for the country's percentage of single-parent families (Model 2). In Model 3, we test Hypothesis 1 by adding

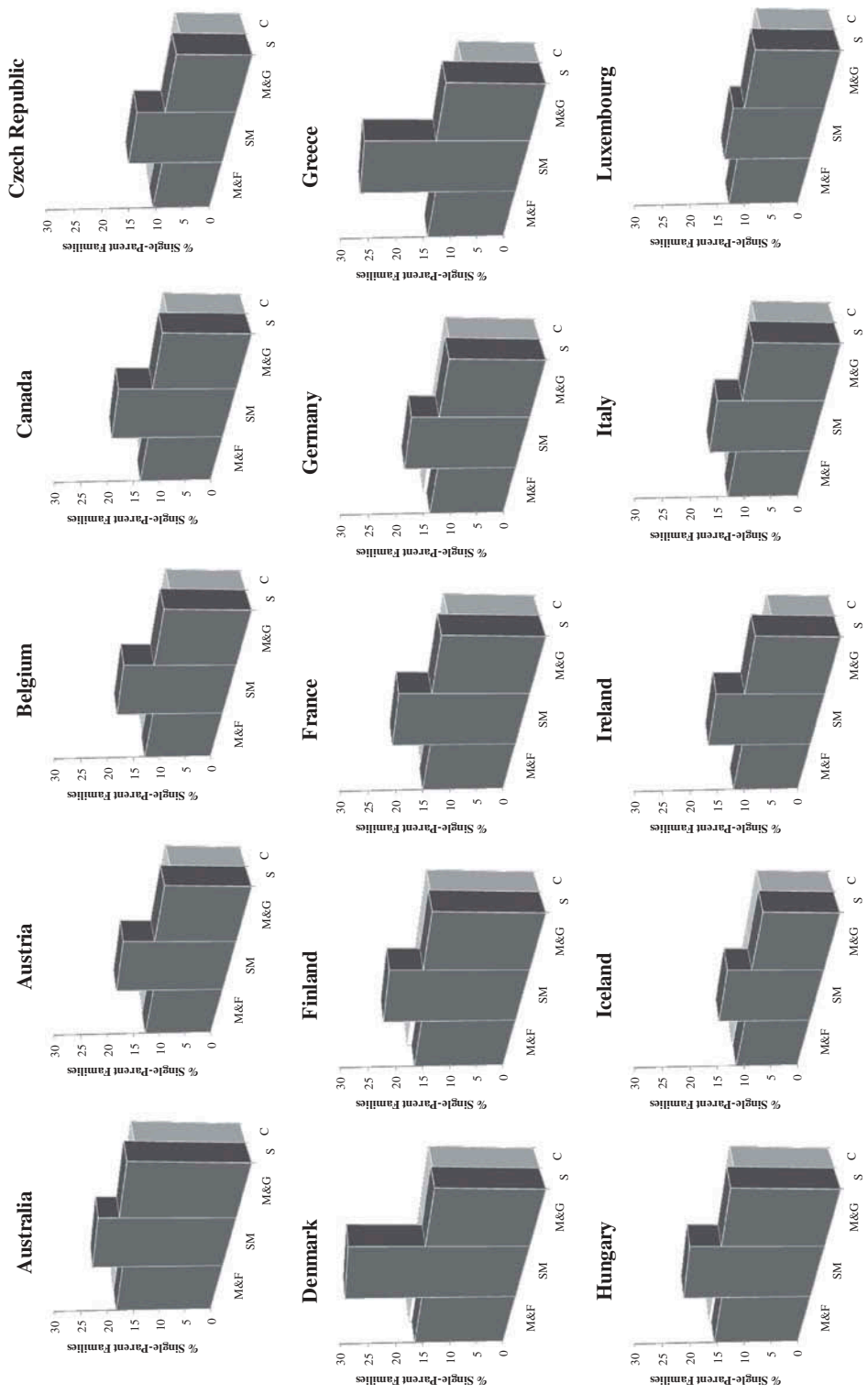


Figure 1. Percentage of single-parent families at school and in country, according to family form.

