Discussion Paper No. 05-44

Educational Opportunities and the Role of Institutions

Andreas Ammermüller

ZEW
Zentrum für Europäische Wirtschaftsforschung GmbH
Centre for European Economic Research

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Nontechnical summary

Over the last years, educational systems around the world have increasingly been evaluated and subjected to scientific as well as political debate. Recent large scale performance tests of students by international organizations like the IEA and OECD aim at establishing an internationally comparable account of student performance and triggered the debate on school quality. One important aspect of the debate that is the topic of this study is the equality of educational opportunity, i.e. how strongly educational performance is determined by the background of students. The intergenerational mobility of human capital, and hence of income, depends on the degree of equality in educational opportunities. In many countries, the debate on providing equal educational opportunities focuses on institutional features of the schooling systems such as the use of streaming and public vs. private schools. It is often argued that the access to schools of higher quality depends on the social background of students. A heterogeneous schooling system with various school types and many private schools is claimed to rather benefit students from a high compared to a low social background. Other institutional feature like the amount of instruction time are instead considered to be positively associated with educational opportunity because students spend more time together and less time with their parents.

The aim of this paper is twofold. First, it intends to assess the extent to which student background affects student performance at two stages in a student's life. This describes the educational opportunity that students face at different stages within a particular schooling system. Second, the paper aims at exploring whether cross-country differences in educational opportunities are related to essential features of educational systems. This step of the analysis provides empirical evidence on the link between institutional settings and educational opportunity and seeks to elaborate on better frameworks for more equal opportunities.

The estimation strategy applied in this study aims at a consistent estimation of the link between institutions and educational opportunities. A difference-in-differences estimation approach is employed in order to explain changes in educational opportunities over time (measured by student age) by changes in institutional features. Thereby, country-specific factors besides the schooling system that bias any simple cross-country analysis of the role of institutions can be largely eliminated. The analysis builds on internationally comparable micro data from the two studies PIRLS (Progress in International Reading Literacy Study) and PISA (Programme for International Student Assessment) on student performance in 14 mainly European countries. The schooling systems are analyzed at grade four and grade nine/ten, two important points in a child's development and in the schooling system.

The estimation of the effects of student background on student performance shows that educational opportunities seem to increase for individuals with the right attitude towards education although the overall degree of equality of educational opportunity decreases. The results indicate that there are several dimensions of educational opportunities, which develop differently with student age.

It can be shown that schooling institutions are linked to educational opportunities of students. The effect of social origin on student performance, measured by the number of books at home and parental education, increases in countries with a differentiated schooling system with several school types or a high share of private schools. This supports the hypothesis that streaming and private education benefit the performance of students from a better social background. The time students spend in schools seems to limit the effect of social background upon student performance, while school autonomy is positively linked to parental influence.

Educational Opportunities and the Role of Institutions*

Andreas Ammermueller

Centre for European Economic Research (ZEW)
L7,1 Mannheim
ammermueller@zew.de

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Abstract:
Educational opportunities determine the intergenerational mobility of human capital and are affected by institutional features of schooling systems. The aim of this paper is twofold. It intends to show how strongly student performance depends on student background at two important stages in a student's life as well as to explain cross-country differences in educational opportunities by schooling institutions. A difference-in-differences estimation approach is applied to control for country-specific effects. The results imply that educational opportunities decrease with student age in most countries. However, the attitude of parents seems to become more important while the impact of social origin decreases. A greater differentiation of the schooling system as indicated by streaming and private schools is associated with a greater effect of social background while more instruction time limits the impact of social origin on student performance. Higher school autonomy increases the impact of parental influence.

JEL Classification: I21, J62
Keywords: Equality of educational opportunity, student performance, institutions, PISA, PIRLS

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1 Introduction

Over the last years, educational systems around the world have increasingly been evaluated and subjected to scientific as well as political debate. Recent large scale performance tests of students by international organizations like the IEA and OECD aim at establishing an internationally comparable account of student performance and triggered the debate on school quality. The importance that is directed at school education is supported by a growing literature that stresses the extent to which schooling quality affects the earning prospects of students (e.g. Bishop, 1992) and economic growth (e.g. Barro, 2001). One important aspect of education that is the topic of this study is the degree of equality of educational opportunity, i.e. how strongly educational performance is determined by the background of students. The intergenerational mobility of human capital and hence of income depends on the degree of equality in educational opportunities (e.g. Björklund and Jäntti, 1997; Dearden, Machin and Reed, 1997). Thereby, social mobility within societies is largely determined by educational opportunities. From an economic point of view, e.g. an extremely low degree of equality in opportunities would imply that investment in human capital depends less on innate ability and more on social origin, which leads to a non-optimal investment in human capital of individuals. Thus, educational opportunities are likely to affect also significant economic outcomes like economic growth through e.g. possible spillovers from higher education (e.g. Audretsch et al., 2004). In many countries, the debate on providing equal educational opportunities focuses on institutional features of the schooling systems such as the use of streaming and public vs. private schools. It is often argued that the access to schools of higher quality depends on the social background of students. A heterogeneous schooling system with various school types and many private schools is claimed to rather benefit students from a high compared to a low social background. Other institutional feature like the amount of instruction time are instead considered to be positively associated with educational opportunity because students spend more time together and less time with their parents.

The aim of this paper is twofold. First, it intends to show how strongly student background affects student performance at two stages in a student's life. This describes the degree of equality of educational opportunity that students face at different stages within a particular schooling system. Besides social background also the attitude of parents towards their child's education and student characteristics will be considered in order to describe the various dimensions of educational opportunity. Second, the paper aims at exploring whether cross-country differences in educational opportunities are related to essential features of

educational systems. This step of the analysis provides empirical evidence on the link between institutional settings and educational opportunities, and seeks to elaborate on better frameworks for equal opportunities. The analysis builds on internationally comparable micro data from two studies (PIRLS and PISA) on student performance in 14 countries. The schooling systems are analyzed at grade four and grade nine/ten, two important points in a child's development and in the schooling system. The first point is associated with the end of primary education in many countries while the second often constitutes the end of compulsory education. The impact of the following schooling institutions is analyzed: The number of school types / use of streaming in school systems, annual instruction time, share of students in private schools and school autonomy. These institutions have been chosen because they are likely to affect educational opportunities of students rather than student performance and are at the center of the debate on how to improve the equality of educational opportunity in many countries. Moreover, the institutions vary between the countries considered here but hardly within countries and are hence well-suited for this cross-country analysis.

Previous literature that deals with certain aspects of schooling quality is abundant. In the literature, schooling quality is measured predominantly either by student performance in standardized tests, or by grades and graduation or dropout rates. Common facts emerging from the literature are the large and internationally comparable effects of student background on performance. In the recent literature that considers explicitly the social background of students, most studies refer to only one country or small groups of countries (Ammermueller et. al, 2005; Ammermueller, 2004, 2005; Woessmann, 2003a). Larger comparisons that include a wide range of countries have been conducted as well (Hanushek and Luque, 2002; Woessmann, 2004) but analyze the schooling system at only one stage. Moreover, the respective literature describes the educational opportunities of students but does not explain cross-country differences. Further literature addresses specific issues such as school resources (Betts, 2001; Hanushek, 2003; Hoxby, 2000), the use of streaming in schools (Cappellari, 2004; Figlio and Page, 2000), the effects of private versus public schools (Figlio and Ludwig, 2000; Neal, 1997; Vandenberghe and Robin, 2004) or peer effects in schools (Glewwe, 1997; Rivkin, 2001; Toma and Zimmer, 2000). This evidence relates mostly to the U.S. and only rarely takes an international perspective. Further literature that focuses on the role of student background on different outcome variables such as years of schooling or labor market outcomes underlines the importance of social background (Brunello and Checci, 2003; Ermisch and Francesconi, 2001) and even shows that the social background impacts both

through the genes and the education that are transmitted by parents to their children, while the former appears to be slightly more important (Plug and Vijverberg, 2003).

The role of institutions in determining the quality of schooling has been investigated by several recent papers, which were also based on international studies on student performance (Vandenberghe and Robin, 2004; Woessmann, 2003b). The approach followed in most studies is to determine the effect of institutional settings on student performance by estimating educational production functions (e.g. Fuchs and Woessmann, 2004) or applying a matching approach (e.g. Vandenberghe and Robin, 2004). However, in an international comparison one cannot perfectly control for cultural and societal differences between countries. Therefore, only institutional features that vary within countries can be reasonably analyzed (cf. Ammermueller, 2004). The effects of institutional settings like the structure of schooling systems, the length of the school year or other features that apply to all students within a country cannot be consistently estimated in such cross-country analyses. Hanushek and Woessmann (2005) follow a similar approach as is used in this paper by looking at difference-in-differences evidence from two student performance studies to assess the impact of streaming in secondary schools on overall inequality. However, they focus only on one institutional factor and one measure of inequality and do not exploit the micro-level data. Thereby, the effects on the different dimensions of educational opportunities cannot be examined and possible other sources of inequality are ignored by their approach.

The estimation strategy employed here aims at a consistent estimation of the link between institutions and educational opportunities. A difference-in-differences approach is applied in order to explain changes in educational opportunities over time (measured by student age) by changes in institutional features. Thereby, country-specific factors besides the schooling system can be largely controlled for, assuming they are identical for students of age nine/ten and fifteen. Attention is also paid to the comparability of cross-sectional student performance studies.

A comparison of the PIRLS and PISA studies indicates that differences in mean scores are negatively linked to differences in standard deviations, i.e. an increase in mean scores is associated with a decrease in the spread of scores. The estimation of the effects of student background on student performance shows that the absolute effect of gender, the amount of books at home, the school location and parents‘ attitude increases between the end of primary and lower secondary education in most countries, while the effect of parental education seems to decrease. Therefore, educational opportunities seem to increase for individuals with the right attitude towards education. Moreover, the results show that there are several student

background factors which have an impact on student performance. Hence, educational opportunities are not one-dimensional. There is a considerable amount of variation in the changes of educational opportunities over a student's schooling career between countries. It remains unclear what part of the changes in educational opportunities is due to differences between the studies and what changes really take place, though.