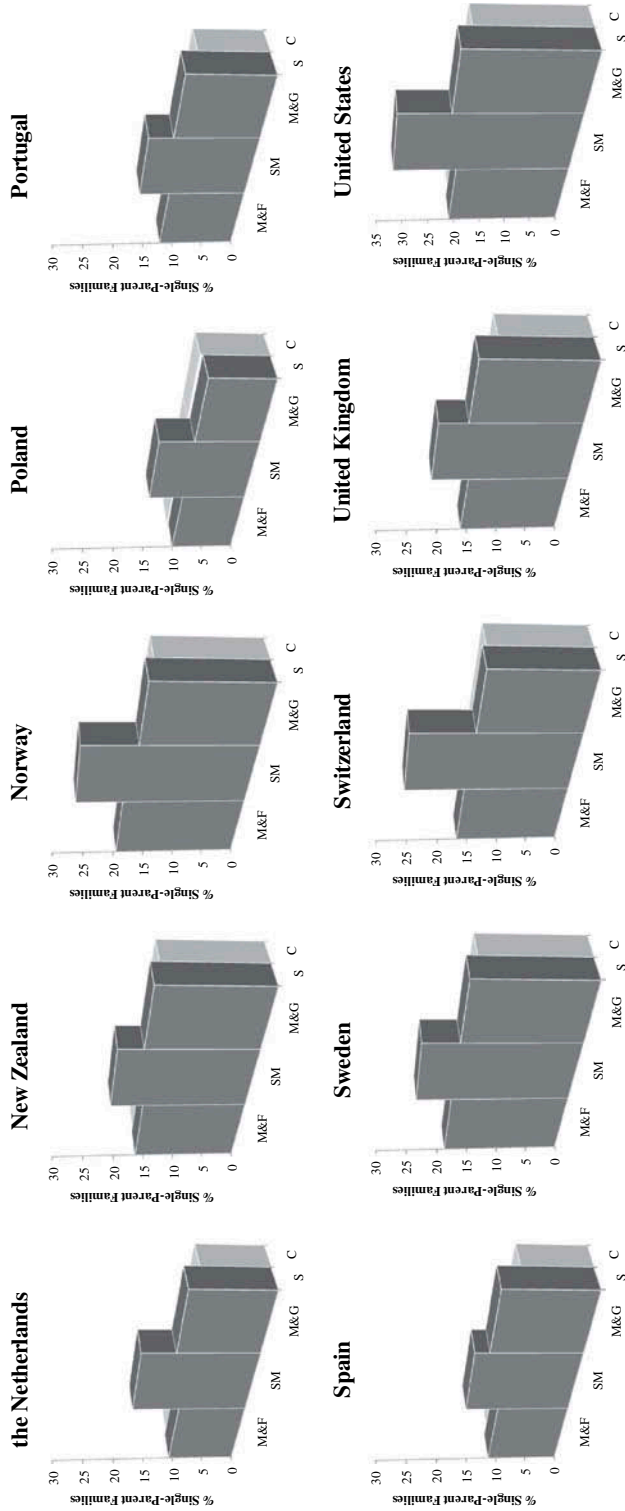


Figure 1. (Continued).

the school's percentage of single-parent families to the equation of Model 2. We estimated Model 3 without socioeconomic status of the school, school size, school's percentage of immigrants and the community where the school is standing. In the next model, we add these other school features as well and test Hypothesis 3 (Model 4). In Model 5, we test Hypothesis 4 by adding the two indicators of the lack of educational resources of the school to Model 4. In Model 6, we also include the interaction terms between schools' percentage of single-parent families and single-mother and mother and guardian family form, in order to test Hypothesis 2. Finally, in Model 7 we also include the interaction terms between school's percentage of single-parent families and country's percentage of single-parent families, in order to test Hypothesis 5.

Results

Model 1 shows the expected negative relationship between family form and educational performance: Students living in single-mother families score nearly 14 points lower than students living with a mother and father, while those living with a mother plus guardian score on average 10 points lower. Model 2 shows that the individual background variables explain a substantial part of this negative relationship. Also after controlling for individual background variables and country's percentage of single-parent families, family form continues to have a significant negative relationship with educational performance. Single-mother family and mother plus guardian family show more or less an equal deviation after these controls (-7.64 and -5.93, respectively).

With Model 3, we test Hypothesis 1 (i.e., children from schools with a large concentration of students from single-parent families perform less well than children from schools with a small concentration of students from single-parent families). It appears that there is a strong negative relationship between school's percentage of single-parent families and performance. Each percent increase in the number of single-parent families at a school decreases the educational performance of all students with nearly 0.8 (-79.40/100), thus 10% lowers the score with some 8 points. An interesting finding was that the inclusion of the school's percentage of single-parent families hardly affects the negative relation between family form and educational outcomes. This clearly suggests that family form and school's percentage of single-parent families are indicators of different processes.

In Model 4, we test Hypothesis 3, which predicts that the negative relationship between school's percentage of single-parent families and performance can be explained by the lower socioeconomic composition of schools with a large concentration of single-parent families. The results of Model 4 only partly support this hypothesis. The socioeconomic composition of school has a strong positive effect on educational performance, but it only explains about half of the original relationship between school's percentage of single-parent families and performance. An increase of 10% in the number of single-parent families at school still decreases the educational performance of students with 3.8 points. So, the inclusion of the school's socioeconomic composition only partly affects the negative relation between family form and educational performance.

Hypothesis 4 is tested through Model 5, expecting that the negative relationship between school's percentage of single-parent families and performance can be explained by the lack of resources of schools with a large concentration of single-parent families, like a shortage of qualified teachers and a high student-staff ratio. The results from Model 5 clearly show that this hypothesis needs to be rejected. Although both a shortage of qualified teachers and a high student-staff ratio negatively affects student's educational

Table 2. Multilevel regression models for mathematical literacy ($N_{\text{students}} = 209,300$; $N_{\text{schools}} = 11,887$; $N_{\text{countries}} = 25$).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	509.98 **	500.51 **	497.09 **	505.08 **	505.11 **	505.32 **	505.46 **
Year of Survey							
2000	ref.	ref.	ref.	ref.	ref.	ref.	ref.
2003	-2.27 *	-4.84 **	1.19	-2.34 **	-2.35 **	-2.48 **	-2.51 **
<i>Student-Level Effects</i>							
Family Form							
Mother & Father	ref.	ref.	ref.	ref.	ref.	ref.	ref.
Single Mother	-13.80 **	-7.64 **	-6.83 **	-7.34 **	-7.34 **	-6.18 **	-6.20 **
Mother & Guardian	-10.23 **	-5.93 **	-5.85 **	-5.91 **	-5.90 **	-6.09 **	-6.10 **
Sex							
Boy	ref.	ref.	ref.	ref.	ref.	ref.	ref.
Girl		-14.03 **	-14.01 **	-14.17 **	-14.17 **	-14.18 **	-14.18 **
Educational Level							
Lower Secondary Education	ref.	ref.	ref.	ref.	ref.	ref.	ref.
Higher Secondary Education	46.91 **	46.48 **	46.48 **	42.22 **	42.13 **	42.08 **	42.12 **
Unknown	18.75 **	18.75 **	18.63 **	16.43 **	16.62 **	16.60 **	16.58 **
Immigrant Status							
Native	ref.	ref.	ref.	ref.	ref.	ref.	ref.
Second Generation	-7.22 **	-7.05 **	-7.05 **	-6.40 **	-6.40 **	-6.40 **	-6.40 **
First Generation	-20.04 **	-19.80 **	-19.80 **	-18.35 **	-18.37 **	-18.39 **	-18.39 **
Unknown	-22.52 **	-22.48 **	-22.48 **	-21.60 **	-21.58 **	-21.61 **	-21.60 **
ESCS Index	184.55 **	184.79 **	184.79 **	165.71 **	165.73 **	165.68 **	165.68 **
<i>School-Level Effects</i>							
School's % Single-Parent Families			-79.40 **	-37.69 **	-37.78 **	-32.96 **	-31.80 **