It can be shown that schooling institutions that are determined by school policy are linked to educational opportunities of students. The social origin of students, measured by the number of books at home and parental education, increases its effect on student performance rather in countries with a differentiated schooling system with several school types and a large private school sector. This supports the hypothesis that streaming benefits the performance of students from a better social background. The time students spend in schools seems to limit the effect of parents upon student performance while school autonomy is positively linked to parental influence.

The paper is structured as follows. Section two introduces the two data sets and compares them. The estimation strategy is outlined in section three. Section four discusses the results of the estimations of the educational production functions while section five presents the evidence on the role of the schooling systems. Section six concludes.

2 Data

The data from two international studies on student performance in reading literacy are taken for the analysis of 14 countries. The Programme for International Student Assessment (PISA) tested 15 year-old students while the Progress in International Reading Literacy Study (PIRLS) refers to the performance of students in grade four (age 9 to 10). The countries that are included in both studies and provide the necessary background information are Canada (CAN), the Czech Republic (CZE), England (ENG), France (FRA), Germany (DEU), Greece (GRC), Hungary (HUN), Iceland (ISL), Italy (ITA), Latvia (LVA), New Zealand (NZL), Norway (NOR), Russia (RUS) and Sweden (SWE)[1]. Information on the participation in PIRLS and PISA on school and student level is given for both studies in Table A1. Tables A2 and A3 present the means and standard deviations for the data. The following sections describe both studies and discuss the handling of missing values and the comparability of the data in addition.

[1] In PIRLS, Canada is represented only by the provinces of Ontario and Quebec and only England is sampled while in PISA, the whole of Canada and Great Britain are sampled. Therefore, the analysis that considers the role of the schooling systems is conducted both including and excluding the two countries. The United States

2.1 The PIRLS study

Thirty-five countries participated in the Progress in International Reading Literacy Study (PIRLS). This study was conducted by the International Association for the Evaluation of Educational Achievement (IEA) in 2001 and tested fourth grade students (nine- and ten-year-olds) in reading literacy. In the data, extensive information on home and school environments is available through student, parent, teacher and school questionnaires. With 150,000 students tested, PIRLS 2001 is the first in a planned 5-year cycle of international trend studies in reading literacy (Mullis et al., 2003).

The data are clustered due to the two-stage stratified sampling design of the study. The schools that participated have been chosen first, before a sample of classes from the targeted grade was drawn. Therefore, the schools are the primary sampling units and not the classes or students.

Student performance is measured by test scores in reading literacy, which is the most important basic competency needed to acquire further skills and knowledge and to successfully participate in social life (Mullis et al., 2003). The test scores are plausible values that are drawn from an estimated proficiency distribution. Plausible values are imputed scores based on the students' answers to the test items (cf. Mislevy, 1991). The scores have then been standardized, to an international mean of 500 and a standard deviation of 100, which facilitates the comparison across countries. Figure A1 in the appendix displays the mean scores and their standard deviations for all 14 countries in a scatter plot. The negative trend line implies that countries with higher mean test scores tend to have a lower spread of scores but the relationship is not significant. The high standard deviations in New Zealand and England are striking.

2.2 The PISA study

The Programme for International Student Assessment (PISA) tested 15 year-old students in the subjects mathematics, science and reading proficiency in the first half of 2000. The goal was not to test only the knowledge of students but rather their understanding of the subject matter and ability to apply the acquired knowledge to different situations. The testing was conducted by the OECD throughout its 28 member countries plus Brazil, Latvia, Liechtenstein and the Russian Federation. Apart from test scores, data from student, school and computer questionnaires were collected. These include information on the student

participated in both studies but provides no information on parents in PIRLS. The U. S. is included in the graphs comparing the two studies but not in the later analysis.

background, the availability and use of resources as well as the institutional setting at schools (Adams and Wu, 2002).

PISA uses also a two-stage stratified sampling design, which differs slightly from the sample design for PIRLS because the targeted population is not a specific grade but students aged 15. Therefore, schools have been sampled first and then students from the targeted population have been drawn randomly. The scores used for the analysis are plausible values as in the PIRLS data and are standardized in the same way.[2] However, the sample of countries differs for the two studies. The scores have not been rescaled to account for the difference in the sampled countries because it is unknown in how far student performance and its variation differ between the two grades and in how far the difference in the tests impacts on this. The weighted means and standard deviations of the scores and the student background variables used in the analysis are presented in Table A2 in the appendix. Figure A2 shows that no relationship between mean test scores and the standard deviations seems to exist across countries. Germany is an outlier with an extremely high spread of scores.

2.3 Imputation of missing values

Missing values for the student background variables are the main problem of the data from both studies. Test scores are reported for all students but some students did not complete the tests. Table A4 presents the percentage of missing values for all variables and countries. Commonly, the whole observation (student) is dropped from the regression whenever the value of any explanatory variable is missing. Including several variables in the regression thus leads to a great reduction in the number of observations that can be used for the estimations. In ENG, 65 percent of the students in PIRLS would have been dropped for example. Apart from losing valuable information, dropping students with incomplete answers to the questionnaires leads to a sample selection bias if the values are not missing randomly conditional on student performance. Indeed, given that attentive students are more likely to both complete the questionnaire and to answer the test questions, low performing students have a higher probability of being dropped. Thus, dropping the observations with missing values leads to an upward bias in the test scores, which can be seen in Table A3, which displays the means and standard deviations of the data without the imputed values.

The approach chosen here to overcome the problem of missing data is to predict missing values on the basis of regressions on those background variables like age, sex and the

[2] The description of the imputation methods for the plausible values in PIRLS and PISA in the technical reports indicates that the methods are similar. Still, it has to be assumed that possible minor difference do not bias the results.

grade a student attends that are available for all students. Linear models are used for continuous variables and probit and ordered probit models for qualitative variables.[3] Students who did not answer these elementary background questions or did not complete the tests have been excluded from the regressions. Students for who most of the values were missing have also been excluded.

The prediction of missing values on the basis of regression results is clearly no impeccable solution. The variation of the variables decreases, as can be seen in the lower standard deviations of the variables including the imputed values as compared to the original data (see Table A2 and A3). However, the imputed values vary greatly as well and the information of the non-imputed values of the observation is kept. Several other empirical studies that apply this method to test score data show that the imputation has no effect on the qualitative results (e.g. Ammermueller et al., 2005; Woessmann, 2004).

2.4 Comparability of the studies

Certainly, the studies have not been designed to be comparable to each other and they differ partially. However, both studies use the same concept, to test students' understanding rather than knowledge and they depend little on national curricula, making the studies internationally comparable. As the samples of countries differ, the mean scores are not directly comparable. For the sample considered in this study, the average PIRLS scores are mostly higher than the average PISA scores, which can be explained by low scoring non-OECD countries that are sampled in PIRLS but not in PISA. Figure 1 shows that there is a slight positive relationship, which is not significant, between the PIRLS and PISA outcomes but that PIRLS scores are mostly higher.

[3] For a more detailed discussion of the imputation method, see Woessmann (2003b).