(continued)

Table 2. (Continued).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
School's ESCS Index				236.81 **	234.36 **	234.25 **	234.07 **
School Size				50.37 **	55.24 **	55.02 **	55.29 **
School's % Immigrants				-27.38 **	-27.60 **	-27.50 **	-27.59 **
Community				ref.	ref.	ref.	ref.
Village/Small Town				-4.92 **	-4.98 **	-5.03 **	-5.02 **
Town				-9.32 **	-9.60 **	-9.66 **	-9.67 **
City				-10.48 **	-10.63 **	-10.72 **	-10.76 **
Big City				5.04 **	5.02 **	5.03 **	5.15 **
Other							
<i>School Resources</i>							
Teacher Shortage					-11.42 **	-11.39 **	-11.36 **
Student-Staff Ratio					-13.90 **	-13.89 **	-13.88 **
<i>Interaction Effects (School Level)</i>							
School's % Single-Parent Families * Single Mother						-20.84 **	-20.39 **
School's % Single-Parent Families * Mother & Guardian						11.89	12.25
<i>Country-Level Effects</i>							
Country's % Single-Parent Families		22.06	30.78	4.75	4.96	4.82	5.03
<i>Interaction Effects (Country Level)</i>							
Country's % Single-Parent Families * School's % Single-Parent Families							-18.65
<i>Variance Components</i>							
Student Level	5129.69	4640.93	4641.99	4641.98	4642.18	4641.49	4641.40
School Level	2644.50	1699.14	1632.10	939.64	933.52	933.46	933.61
Country Level	743.03	882.45	862.12	703.79	702.18	699.60	699.62
Deviance	2407401	2383074	2382733	2377732	2377685	2377654	2377652

p* < .05, *p* < .01.
Source: Pooled PISA 2000 and 2003.

performance, the negative relationship between school's percentage of single-parent families with educational performance hardly changes by the inclusion of these school characteristics.

Model 6 tests Hypothesis 2 (i.e., the negative relationship between school's percentage of single-parent families and educational performance is larger for children from single-parent families than for children from two-parent families). This hypothesis is supported, but only for the single-mother family: We find a substantial and significant coefficient for the interaction between school's percentage of single-parent families and single-mother family. This means that the negative relationship between school's share of single-parent families and performance is larger for children from single-mother families, like we expected. The interaction between school's percentage of single-parent families and mother plus guardian family is positive, but not significant, contrary to our hypothesis. This finding suggests that the addition of a male guardian to a mother family at least re-establishes the relations with the larger community and adds new social capital to the family.

Model 7 tests Hypothesis 5, which assumes that the negative relationship between school's percentage of single-parent families and performance is less strong in societies where nontraditional family forms are more common. This hypothesis cannot be corroborated. Instead, the interaction term between school's percentage of single-parent families and country's percentage of single-parent families is negative but insignificant, while we assumed a positive and significant coefficient of this interaction.

To check the robustness of our findings, we present the most important estimates of Model 7 again in Appendix 1, each time leaving out another country. The results indicate that almost all relations are rather robust, since they hardly change when leaving out one of the countries arbitrarily. Regarding the acceptance or rejection of our hypotheses by this robustness test, there is one important exception: Both the sign and significance of the interaction between the school's and the country's percentage of single-parent families vary in different countries. What is most striking is that the relationship turns significantly positive when the US is left out. This suggests that attending a school with many children from single-parent families is less negative for children's educational performance in societies with higher shares of single-parent family forms. On this point, the US is an exception, because despite its high level of single-parent families the relation of school's share of single-parent families and performance has not declined like in the other societies. Furthermore, leaving out Australia, Belgium, Denmark, or The Netherlands results in a significant negative interaction effect. We may assume that, especially in these countries, the higher share of single-parent families leads to a less negative relationship between the share of single-parent families at school and performance. In addition to these robustness analyses, we have repeated our analysis by including the variable *Number of siblings* at the individual level.⁶ The inclusion of this variable does not alter the results.

Conclusion and discussion

In this article, we studied the contextual relationship between a school's share of single-parent families and the educational performance of 15-year-old children from single-parent and two-parent families in this school. The aim of our study was to contribute to the existing knowledge about single-parent family forms and children's educational performance by investigating how the family-form composition of schools affects the negative relationship between living in a single-parent family and children's educational performance.

First of all, we studied how the share of children from single-parent families at school affects the educational performance of all children at that school. We can conclude that attending a school with many children from single-parent families negatively influences children's educational performance, even after taking account of the socioeconomic status of the school, school size, school's percentage of immigrants, and the urban environment of the schools. The negative relationship between school's share of children from single-parent families and performance could not be explained by the percentage of single-parent families within the country, as we controlled for this effect comparing 25 OECD countries. The results of single-country studies of Pong (1997, 1998) and Sun (1999) are thus confirmed in our analysis. The negative relationship between school's share of single-parent families and children's educational performance, which they found for the US, is not unique for that country, but can be found in nearly all Western countries. As a consequence, possible explanations for this negative relationship should be general enough to be applicable in all countries and not only in the US. This means that, next to the classical variable of socioeconomic composition of schools, also other indices of school-composition, like the share of single-parent families, have an independent and substantial relation with educational performance.

We also found that a shortage of quality teachers at school and a higher student-staff ratio negatively influence 15-year-old student's educational performance, but these indicators of school resources could not explain the negative relationship between school's share of single-parent families and performance. This is an important conclusion, because single-mother families often have to move to more modest houses and neighborhoods after a divorce or separation. In some countries, like the US, school resources are related to the fiscal resources of neighborhoods and districts. The negative relationship between school's share of single-parent families and performance might reflect these differences in school resources, related to their environment. The fact that a lack of school resources could not explain why children at schools with many children from single-parent families perform less well makes this explanation less plausible, also because in many countries the relationship between school resources and neighborhood or district is far less strong or even absent.

Although all children at schools with a high share of children from single-parent families perform less well than children at schools with a low share of children from disrupted families, the educational performance of children from single-mother families is even lower at such schools, compared to children from two-parent families. Accordingly, the difference is smaller at schools with a low share of single-parent families. So, children from divorced or separated parents are even more disadvantaged when many of their fellow students also have divorced or separated parents, compared to children living with two biological parents.

In addition, we observed that the negative relationship between school's share of single-parent families and children's educational performance is not lower in societies with a high share of single-parent families, when comparing all 25 societies. However, excluding the US leads to the conclusion that the negative relationship between school's share of single-parent families and performance is lower in societies with a high share of single-parent families, especially in Australia, Belgium, Denmark, and The Netherlands. This supports the assumption that as divorce and separation become more normal and accepted, schools have learned how to handle some of the consequences of divorce and separation for students. It is not clear, however, why the US is an exception. It might be that the continuing "cultural wars" about family values in the US hinder schools to adjust themselves to the realities of having high numbers of students from single-parent families.

Another explanation of the US exception might be the strong relation between ethnicity and single-motherhood in that society.