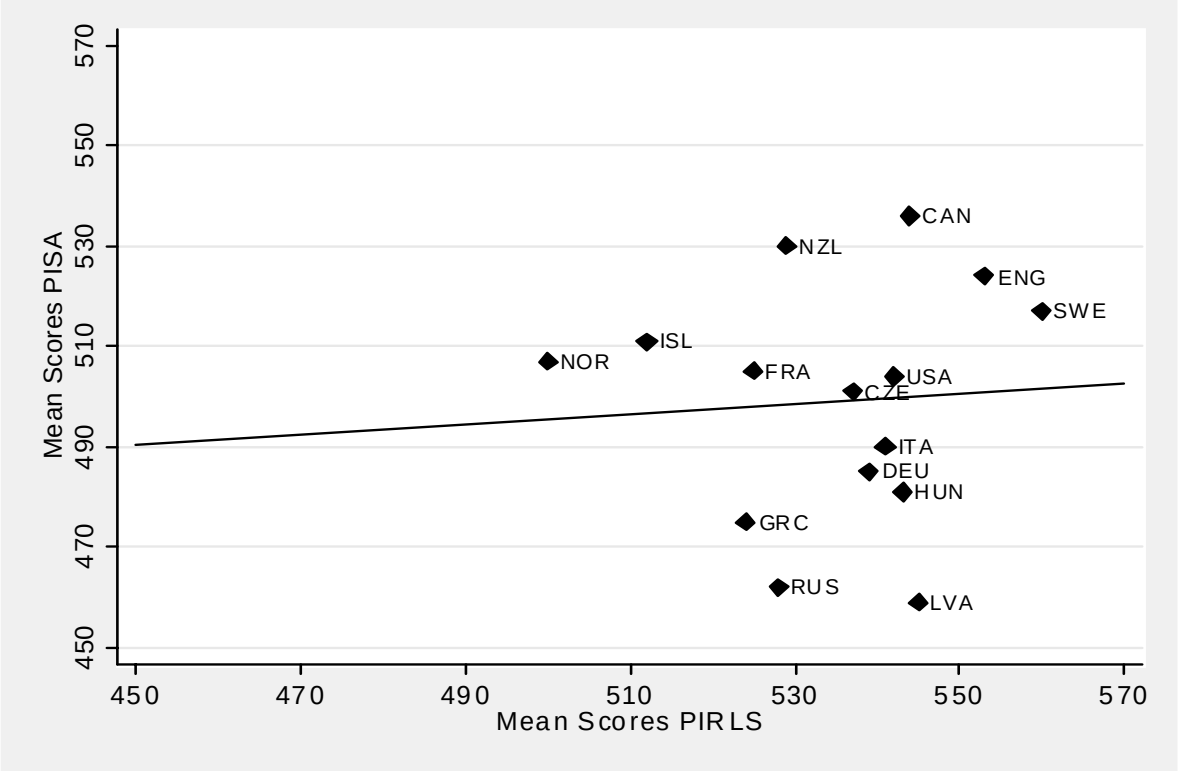

Figure 1: Mean test scores in PIRLS and PISA

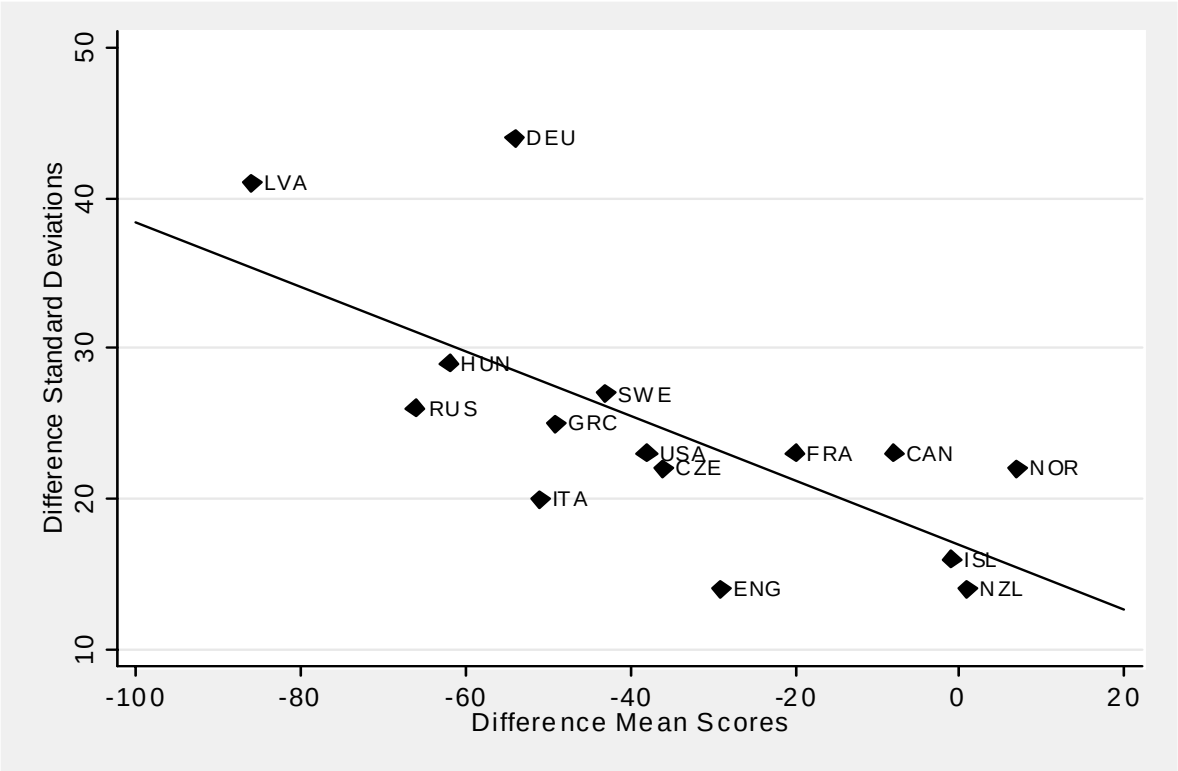

Figure 2: Difference in test scores and standard deviations between PISA and PIRLS

Figure 2 shows the relationship between the difference between PIRLS and PISA in mean test scores and in the standard deviations. The negative slope of the trend line, which is significant at the one percent level, implies that an increase in mean scores is associated with a decrease

of the spread of scores. The greatest outlier is Germany, whose standard deviation increased immensely from the PIRLS to the PISA study. This finding further motivates this study because more equal educational opportunities seem to be positively linked to higher mean test scores.

The relevant variables like parents' education and number of books at home have been transformed in the data in order to be comparable. All student background variables have been transformed into dummies except student age. The effects of the student background variables should therefore not only be comparable across countries but also across studies. Table A5 presents the correlation coefficients between the country means from the two studies for variables which should have similar mean values, although the sample of students and their age differ. For the origin of parents, the number of books at home and the school location the correlation coefficients are reasonably high both for the mean values computed with and without the imputed values. Especially the high coefficients for books at home indicate that this is a trustworthy measure of home resources. The coefficients are quite low instead for the language spoken at home and some categories of parents' education, especially for the country means including imputed values. This may be due to the fact that different categories are used in the studies to report education and that the share of missing values for education is relatively high (see Table A4). In PIRLS, the share of secondary schooling is relatively high compared to PISA, in which the share of university education is relatively high for most countries.

The studies have been conducted in 2000 (PISA) and 2001 (PIRLS). The lag of one year should not affect the comparability, as long as the studies themselves have been carried out in a short time span. The determinants of test scores should therefore be comparable as well. Even if the studies differ somewhat, the difference should be systematic across all countries and any deviations from a common pattern can still be explained by schooling systems. Therefore, the comparison of the descriptive evidence but not the analysis on the link between institutions and educational opportunity depends crucially on the comparability of the two studies.

3 Estimation strategy

This section first shows how educational opportunities are estimated and then derives the estimation strategy for estimating the link between educational opportunities and schooling institutions.

3.1 Estimating the effect of student background on student performance

A thorough comparison of student performance in the schooling systems of the countries presupposes the knowledge of the process by which education is produced. Educational production functions provide a means of understanding the production process by estimating the effects that various inputs have on student achievement. For the estimation to yield unbiased estimates of the effects, all current and prior inputs that are likely to determine educational performance should be included in the production function. The cross-sectional PIRLS and PISA data give information on the background of each student, the current school resources including teacher characteristics as well as the institutional setting at the school level. However, no information on prior achievement of students or inputs into educational production at another time is available. This missing information on prior inputs limits the estimation of educational production functions using cross-sectional data, as already noticed by Todd and Wolpin (2003). Therefore, the coefficients of the following model of an educational production function can only be interpreted as causal effects under certain assumptions, as will be explained below.

(1) $$T_{is} = \beta_0 + \beta_1 B_{is} + \beta_2 D_{is} + \upsilon_S + \varepsilon_{is}$$

T_{is} is the reading test score of student i in school s, B_{is} is a set of student background variables including student's sex and age, parents' origin, education and attitude towards reading, the language spoken at home, the number of books at home, the school's location and D comprises dummies for the grade levels. υ_s and ε_{is} are the error terms at the school and student level, respectively. The parameter vectors β_0 to β_2 are to be estimated using weighted cluster-robust linear regressions (CRLR) with schools being clusters. The analysis refers only to reading literacy because it is the only proficiency that is tested in both PIRLS and PISA.

Besides innate ability, which cannot be measured, the background of students has been shown to be the most decisive factor explaining student performance (cf. Hanushek and Luque, 2002; Woessmann, 2003b). The student background variables are unlikely to change much over time and are hence a good proxy also for prior inputs of student background. Their effect on the cognitive achievement of students can therefore be interpreted essentially as a causal relationship. In schooling systems in which the enrolment age is not strictly regulated but depends on the characteristics of students or parents, the grade level dummies in model (1) may be endogenous. Therefore, estimations using only one grade level will be performed as well. By including only variables on the student background and none on schools, we get the total effect of student background on performance. Any indirect effects of background on previous performance and school choice are included.

3.2 Relating educational opportunities to educational institutions

Determining the role of institutions in international comparisons of schooling systems depends crucially on the assumption that one can control for country-specific differences such as cultural and social factors. It is however doubtful that traditional behavior and attitudes towards education can be grasped by standard variables. Instead, the strategy chosen here is to eliminate country-specific factors by combining a two-step procedure with a differencing out approach. First, not the level of educational opportunities but the changes between grade four and grade nine in educational opportunities are estimated for each country. In a second step, these changes are related to changes in institutions of the schooling systems. The intuition behind the estimation strategy is the following. When we consider the relationship between the share of students that attend private schools and the effect of parents' education on student performance, we would expect a higher impact of parents' education in countries in which we observe a large private school sector, given that private schools provide better schooling for students from a higher social background. Relating the effect of parents' education to the size of the private school sector in lower secondary education would only show this relationship if there were no other differences between countries that could explain the size of the effect of parents' education on student performance. Therefore, the estimation strategy relates the changes in the effect of parents' education between grade four and grade nine to the changes in the size of the private school sector.[4] In countries in which the size of the private school sector increases strongly between the two grades, we expect that the effect of parents' education on student performance increases as well. However, in countries in which the importance of private schools is the same in grade four and grade nine, there should be no change in the effect of parents' education, irrespective of the absolute size of the private school sector. The details of the estimation strategy are presented more formally below.

The first problem we face is that the two studies on which the analysis builds are not identical and the skills tested might differ slightly. If we assume that the PIRLS study is the reference study, the PISA test score is only an imperfect measure of what students would have achieved in a PIRLS-like test at grade nine. The educational production function for the 'true', that is PIRLS-like test of students at grade *9*, would be:

$$\widetilde{T}_{9yi} = \widetilde{\beta}_{09y} + \widetilde{\beta}_{19y}\widetilde{B}_{9yi} + \widetilde{\varepsilon}_{9yi} \,. \tag{2}$$

[4] 'Grade nine' refers to the PISA data and actually includes all 15 year-old students in grades eight, nine and ten. The estimations were also run only for students in grade nine to check for a possible selection bias due to the PISA sampling design (see sections 2.2 and 5.4).

The subscript *9* implies that students are tested in grade nine, *y* indicates the country and *i* the individual. The index for schools has been dropped for simplicity. However, we can only estimate the following equation using PISA data:

(3) $$T_{9yi} = \widetilde{\beta}_{09y} + \widetilde{\beta}_{19y} B_{9yi} + \widetilde{\varepsilon}_{9yi} + e_{yi}$$

We assume that (A1) $B_{9yi} = \widetilde{B}_{9yi}$, i.e. the measures of student background are identical in PIRLS and PISA. The test score in PISA T_{9yi}, however, is only an imperfect measure of the 'true' test score $\widetilde{T}_{9yi}$. There is hence a measurement error $e_{yi} = T_{9yi} - \widetilde{T}_{9yi}$. The 'true' production function then can be written as:

(4) $$T_{9yi} = \beta_{09y} + \beta_{19y} B_{9yi} + \varepsilon_{9yi} + e_{yi}$$

In case the measurement error e_{yi} is not related to student background B_{9yi}, the coefficient β_{19y} is unbiased and equals $\widetilde{\beta}_{19y}$. This might not be completely true because the difference in testing between the 'true' and the PISA test could e.g. favor a certain sex or native students compared to immigrant students. It is hence assumed that Cov ($B_{9yi,}$ e_{yi}) ≠ 0 but rather small. A somewhat stricter assumption is (A2) Cov ($B_{91i,}$ e_{1i}) = Cov ($B_{92i,}$ e_{2i}) = …= Cov ($B_{914i,}$ e_{14i}). This assumption implies that the correlation between student background and measurement error is identical across all countries. Since both studies are designed to be internationally comparable, the difference between the studies should not change across countries. Under assumption (A2), $\beta_{19y} = \alpha\widetilde{\beta}_{19y}$, with α being close to one.