These last conclusions underline the importance of rethinking the societal consequences of the still increasing levels of divorce and separation for society at large, in particular when children are involved. This is especially important in the light of the growing confirmation of the old suggestion of William Goode (1963), that is, that when the (social) costs of union dissolution are high, one needs extra resources to dissolve the union, but when they are low, one needs more resources to maintain a relationship (Härkönen & Dronkers, 2006). Therefore, it seems that strict divorce regimes bias the composition of union of the lower ranks of society. Lax divorce regimes, on the other hand, have the consequence of increasing dissolution risks, especially for those with less education. This means that in combination with the results of our analysis of the relationship between school's share of single-parent families and performance, divorce or separation is not only a private affair, which affects only those who are directly involved, but that divorce and separation also have consequences for the inequality in society and the functioning of education, one of the most important institutions of modern societies.

Three caveats need to be mentioned. First, the PISA data are cross-sectional data, which make them more vulnerable for unobserved individual differences between children from various family forms and between students at schools with different shares of single-parent families. Families that will end up as single-parent families might be less effective in raising children also before their breakup, and thus their children have lower educational performance, despite equal socioeconomic parental background. Schools with a high share of single-parent families might be situated in less favorable neighbourhoods, which might affect educational performance of the pupils of those schools, despite equal educational school resources. Unfortunately, there are no longitudinal cross-national data available, which would allow us to add preliminary indicators of early scholastic ability, causes, and timing of single-parent family form or the quality of the neighbourhoods of schools and to estimate the importance of this unobserved variance. This disadvantage of the cross-sectional nature of the PISA data might be balanced by the advantages of using these cross-sectional data to estimate the impact of school and country contexts. But, until today, nobody has proof whether disadvantages are balanced by the advantages, due to the lack of better cross-national longitudinal data and good estimators of the importance of the unobserved variance (see Frisco et al., 2007, for such an estimation).

Second, the data used do not allow for a direct test of the two main possible explanations of the negative relationship between school's share of single-parent families and performance, that is, the decline of the community network of the school and the lower amount of teaching and learning time at school and at home. There are indications that children from single-parent families make less use of teaching and learning time (they are, for instance, more often too late at school or skip classes; see Garriga, 2010), but this is not enough evidence to decide for the second explanation of the single-parent school effect.

Third, the study of compositional effects knows methodological obstacles, like the correct measurement of various dimensions of parental background and pupils' characteristics (different variables or one composite), the omitted variable bias, the control for prior educational achievement, and the choice of the right models and control variables (Van Ewijk & Slegers, 2010). The same methodological obstacles exist for the study of school effectiveness (see Creemers & Kyriakides, 2006; Creemers, Kyriakides, & Sammons, 2010). Our cross-sectional data at hand cannot address all these obstacles fully. The importance of our analysis is that we show that school's share of single-parent families

might be another and independent school composition characteristic, next to the classical socioeconomic school composition, not only in one country (US) but also in other societies. But our outcome needs to be replicated with national longitudinal data, which can address the mentioned methodological obstacles more fully.

Notes

1. The PISA 2006 wave did not contain any information about the single-parent family form of students. In PISA 2009, the family-form question has returned.
2. In the 2003 wave, the precise question was “Who usually lives at <home> with you? (a) Mother; (b) Other female guardian (e.g., stepmother or foster mother); (c) Father; (d) Other male guardian (e.g., stepfather or foster father); (e) Others (e.g. brother, sister, cousin, grandparents).” In the 2000 wave, more options were offered.
3. Although Japan, Turkey, and Korea are OECD countries that participated in PISA 2000 and 2003, we did not select these countries for our analyses because of the fact that divorce has a completely different meaning in these countries (see, e.g., Park, 2008, for Korea).
4. We also applied other techniques (separate analyses for the 10 plausible values [5 for each wave] and averaging the parameters), but these results are not substantially different.
5. Upon request, we provide the results for reading and scientific literacy as dependent variables. Effects of single-mother families are generally smaller on reading than on mathematics (Murray & Sandqvist, 1990), because mothers averagely stimulate language better than mathematics, while fathers, who generally can stimulate math development, are absent in single-mother families. But these results are not substantially different, only smaller. A possible explanation is that the various literacy tests, used by PISA, measure scholastic ability instead of literacy (Rindermann & Ceci, 2009).
6. The number of children in a family might, first of all, affect the likelihood that people divorce or separate. Second, growing up in a single-mother family without any siblings might have a different meaning compared to growing up with at least one or more siblings. As the number of siblings was only measured in PISA 2000 and was not even available for all students in that year, we decided not to control for this variable initially. However, the results of this additional analysis (on a smaller sample) show that the effect of growing up with a single mother does not change, and that the effect of growing up with a mother plus guardian is only slightly reduced. In addition, the effect of the school’s percentage of single-parent families is robust, as well as the effect of all other variables.