In a second step, the estimated coefficient β_{19y} is now explained by the institutional setting *I* in country *y*. For this estimation we have only one observation per country.

(5) $$\beta_{19y} = \gamma_{09} + \gamma_{19} I_{9y} + \gamma_{29} C_y + \upsilon_{9y},$$

where C_y are unobservable country-specific factors such as culture, educational traditions and so forth. This or a similar equation is mostly estimated in previous studies, where C_y is either omitted or replaced by proxy variables such as GDP per capita. However, it is likely that schooling institutions are strongly linked to cultural background which can hardly be grasped by proxy variables, i.e. Cov (I_{9y},C_y) ≠ 0. In this case γ_{19} is biased and we cannot observe the relationship between institutions and educational opportunities. In order to overcome this problem of omitted variables, we explain the differences in coefficients instead of the level of coefficients by changes in institutions. The difference-in-differences approach also controls for a difference in the correlation between student ability and student background across countries, as long as this correlation does not change differently over student age. Hence, the first step equation for students in grade four is subtracted from equation (5).

(6) $$\beta_{19y} - \beta_{14y} = \gamma_{09} - \gamma_{04} + \gamma_{19} I_{9y} - \gamma_{14} I_{4y} + \gamma_{29} C_y - \gamma_{24} C_y + \upsilon_{9y} - \upsilon_{4y}$$

If we assume that the effects of the institutional factors I_y and unobservable country-specific factors C_y on educational opportunities do not change between grade four and grade nine, i.e. (A3) $\gamma_{14} = \gamma_{19}$ and (A4) $\gamma_{24} = \gamma_{29}$, we get

(7) $$\beta_{19y} - \beta_{14y} = \gamma_{09} - \gamma_{04} + \gamma_{19}(I_{9y} - I_{4y}) + \upsilon_{9y} - \upsilon_{4y}\,.$$

Moreover, we have to assume that no anticipation effects take place, i.e. that institutional features in lower secondary education take effect already in primary education. Equation (7) is being estimated for those institutions on which we got information for primary and lower secondary education. For one institutional feature, the degree of school autonomy, information is only available for grade nine. Here, we have to assume that school autonomy is identical across all countries at grade four, i.e. (A5) $I_{41} = I_{42} = \ldots = I_{414}$. Hence, we can only exploit the variation in school autonomy at grade nine. Equation (7) then turns to

(8) $$\beta_{19y} - \beta_{14y} = \delta_0 + \gamma_{19} I_{9y} + \upsilon_{9y} - \upsilon_{4y}\,,$$

where the intercept is $\delta_0 = \gamma_{09} - \gamma_{04} - \gamma_{14} I_4$. The coefficient of interest in equations (7) and (8) is γ_{19}. The dependent variable $\beta_{19y} - \beta_{14y} = \alpha\widetilde{\beta}_{19y} - \beta_{14y}$ is the change in educational opportunity between PIRLS and PISA. For each student background variable, we have one dependent variable that is regressed on the changes in one characteristic I of the schooling systems at a time. As the outcome variable of the second step is estimated in the first step, the second step regressions are weighted by the inverse of the standard error of the coefficient $\beta_{19y} - \beta_{14y}$ (cf. Card and Krueger, 1992).[5] So for each student background variable, there are separate regressions for each institutional variable, having a single observation for each country. The institutional variables are presented in part 5.

The results are almost identical when assumption (A3) is relaxed. However, we loose a further degree of freedom in the second-step estimation and the estimates are less precise. Therefore, assumption (A3) is not relaxed in the estimations that are presented in the following section. In most countries considered in this analysis, the specific features of the schooling systems like streaming or a high share of private schools are introduced only after primary education. If this holds as well for the degree of school autonomy, assumption (A5) should hold. Under the assumption that country-specific factors do not change between the fourth and ninth/tenth grade except for the schooling system (A4), country-specific factors are largely eliminated by this estimation strategy. The results should be interpreted as

[5] It would actually be preferable to estimate the two-step model in a system of equations using the minimum-distance procedure. Since the two-step model serves only as an introduction to the preferred pooled model, the difference in methods is not decisive.

correlations, however, because the interaction effects may be determined by other observable and unobservable institutional variables as well, so that the estimate γ_{19} may be biased due to omitted variables. Unfortunately, this very data demanding estimation strategy leads to a low amount of observations in the second step, which leaves little room to explain the interaction effects by several institutional features.

The two steps of the previous model can be integrated into one pooled model. In this model, all interaction effects can be estimated within one model, which mitigates the potential problem of omitted variables. The preferred pooled model is the following:

$$T_{yi} = \alpha_{0y} + \alpha_{1y} P + (\alpha_{2y} + \alpha_3 P + \alpha_4 P(I_9 - I_4))B_{yi} + \upsilon_{yi} . \quad (9)$$

Here, all students *i* from all countries *y* are pooled in one regression. *P* is a dummy that is one for observations from the PISA data and zero otherwise. The country-specific intercepts for PIRLS are denoted by α_{0y}, while $\alpha_{1y}P$ allows for country-specific intercepts for PISA. The coefficient α_{2y} measures the country-specific effect of student background, while α_3 indicates the change in the impact of student background from grade four to grade nine/ten. Notice that α_3 is not indexed by country. The cross-country variation that is spared is used to identify the interaction effects between student background and institutions. The coefficient of interest is α_4, which expresses the difference in the coefficient of the student background variable resulting from a change of the institution variable *I* between PIRLS and PISA by one unit. Similarly to the two-step estimation approach, it is assumed that the changes in educational opportunities vary with certain features of the schooling institutions. Only those interaction effects with institutional variables are included in model (9) that are supported by theoretical considerations (see section 5.2 and Table 5). By including all interaction effects in the model we can mitigate the potential problem of omitted variables in the second step of the two-step approach, making the pooled model preferable to the two-step model. The institutional variables are only included in the interaction with student background variables and not as additional explanatory variables because we want to explain the total effect of student background on test scores, including any effect via institutions like school types. This total effect for each country is then explained by differences in institutions across countries as in the two-step approach.

Equation (9) is estimated using weighted cluster-robust linear regression. The schools and not the countries are chosen as clusters because country-specific intercepts for both PIRLS and PISA and country-specific effects of student background are included in this pooled model. This should be sufficient to control for heterogeneity across countries and unobserved country-effects.

4 The degree of equality of educational opportunity

This section presents the estimates of student background effects on student performance, which serve as a proxy for educational opportunity here. Model (1) has been estimated separately for both datasets and each country. First the results from PIRLS for fourth-graders, then from PISA for ninth-/tenth-graders and finally the differences between the results are presented.

4.1 Effects at the end of primary education

Table 1 displays the estimates for the effect of student background variables on reading literacy, their significance-levels and the R^2 from the regressions.

Table 1: Estimates for grade 4 (PIRLS)

	CAN	CZE	DEU	ENG	FRA	GRC	HUN	ISL	ITA	LVA	NOR	NZL	RUS	SWE
Female	16.83*	11.50*	10.42*	20.33*	8.23*	20.20*	13.47*	18.23*	7.52*	19.31*	22.08*	27.36*	12.87*	22.63*
Age	-9.53*	-4.05	-15.42*	31.15*	-25.51*	2.95	-17.14*	22.43*	12.52*	-8.57*	25.72*	13.52‡	-5.62†	2.20
Parents' origin	-1.68	-8.17†	-12.35*	-1.39	-6.01†	-18.63*	-12.42*	-9.80†	-17.00*	3.30	-5.01	0.05	-15.53*	-12.28*
Language	-30.84*	-24.27*	-28.77*	-42.21*	-19.76*	-10.96‡	-35.08*	-29.94*	-28.76*	-16.93*	-34.64*	-47.20*	-37.36*	-27.62*
Books at home														
26-100	2.31	15.24*	13.55*	-6.52	12.07*	18.11*	18.49*	10.75†	9.49*	5.18	16.70†	-3.08	7.96‡	11.93*
101-200	15.60*	33.75*	28.56*	18.16†	20.96*	27.26*	25.00*	29.21*	25.49*	12.69†	27.84*	19.27†	15.83*	16.03*
>200	27.72*	39.00*	35.06*	26.88*	32.24*	39.77*	37.79*	25.80*	38.23*	11.90‡	34.17*	31.44*	18.05*	20.80*
Parents' educ.														
Upper Second.	9.62‡	17.11‡	24.12*	21.48*	12.41*	18.37*	24.87*	21.31*	17.37*	21.04*	32.03*	17.72‡	9.85	17.67*
Post-Second.	21.02*	35.68*	18.29*	34.69*	26.32*	34.21*	29.00*	33.02*	12.09‡	30.99*	--	40.86*	12.67‡	26.93*
University	51.80*	35.54*	33.61*	43.77*	34.23*	55.87*	52.26*	38.55*	28.36*	46.65*	51.27*	48.27*	30.17*	35.23*
School location														
City	-1.29	12.75†	-8.61†	2.53	5.08	14.15†	3.11	4.37	-2.29	8.25‡	16.26†	15.86†	4.79	-0.66
Rural	-14.32*	0.89	-9.49	-3.81	7.70	9.45	-3.87	-6.47	-24.20†	6.67	7.58	-10.27	--	-0.91
Parents' attit.														
High	6.70*	4.84‡	9.72*	17.76*	9.68*	15.89*	9.85*	-5.06‡	14.95*	10.77*	9.56†	26.54*	5.39†	6.23*
Low	-4.54	-7.32	3.65	2.70	-5.47	7.22	-1.74	-12.72‡	-0.08	-1.48	-3.57	-11.33	5.27	-9.25†
R-Square	0.17	0.15	0.25	0.18	0.26	0.24	0.29	0.11	0.16	0.16	0.15	0.21	0.14	0.15

Coefficients from cluster-robust linear regressions (CRLR), weighted by students'sampling probabilities.
Significance-levels: * 1 percent, † 5 percent, ‡ 10 percent. Dependent variable: PIRLS reading literacy score.

The estimated coefficients are highly significant for most variables and countries. Especially the effects of books at home and of the education of parents are of a high magnitude. The sign of the effects is as expected for all variables. The only significant counter-intuitive effect is a negative coefficient for a favorable attitude of parents in Iceland. The R-squared varies between 11 percent in Iceland and 29 percent in Hungary.

The coefficients and their significance-levels of the regressions using only the observations with no imputed values are presented in Table A6. Few coefficients change the significance-level or sign and no signs of significant coefficients change in comparison to

Table 1. The R-squared is higher in most countries for the regressions using only the original data.

4.2 Effects at lower secondary education

Table 2 presents the estimates from the PISA study. Similarly to the former estimates, most coefficients are highly significant and are of the expected sign. Only the effect of parents' origin is positive in three countries. The R-squared is consistently higher in all countries compared to the regressions for primary education, which could imply that student background has a higher effect on student performance in lower secondary than in primary education relative to other factors like innate ability. The R-squared ranges from 15 percent in Iceland to 52 percent in France. The higher values may also be partly due to differences in both what is measured and how it is measured in the two studies.

Table 2: Estimates for grade 9/10 (PISA)

	CAN	CZE	DEU	ENG	FRA	GRC	HUN	ISL	ITA	LVA	NOR	NZL	RUS	SWE
Female	26.48*	21.11*	22.60*	23.99*	16.01*	33.23*	24.68*	35.41*	25.81*	42.63*	36.37*	39.64*	33.19*	29.69*
Age	-1.95	-27.44*	-60.22*	17.61*	0.00	5.71	-35.24*	7.61	11.83*	-27.90*	19.27*	29.14*	-13.35†	15.70*
Parents' origin	2.74	7.47†	20.80‡	2.44	-6.98*	5.56	-5.04	-8.88	16.21*	-8.01	-9.24‡	6.53‡	3.11	0.79
Language	-34.15*	-16.73	-66.20*	-45.67*	-22.85*	-38.84*	--	-29.12†	-30.38*	-25.93†	-30.68*	-82.18*	-4.42	-43.29*
Books at home														
26-100	20.12*	24.25*	36.76*	27.60*	20.67*	22.00*	24.31*	15.76*	17.01*	7.49	22.67*	35.97*	16.83*	24.75*
101-200	30.27*	40.01*	61.87*	52.24*	33.18*	33.32*	46.30*	33.89*	28.56*	32.24*	51.08*	57.04*	44.04*	38.77*
>200	38.99*	60.09*	76.25*	63.13*	39.26*	47.77*	60.77*	47.65*	33.07*	42.48*	54.09*	68.15*	49.44*	61.49*
Parents' educ.														
Upper Second.	--	4.66	14.57†	9.43	8.79†	17.71*	24.90*	15.03*	12.44*	12.12	19.25*	19.39*	23.86†	12.78†
Post-Second.	--	28.06*	39.38*	50.22*	14.17*	29.75*	53.12*	22.88*	20.99*	19.71†	9.69	40.11*	35.71*	18.38*
University	19.07*	61.18*	40.32*	29.11*	8.13†	38.13*	78.73*	25.57*	26.78*	29.48*	13.61†	29.85*	43.07*	11.86†
School location														
City	--	-0.47	-10.57	0.83	5.00	14.66‡	19.94*	--	3.25	15.19‡	4.13	19.12*	18.60†	3.44
Rural	--	-23.75*	-16.65‡	-1.55	-0.62	-12.01	-26.42	--	10.56	-28.14*	-13.53*	-11.88‡	-19.64†	-4.99
Parents' attit.														
High	22.49*	9.51†	16.34*	31.24*	8.84*	6.01	7.31*	14.26*	1.68	11.01*	25.75*	15.13*	12.27*	13.10*
Low	-27.02*	-20.72*	-9.14	-25.00*	-13.79*	-22.53*	-13.29*	-30.01*	-23.50*	-16.01*	-38.92*	-19.94*	-15.55*	-33.42*
R-Square	0.21	0.31	0.41	0.20	0.51	0.25	0.42	0.15	0.28	0.28	0.19	0.25	0.23	0.23

Coefficients from cluster-robust linear regressions (CRLR), weighted by students' sampling probabilities.
Dummies for grade levels are included in regressions.
Significance-levels: * 1 percent, † 5 percent, ‡ 10 percent. Dependent variable: PISA reading literacy score.

Table A7 displays the coefficients for the original data without any imputed values. For some of the estimates the significance-level or sign changes compared to Table 2 but no signs of significant coefficients change. The R-squared are higher in the regression without imputed values for most countries.

4.3 Comparison of results

This section compares the estimates of the educational production functions from the previous section in two ways. First, the effects will be aggregated and compared by a ranking of countries. Second, the individual interaction effects between PIRLS and PISA will be discussed.

Table 3 presents the sum of selected coefficients from the educational production functions, which constitute the difference in PIRLS / PISA test score points between students with an unfavorable and a favorable background. The countries are ranked by the estimates for PISA.

Table 3: Difference in test score points between favorable and unfavorable student background

Country	PIRLS	PISA	PISA-PIRLS
ITA	119.87	114.45	-5.42
FRA	100.47	116.48	16.01
CAN	128.87	165.46	36.59
RUS	113.98	174.47	60.49
ISL	122.32	190.90	68.58
GRC	145.43	192.96	47.53
SWE	118.56	197.05	78.49
LVA	91.49	203.69	112.20
CZE	118.48	205.62	87.14
HUN	151.02	216.24	65.22
ENG	134.58	217.25	82.67
NOR	147.17	222.19	75.02
DEU	120.21	226.70	106.49
NZL	154.22	260.24	106.02

Sum of coefficients = ‘female’-‘parents’origin’-‘language’+‘books>200’+‘university’.
Countries are ranked by results for PISA.

At grade four, student background has the lowest impact in Latvia and France and the highest in Hungary and New Zealand. The difference between the lowest and highest ranked countries amounts to 63 test score points. At grade eight/nine instead, the difference between the two countries at the extreme is 146 points. These countries are Italy with a very low impact of student background on PISA results and New Zealand again with a very high impact. The last column in Table 3 displays the difference between the two studies. Italy is the only country for which the aggregated effect of the selected student background variables decreases at grade eight/nine compared to grade four. In all other countries the impact increases strongly, most notably in Latvia, Germany and New Zealand.

In the following, the results from the two studies are compared by presenting the interaction effects, which show how the effects of student background variables on student

performance – i.e. the educational opportunities - change between the end of primary and lower secondary education.

Table 4: Differences in the effects of student background between grade four and grade nine/ten

	CAN	CZE	DEU	FRA	GRC	HUN	ISL	ITA	LVA	NOR	NZL	RUS	SWE
Female	+	+	+	+	+	+	+	+	+	+	+	+	+
Age	+	-	-	+		-	-		-		+	+	+
Parents' origin		+	+		+			+	-			+	+
Language			-		-						-	+	-
Books at home													
26-100	+	+	+	+							+	+	+
101-200	+		+	+		+			+	+	+	+	+
>200	+	+	+			+	+		+	+	+	+	+
Parents‘ education													
Upper Second.													
Post-Second.			+	-		+						+	
University	-	+		-	-	+	-			-			-
School location													
City						+							
Rural		-						+	-	-		-	
Parents‘ attitude													
High	+						+	-		+		+	
Low	-		-		-		-	-		-		-	-

Signs reflect the difference in the impact of student background on performance between PIRLS and PISA that are significant at the 10 percent-significance-level.

A plus in Table 4 indicates an increase in the coefficient β_1 in equation (1) between PIRLS and PISA, which would imply a diminishing effect if the coefficient for PIRLS is negative. Looking at the characteristics of the students, the sex of students has a stronger positive impact on student reading performance in almost all countries. Girls have expanded their advantage compared to boys at grade nine/ten compared to grade four. Changes in the effect of age are not consistent across countries.

The following variables indicate the social and cultural background of students. The positive signs for parents' origin imply that a foreign born parent has a less negative or even positive impact on student performance at grade nine/ten. However, speaking a different language at home has a more negative effect in four countries. The number of books at home has gotten more important for student performance. This finding is consistent across almost all countries. Parents' education has less impact on the performance of 15-year old students in seven countries, while the effect has increased in four countries. The effect of community location is apparently relatively constant across student age. A rural location has a stronger negative effect in four countries. The changes in the effect of parents' attitude are fairly consistent across countries and depict a stronger impact on student performance.

The changes in the educational opportunities indicate that student characteristics and family background are getting more important for determining student performance in almost all countries. The equality of opportunity seems thus to decrease between primary and secondary education. However, the results also show that the attitude and interest of students and parents are becoming more influential (e.g. language spoken at home, books at home, parents' attitude), while other factors are loosing their importance (e.g. parents' origin and education). Therefore, the educational opportunities seem to increase for individuals with the right attitude towards education.

As the two studies are not directly comparable, it remains unclear what part of the changes in the educational opportunities is due to differences between the studies and what changes really take place, though. The difference in the test design as well as the scaling of the test scores might cause a systematic greater dependence of test scores on student background in PISA compared to PIRLS. [6] Even then, the result that the structure of educational opportunities changes should hold because the systematic difference should affect all student background variables. The comparison of the two studies in section 2.4 showed that the definition of the background variables might differ between the studies, especially for parents' education. The seemingly stricter definition of university education in PIRLS compared to PISA might at least partly explain the estimated negative signs in Table 4.

5 The role of institutions

This section aims at establishing the link between the institutional setting of the schooling systems and the former results on changes in the educational opportunities in the countries. First, the schooling systems of the different countries will be described according to certain criteria. Second, theoretical considerations on the link between schooling systems and educational opportunities will be pointed out before the empirical evidence will be presented.