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Appendix 1. Multilevel regression estimates for mathematical literacy (in all countries minus one)

Country (omitted)	Single Mother	Mother & Guardian	School's % SPF	School's % SPF*SM	School's % SPF*M&G	School's % SPF* Country's % SPF
Australia	-6.05 **	-6.00 **	-32.98 **	-18.03 **	10.52	-28.90 *
Austria	-6.41 **	-6.13 **	-32.75 **	-20.89 **	11.98	-16.38
Belgium	-6.09 **	-6.26 **	-29.03 **	-21.35 **	11.76	-29.24 *
Canada	-6.04 **	-5.66 **	-32.08 **	-20.83 **	10.15	-19.51
Czech Republic	-6.47 **	-6.38 **	-34.13 **	-19.13 **	14.43 *	-12.88
Denmark	-6.11 **	-6.03 **	-33.99 **	-21.73 **	13.75 *	-31.72 *
Finland	-6.29 **	-5.87 **	-32.87 **	-20.28 **	15.01 *	-24.90
France	-6.46 **	-6.30 **	-31.51 **	-20.06 **	13.94 *	-18.96
Germany	-6.49 **	-6.56 **	-30.32 **	-21.48 **	10.05	-19.55
Greece	-6.02 **	-6.11 **	-35.29 **	-22.46 **	11.44	-7.63
Hungary	-6.32 **	-6.17 **	-33.76 **	-22.40 **	11.72	-24.05
Iceland	-6.32 **	-5.93 **	-30.31 **	-20.15 **	12.01	-19.48
Ireland	-6.07 **	-6.10 **	-31.49 **	-20.73 **	12.07	-20.60
Italy	-6.12 **	-6.18 **	-31.17 **	-20.35 **	12.67	-18.10
Luxembourg	-6.31 **	-6.36 **	-32.38 **	-19.43 **	12.56	-16.60
The Netherlands	-6.19 **	-6.10 **	-30.91 **	-20.63 **	12.22	-27.72 *
New Zealand	-6.25 **	-5.83 **	-31.65 **	-20.05 **	11.26	-17.02
Norway	-6.09 **	-5.87 **	-33.22 **	-17.57 **	10.67	-23.35
Poland	-6.05 **	-6.06 **	-29.14 **	-21.43 **	11.73	-18.07
Portugal	-6.08 **	-6.21 **	-30.59 **	-21.30 **	12.50	-15.46
Spain	-6.14 **	-6.26 **	-29.48 **	-20.36 **	12.38	-21.48
Sweden	-5.92 **	-5.76 **	-33.05 **	-19.91 **	12.78	-23.68
Switzerland	-6.40 **	-6.02 **	-31.50 **	-18.87 **	14.39 *	-16.32
United Kingdom	-6.31 **	-6.32 **	-28.80 **	-21.63 **	9.62	-23.37
United States	-5.99 **	-6.01 **	-30.49 **	-18.33 **	14.68 *	44.43 **

* $p < .05$. ** $p < 0.01$.

Source: Pooled PISA 2000 and 2003.

Note: Models also include Year of Survey, Sex, Educational Level, Immigrant Status, ESCS Index, School's ESCS Index, School Size, School's % Immigrants, Community, Teacher Shortage, Student-Staff Ratio, Country's % Single-Parent Families.