5.1 Schooling systems

Although all countries except for Canada and New Zealand are European countries, their cultural background and population as well as their institutions may differ to a great degree. Moreover, the educational expenditures from the public and private side may differ. According to the general cultural background, the former socialist countries CZE, HUN, LVA and RUS, the Scandinavian countries NOR and SWE and the Western European countries

[6] The hypothesis of a lower degree of equality is supported by the higher R-squared in the regressions at grade nine/ten than at grade four, which should be largely independent of the scaling of test scores but not of the test design.

DEU, FRA and ITA are likely to feature similar schooling systems. In the following, the countries will be described by the criteria schooling institutions, educational expenditures, and country and population.

Table A9 in the appendix presents some features of the national schooling systems and of educational expenditures as well as country and population facets. Although there is no obvious link between the general cultural background and the institutional setting, the figures point at similarities within the groups of countries mentioned above. The total intended instruction time per year is relatively low in the Scandinavian countries and in ISL. Furthermore, compulsory education is organized in a single structure system in these three countries and the PISA indices of school autonomy are comparatively high, which is consistent with the Nordic ´local control´ model of educational control (cf. Green et al., 1999, p. 91 et sqq.).

In CZE, HUN and RUS lower secondary education is differentiated into two school types. Besides the single structure schools which are attended by most of the students, a low but growing number of students attends separated secondary schools (*gymnazium*) (cf. Anweiler et al., 1996, p. 21). The PISA index of school autonomy is high in CZE and HUN as well as the private education expenditures as share of total education expenditures. However, the rate of students in private schools is rather low in these countries. This ratio is remarkably high in France (21 percent), whereas the relative private education expenditures in France are about average. The high German figure is due to the vocational training in the dual system. In general, the parameter values of the Western European countries DEU, FRA and ITA do not point at similar schooling systems, in terms of e.g. the number of school types, the total intended instruction time or the offer of special language training for low achievers.

The dispersion of educational expenditures is relatively low, the expenditures on educational institutions as a percentage of GDP are higher than average in the Nordic countries, in France and in New Zealand. The country and population data indicate a higher female employment rate and also a tendency to a higher stock of foreign population in countries with a relatively high rate of urban population.

5.2 Theoretical aspects

This part describes the expected links between changes in educational opportunities and the school systems by making theoretical considerations and referring to the available literature. According to the estimation strategy outlined in section 3.2, changes in the impact of student background on student performance should be related to changes in schooling institutions.

Student characteristics

The origin of students and the language spoken at home may be related to the support immigrant students receive at school. The differentiation of the schooling system could be linked to the effect of origin or language spoken at home. On the one hand, a grouping according to the ability of students could harm immigrant children because they are allocated to lower school types. On the other hand, if immigrant children are better supported in specialized schools, where teachers have more time to deal with their needs, a differentiated school system could have a beneficial effect for immigrant children. The relation between the interaction effect of being an immigrant and the number of school types is therefore ambiguous.

Social background

The social origin of students is indicated by the number of books at home and parental education. Social differentiation might be both reduced and increased by the use of streaming in lower secondary education, i.e. when students are allocated to different school types according to their ability. The direction of the link depends on whether school types for low achievers succeed in supporting these students and whether mobility between school types is sufficiently high. This is partly determined by peer effects, i.e. in how far which kind of students benefit from a more homogeneous or heterogeneous class composition. For a discussion of streaming in the literature see Heath (1984) or Slavin (1990). When access to higher school types depends on social background, students from a high social background are always advantaged because they have a wider choice of schools to attend. Especially when streaming takes place early in a child's life, the effect should be great. Evidence for England supports the hypothesis that especially high ability students from a high social background benefit from streaming (Galindo-Rueda and Vignoles, 2004). Although private schools seem not to affect the performance of students on the average (Vandenberghe and Robin, 2004), they may offer a further mode of differentiation, by which children from a high social background benefit from possibly better private institutions. One factor which may reduce the effect of social origin is the time students spend in schools. Assuming that educational production takes place both at school and at home (cf. Todd and Wolpin, 2004), a high instruction time may limit the influence of the home production of education.

School location and parents' attitude

The school location effect may depend on the degree of differentiation of the schooling systems. In a system with many different school types and private schools, being a student in a rural area might have a negative effect because of the low accessibility of higher secondary schools in rural areas. However, this might also depend on the degree of urbanization in the country, so that an interaction effect between urbanization and differentiation of the school system might exist. There may also be a link between the autonomy of schools and school location because rural schools might suffer from a lack of resources and know how in the community, which might as well be the case for schools within large cities.

Parents' attitude towards their child's educational success may be linked to several factors. A high instruction time might limit the influence of parents, while a higher autonomy of secondary schools may increase the possible effect on student performance.

5.3 Empirical evidence

In order to test the hypotheses stated above, we estimate the pooled model presented in equation (9). Moreover, the estimates of the second step of the two-step model shown in equation (7) are presented as additional evidence in the appendix. The features that are used to describe the institutional setting include the number of school types, instruction time, share of students that attend private schools and an index of autonomy of lower secondary schools and are presented in Table A9 in the appendix. Recall that no information is available on school autonomy in primary education. Therefore, we have to assume that school autonomy is identical across countries in primary education to get consistent estimates.

Table 5 presents the estimates from equation (9), in which the changes in educational opportunities are interacted with the changes in institutional variables and are estimated in a pooled model including 12 countries.[7] Only the interaction effects which test the stated hypotheses are included in the regression. The effect of 1.44 indicates that the impact of having more than 200 books at home increases by 1.44 test score points from grade four to grade nine/ten when the share of students in private schools increases by one percentage point between primary and lower secondary education. Although the sign of the effects can be reasonably interpreted it is difficult to compare and interpret the size of the effects due to possible differences between PIRLS and PISA test scores. The results indicate a positive relationship between the impact of parents' origin and education and the number of school types. For language spoken at home, the link is negative. A higher instruction time is

associated with a lower impact of social background as indicated by the number of books at home. A higher degree of school autonomy is positively linked to the impact of a high parental attitude towards their child's education.

Table 5: Results from pooled model

	School types	Instruction time	Share of students in private schools	School autonomy
Female				
Parents' origin	**13.34*** **(4.91)**			
Language	**-15.81*** **(6.08)**			
>200 Books at home	2.20 (2.96)	**-.002*** **(.0006)**	**1.44‡** **(.80)**	
One parent univ. degree.	**12.17*** **(2.38)**	.0001 (.0005)	-.15 (.66)	
School location				
City	5.59 (5.91)			-3.67 (3.05)
Rural	-4.83 (6.36)			-1.18 (3.28)
Parents' attitude				
High		.0007 (.0007)		**3.22*** **(.99)**
Low		.0001 (.001)		2.24 (1.63)

Significance-level: * 1 percent. † 5 percent. ‡ 10 percent. Estimated using equation (9).

Table A7 in the appendix presents the coefficients and standard errors from the two-step model. Each coefficient represents a separate regression. The regressions include between 10 and 12 observations because Canada and England have been dropped since the data are not representative for the whole country. The low amount of observations is clearly a drawback of this estimation strategy, which is very data demanding. The results do not differ from the pooled model except for fewer significant effects. The estimates from non-parametric Nadaraya-Watson regressions of the interaction variables on institutional variables are presented in Figure A3. It serves as a graphical presentation of the link between the changes in educational opportunities and changes in schooling institutions but should be regarded cautiously because the amount of observations is too low for reliable non-parametric estimates, the estimator is sensitive to outliers and some regressors are not continuous.

[7] Since the information on institutions is not always available for all countries, separate regressions were performed for those institutional variables with missing values, always including all possible interaction effects.

Table 6 now compares the theoretical hypotheses on the link between educational opportunities and the institutional setting and the empirical evidence from the two estimation approaches. All of the expected effects are either supported by the empirical evidence or the empirical evidence is ambiguous, i.e. the effects are insignificant. The two different models that have been estimated always lead to the same sign of the effect whenever the estimates are statistically significant.

Table 6: Comparing theoretical hypotheses and empirical evidence on institutional effects

Dependent variable explanatory variable	Theoretical hypotheses	Empirical evidence from two-step analysis	Empirical evidence from pooled estimation
Parents' origin			
Number of school types	Ambiguous	Positive	Positive
Language			
Number of school types	Ambiguous	--	Negative
Books at home			
Number of school types	Positive	--	--
Share of students in private schools	Positive	Positive	Positive
Total intended instruction time	Negative	--	Negative
Parents‘ education			
Number of school types	Positive	Positive	Positive
Share of students in private schools	Positive	--	--
Total intended instruction time	Negative	--	--
Urban school location			
Number of school types	Negative	--	--
Autonomy of schools	Ambiguous	--	--
Rural school location			
Number of school types	Negative	--	--
Autonomy of schools	Ambiguous	--	--
Parents‘ attitude high			
Total intended instruction time	Negative	--	--
Autonomy of schools	Positive	--	Positive
Parents‘ attitude low			
Total intended instruction time	Positive	--	--
Autonomy of schools	Negative	-	--

Effects are significant at the 10 percent-significance-level. --: effects are insignificant.
Theoretical hypotheses are based on section 5.2, empirical evidence on section 5.3.

Unfortunately, much of the observed empirical evidence is not significant, which is probably partly due to the low number of countries for which data is available. The positive link between parents' origin and the number of school types seems to indicate that immigrant children profit from a diversified school system. However, a diversified school system seems

to worsen the problems for children who speak a different language at home. Thus, only when integration takes place, immigrant children can benefit from a diversified school system. One indicator of the social origin of students, parents' education, is positively linked to the number of school types. More choice of schools seems to benefit socially advantaged students, who have easier access to better schools. This also holds for the size of the private school sector, which is positively linked to the effect of books at home. The influence of parents seems to be limited by the time students spend in school, which follows from the theoretical discussion. Greater school autonomy is associated with a stronger absolute effect of positive parental attitude. Hence, school autonomy increases the possibility of parents to positively influence their child's school performance.

5.4 Robustness tests

Since the number of observations is very low and the results are hence likely to depend on single observations and might not be very robust, several tests for robustness have been performed using mainly the pooled model. [8] First, all regressions have been repeated using only the original data and not the imputed values. The number of observations in the pooled model then drops from 102,006 to 73,338. Two of the six formerly significant effects turn insignificant. These are the interaction effects between school types and language and number of books at home and private school sector.

Second, the two-step model has been estimated for three different values of the parameter α, 0.8, 1 and 1.2, which indicate the correlation between the 'true' PIRLS-like test for students in grade nine and the observed PISA test scores. The results are very similar for different values of α. Only the level of significance changes slightly in some cases.

Third, the pooled model has also been estimated including Canada and England where possible, i.e. whenever information on institutions is available. The results are almost identical to those shown in Table 5. The size of some coefficients changes slightly but both significance level and direction of the effects stay constant.

Fourth, the pooled model has been estimated using only students in grade four and grade nine or ten. Before, students from the PISA study could be in grade eight, nine or ten. The equations have been estimated using grade level dummies. However, depending on the school enrolment criteria, the grade level dummies might be endogenous in the equations and lead to biased estimates of educational opportunities. Therefore, only students from the most frequented grade level have been kept and the analysis was performed with this restricted

[8] Tables presenting the results for the robustness checks are available from the author upon request.

sample. The results are again very similar and no changes in significance levels or signs occur.

Fifth, the discrete variable on the number of school types has been replaced by a dummy which indicates whether countries use streaming in lower secondary schooling or not. The school type variable was defined in such a way that is represents the degree of streaming that is applied in the countries. Of course, this is difficult to assess and may be object to measurement error. The dummy variable allows for less variation between countries but can be defined more clearly. The results reinforce the presented evidence.

Overall, the results are very robust in spite of the few observations and the vague definitions of institutions like the degree of streaming. Only one of the five robustness tests leads to slightly different results, in which two effects turn insignificant. All other effects are always supported by all specifications.

6 Conclusion

Intergenerational mobility of human capital is largely determined by educational opportunities of students. Therefore, creating equal opportunities should be a main aim for policy-makers and could prevent from costly redistribution later on. The schooling systems and their institutional framework are a key factor for promoting equality of opportunity in education. This paper tries to explain cross-country differences in educational opportunities by analyzing the link between the institutional setting of schooling systems and educational opportunities. The estimation strategy, which exploits the information of changes in educational opportunities between two stages in a student's schooling career and differences in the institutional setting across countries and between primary and lower secondary education, controls largely for country-specific factors that invalidate other cross-country comparisons of institutional effects on student performance.

The empirical analysis builds on the international PIRLS and PISA studies on reading literacy. A comparison of the studies indicates that differences in mean scores are negatively linked to differences in standard deviations, i.e. an increase in mean scores is associated with a decrease in the spread of scores. The estimation of the effects of student background on student performance shows that the absolute effect of gender, the amount of books at home, the school location and parents' attitude increases between the end of primary and lower secondary education, while the effect of parents' origin and education seems to decrease.

The equality of opportunity seems to decrease between primary and secondary education because the impact of student background variables is higher at grade nine/ten than

at grade four in almost all countries. However, the results show that the attitude and interest of students and parents are becoming more influential, while other factors are loosing their importance. Therefore, educational opportunities seem to increase for individuals with the right attitude towards education. This finding should hold even if the two studies differ and the overall dependence on student background is greater in the PISA compared to the PIRLS study only due to the design of the study. For parents' education, a difference in definitions may partly explain the observed pattern.

It can be shown that institutions play a role in determining the educational opportunities of students. The evidence on the link between institutions and changes in educational opportunities is in line with theoretical hypotheses, whenever it is significant. The social origin of students, measured by the number of books at home and parental education, increases its effect on student performance in countries with a differentiated schooling system with several school types and a large private school sector. This supports the hypothesis that streaming and private schools benefit the performance of students from a better social background. The time students spend in schools seems to limit the effect of social origin upon student performance while higher school autonomy is associated with higher parental influence.

The results imply that schooling institutions can affect the equality of educational opportunities of students and have hence an impact on the intergenerational mobility of human capital. According to the findings, educational opportunities could be increased by a low differentiation of lower secondary education, a low share of private schools and a relatively high instruction time for example. School autonomy can have both a negative and a positive effect on student performance, which depends on the attitude of parents. However, these suggestions are based on findings of correlations and not of causal effects and should therefore be taken cautiously. Moreover, the effects of schooling institutions depend always on the implementation of policies within individual countries, which can hardly be measured.

The research has shown that little is known on the comparability of student performance studies so far. This knowledge would help to exploit further information from the available studies. Moreover, further research is needed in establishing a causal relationship between institutional framework and educational opportunities. Comparable data on the schooling systems of a higher number of countries is needed as well.

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Appendix

Table A1: Participation of students and schools in PIRLS and PISA

	CAN	CZE	DEU	ENG	FRA	GRC	HUN	ISL	ITA	LVA	NOR	NZL	RUS	SWE
PIRLS														
Number of students	8,177	3,005	7,515	3,126	3,503	2,478	4,650	3,635	3,502	3,014	3,388	2,458	4,092	6,027
Number of schools	204	141	211	131	145	145	216	133	184	140	136	156	206	146
PISA														
Number of students	29,005	5,170	4,981	9,228	4,642	4,580	4,808	3,193	4,782	3,842	4,062	3,632	6,686	4,362
Number of schools	1,118	221	220	363	178	158	195	131	173	155	177	154	247	155

Table A2: Means and standard deviations of the data including imputed values

	CAN	CZE	DEU	ENG	FRA	GRC	HUN	ISL	ITA	LVA	NOR	NZL	RUS	SWE
Scores														
PIRLS	544.7 (67.7)	537.2 (60.6)	539.7 (63.2)	553.3 (82.8)	525.9 (66.1)	524.7 (69.2)	543.6 (61.8)	513.2 (70.7)	540.7 (67.0)	544.7 (57.9)	500.3 (77.1)	530.2 (89.2)	527.9 (62.7)	561.1 (61.6)
PISA	536.4 (90.5)	501.0 (83.1)	485.1 (108.3)	524.5 (97.2)	505.2 (88.7)	474.7 (93.8)	481.3 (90.3)	510.7 (87.1)	490.5 (86.9)	459.1 (98.7)	507.4 (99.2)	530.4 (104.1)	462.0 (88.8)	517.0 (88.6)
Student Background Variables														
PIRLS														
Female	0.50 (0.50)	0.49 (0.50)	0.50 (0.50)	0.52 (0.50)	0.49 (0.50)	0.50 (0.50)	0.51 (0.50)	0.50 (0.50)	0.48 (0.50)	0.48 (0.50)	0.48 (0.50)	0.49 (0.50)	0.49 (0.50)	0.49 (0.50)
Age	10.02 (0.41)	10.51 (0.45)	10.54 (0.50)	10.21 (0.30)	10.12 (0.50)	9.95 (0.44)	10.67 (0.52)	9.72 (0.29)	9.85 (0.37)	11.05 (0.48)	9.97 (0.33)	10.05 (0.36)	10.28 (0.63)	10.80 (0.32)
Parents' origin	0.35 (0.48)	0.11 (0.32)	0.23 (0.42)	0.32 (0.47)	0.28 (0.45)	0.19 (0.39)	0.06 (0.24)	0.12 (0.33)	0.11 (0.32)	0.33 (0.47)	0.17 (0.38)	0.38 (0.49)	0.23 (0.42)	0.24 (0.43)
Language	0.16 (0.37)	0.07 (0.25)	0.10 (0.30)	0.12 (0.32)	0.13 (0.34)	0.06 (0.23)	0.04 (0.21)	0.11 (0.32)	0.04 (0.19)	0.08 (0.28)	0.08 (0.27)	0.16 (0.37)	0.15 (0.35)	0.10 (0.30)
Books at home														
< 11	0.05 (0.22)	0.01 (0.11)	0.06 (0.23)	0.04 (0.19)	0.10 (0.29)	0.09 (0.29)	0.04 (0.20)	0.01 (0.11)	0.11 (0.32)	0.03 (0.17)	0.02 (0.13)	0.05 (0.22)	0.10 (0.30)	0.03 (0.17)
11-25	0.10 (0.30)	0.07 (0.25)	0.11 (0.31)	0.06 (0.24)	0.13 (0.34)	0.14 (0.35)	0.07 (0.25)	0.04 (0.21)	0.20 (0.40)	0.07 (0.25)	0.05 (0.22)	0.10 (0.29)	0.16 (0.37)	0.06 (0.24)
26-100	0.48 (0.50)	0.42 (0.49)	0.42 (0.49)	0.63 (0.48)	0.40 (0.49)	0.51 (0.50)	0.27 (0.44)	0.23 (0.42)	0.38 (0.49)	0.32 (0.47)	0.25 (0.43)	0.45 (0.50)	0.36 (0.48)	0.24 (0.43)
101-200	0.17 (0.37)	0.21 (0.41)	0.16 (0.36)	0.12 (0.32)	0.16 (0.36)	0.12 (0.32)	0.21 (0.41)	0.22 (0.41)	0.13 (0.34)	0.21 (0.41)	0.20 (0.40)	0.17 (0.37)	0.17 (0.38)	0.20 (0.40)
>200	0.20 (0.40)	0.29 (0.45)	0.26 (0.44)	0.16 (0.36)	0.22 (0.41)	0.14 (0.35)	0.41 (0.49)	0.50 (0.50)	0.16 (0.37)	0.37 (0.48)	0.48 (0.50)	0.24 (0.42)	0.21 (0.41)	0.46 (0.50)
Parents' educ.														
No Second.	0.03 (0.16)	0.03 (0.18)	0.09 (0.28)	0.65 (0.48)	0.42 (0.49)	0.14 (0.35)	0.08 (0.28)	0.11 (0.32)	0.29 (0.46)	0.04 (0.28)	0.03 (0.16)	0.03 (0.18)	0.04 (0.19)	0.06 (0.23)
Upper Second.	0.24 (0.42)	0.69 (0.46)	0.20 (0.40)	0.09 (0.28)	0.16 (0.37)	0.39 (0.49)	0.57 (0.49)	0.36 (0.48)	0.48 (0.50)	0.37 (0.48)	0.42 (0.49)	0.39 (0.49)	0.26 (0.44)	0.34 (0.48)
Post-Second.	0.46 (0.50)	0.06 (0.24)	0.46 (0.50)	0.02 (0.13)	0.13 (0.33)	0.19 (0.39)	0.03 (0.17)	0.08 (0.28)	0.04 (0.18)	0.31 (0.46)	---	0.18 (0.39)	0.43 (0.49)	0.21 (0.41)
University	0.26 (0.44)	0.21 (0.41)	0.24 (0.43)	0.20 (0.40)	0.21 (0.41)	0.20 (0.40)	0.31 (0.46)	0.44 (0.50)	0.17 (0.38)	0.28 (0.45)	0.55 (0.50)	0.38 (0.48)	0.27 (0.44)	0.39 (0.49)
School location														
City	0.35 (0.48)	0.15 (0.36)	0.23 (0.42)	0.30 (0.46)	0.15 (0.35)	0.29 (0.45)	0.33 (0.47)	0.27 (0.45)	0.16 (0.37)	0.42 (0.49)	0.19 (0.39)	0.45 (0.50)	0.39 (0.49)	0.16 (0.37)
Town	0.56	0.73	0.75	0.68	0.78	0.66	0.62	0.60	0.80	0.51	0.66	0.46	0.61	0.77

	(0.50)	(0.44)	(0.43)	(0.47)	(0.41)	(0.47)	(0.48)	(0.49)	(0.40)	(0.50)	(0.47)	(0.50)	(0.49)	(0.42)
Rural	0.09 (0.28)	0.11 (0.31)	0.01 (0.12)	0.02 (0.14)	0.07 (0.26)	0.05 (0.21)	0.05 (0.21)	0.13 (0.34)	0.04 (0.19)	0.07 (0.25)	0.15 (0.36)	0.09 (0.28)	---	0.07 (0.25)
Parents' attit.														
High	0.70 (0.46)	0.69 (0.46)	0.52 (0.50)	0.82 (0.38)	0.48 (0.50)	0.68 (0.47)	0.75 (0.43)	0.72 (0.45)	0.57 (0.50)	0.48 (0.50)	0.76 (0.43)	0.70 (0.46)	0.51 (0.50)	0.74 (0.42)
Medium	0.27 (0.45)	0.28 (0.45)	0.39 (0.49)	0.14 (0.35)	0.48 (0.50)	0.27 (0.44)	0.23 (0.43)	0.25 (0.43)	0.38 (0.48)	0.50 (0.50)	0.21 (0.41)	0.26 (0.44)	0.45 (0.50)	0.22 (0.41)
Low	0.03 (0.17)	0.03 (0.18)	0.09 (0.28)	0.03 (0.17)	0.04 (0.19)	0.05 (0.22)	0.02 (0.15)	0.03 (0.16)	0.06 (0.23)	0.02 (0.15)	0.04 (0.19)	0.04 (0.20)	0.05 (0.21)	0.05 (0.21)
PISA														
Female	0.50 (0.50)	0.53 (0.50)	0.50 (0.50)	0.50 (0.50)	0.51 (0.50)	0.50 (0.50)	0.50 (0.50)	0.51 (0.50)	0.50 (0.50)	0.51 (0.50)	0.49 (0.50)	0.50 (0.50)	0.50 (0.50)	0.49 (0.50)
Age	15.79 (0.28)	15.72 (0.28)	15.70 (0.28)	15.62 (0.29)	15.79 (0.28)	15.70 (0.27)	15.71 (0.28)	15.63 (0.28)	15.72 (0.28)	15.72 (0.28)	15.73 (0.28)	15.70 (0.28)	15.70 (0.28)	15.72 (0.28)
Parents' origin	0.31 (0.46)	0.08 (0.27)	0.21 (0.40)	0.18 (0.38)	0.25 (0.43)	0.10 (0.31)	0.04 (0.19)	0.06 (0.24)	0.05 (0.22)	0.39 (0.49)	0.11 (0.31)	0.36 (0.48)	0.13 (0.34)	0.21 (0.41)
Language	0.13 (0.34)	0.01 (0.12)	0.16 (0.37)	0.05 (0.22)	0.08 (0.27)	0.04 (0.19)	---	0.02 (0.15)	0.22 (0.41)	0.09 (0.28)	0.13 (0.33)	0.14 (0.35)	0.08 (0.27)	0.10 (0.30)
Books at home														
< 11	0.06 (0.24)	0.02 (0.16)	0.08 (0.27)	0.08 (0.28)	0.11 (0.31)	0.11 (0.31)	0.04 (0.21)	0.03 (0.17)	0.09 (0.29)	0.04 (0.19)	0.06 (0.24)	0.06 (0.24)	0.07 (0.25)	0.06 (0.23)
11-25	0.18 (0.38)	0.11 (0.32)	0.20 (0.40)	0.21 (0.41)	0.23 (0.42)	0.30 (0.46)	0.13 (0.34)	0.11 (0.31)	0.21 (0.41)	0.10 (0.30)	0.13 (0.34)	0.18 (0.38)	0.17 (0.37)	0.14 (0.35)
26-100	0.20 (0.40)	0.21 (0.41)	0.22 (0.41)	0.21 (0.41)	0.21 (0.41)	0.26 (0.44)	0.19 (0.39)	0.20 (0.40)	0.23 (0.42)	0.19 (0.39)	0.18 (0.39)	0.21 (0.41)	0.20 (0.40)	0.18 (0.39)
101-200	0.24 (0.43)	0.28 (0.45)	0.21 (0.41)	0.21 (0.40)	0.20 (0.40)	0.16 (0.37)	0.22 (0.41)	0.25 (0.43)	0.21 (0.41)	0.27 (0.44)	0.23 (0.42)	0.23 (0.42)	0.22 (0.41)	0.24 (0.43)
>200	0.32 (0.47)	0.37 (0.48)	0.29 (0.45)	0.29 (0.45)	0.24 (0.43)	0.16 (0.37)	0.42 (0.49)	0.41 (0.49)	0.27 (0.44)	0.41 (0.49)	0.39 (0.49)	0.32 (0.47)	0.34 (0.47)	0.37 (0.48)
Parents' educ.														
No Second.	0.06 (0.24)	0.01 (0.10)	0.05 (0.22)	0.06 (0.24)	0.15 (0.35)	0.15 (0.35)	0.06 (0.23)	0.12 (0.32)	0.27 (0.44)	0.03 (0.17)	0.06 (0.24)	0.05 (0.21)	0.02 (0.15)	0.06 (0.24)
Upper Second.	---	0.30 (0.46)	0.46 (0.50)	0.33 (0.47)	0.20 (0.40)	0.05 (0.21)	0.31 (0.46)	0.25 (0.44)	0.12 (0.33)	0.03 (0.17)	0.13 (0.33)	0.25 (0.43)	0.02 (0.14)	0.08 (0.26)
Post-Second.	0.26 (0.44)	0.45 (0.50)	0.09 (0.29)	0.08 (0.26)	0.13 (0.34)	0.23 (0.42)	0.35 (0.48)	0.20 (0.40)	0.36 (0.48)	0.49 (0.50)	0.19 (0.40)	0.06 (0.25)	0.51 (0.50)	0.22 (0.41)
University	0.67 (0.47)	0.24 (0.43)	0.38 (0.49)	0.52 (0.50)	0.49 (0.50)	0.45 (0.50)	0.28 (0.45)	0.37 (0.48)	0.21 (0.41)	0.44 (0.50)	0.60 (0.49)	0.63 (0.48)	0.44 (0.50)	0.63 (0.48)
School location														
City	---	0.30 (0.46)	0.21 (0.41)	0.33 (0.47)	0.17 (0.38)	0.32 (0.47)	0.42 (0.49)	---	0.29 (0.46)	0.30 (0.46)	0.11 (0.31)	0.46 (0.50)	0.37 (0.48)	0.17 (0.38)
Town	---	0.61 (0.49)	0.72 (0.45)	0.60 (0.49)	0.77 (0.42)	0.63 (0.48)	0.56 (0.50)	---	0.69 (0.46)	0.49 (0.50)	0.51 (0.50)	0.42 (0.49)	0.32 (0.47)	0.61 (0.49)
Rural	---	0.09 (0.28)	0.06 (0.25)	0.08 (0.27)	0.06 (0.23)	0.05 (0.21)	0.02 (0.15)	---	0.02 (0.14)	0.20 (0.40)	0.39 (0.49)	0.13 (0.33)	0.31 (0.46)	0.22 (0.41)
Parents' attit.														
High	0.15 (0.36)	0.09 (0.29)	0.09 (0.28)	0.13 (0.33)	0.20 (0.40)	0.15 (0.36)	0.23 (0.42)	0.17 (0.38)	0.27 (0.44)	0.22 (0.41)	0.10 (0.29)	0.15 (0.36)	0.22 (0.42)	0.09 (0.29)
Medium	0.70 (0.46)	0.69 (0.46)	0.71 (0.45)	0.74 (0.44)	0.70 (0.46)	0.74 (0.44)	0.67 (0.47)	0.67 (0.47)	0.63 (0.48)	0.66 (0.47)	0.68 (0.46)	0.70 (0.46)	0.63 (0.48)	0.71 (0.45)
Low	0.15 (0.35)	0.21 (0.41)	0.20 (0.40)	0.14 (0.34)	0.10 (0.30)	0.11 (0.31)	0.09 (0.29)	0.16 (0.36)	0.10 (0.30)	0.12 (0.32)	0.22 (0.41)	0.15 (0.36)	0.15 (0.36)	0.19 (0.40)

Values are weighted by the sampling probability of the students. Standard deviations are reported in parentheses.

Table A3: Means and standard deviations of the data without imputed values

	CAN	CZE	DEU	ENG	FRA	GRC	HUN	ISL	ITA	LVA	NOR	NZL	RUS	SWE
Scores														
PIRLS	555.8 (65.3)	546.1 (57.2)	547.9 (61.8)	576.0 (82.0)	534.9 (63.4)	537.8 (63.6)	557.4 (57.3)	519.6 (69.4)	546.8 (65.6)	562.1 (51.6)	507.7 (76.0)	538.5 (87.4)	543.0 (58.3)	564.5 (61.2)
PISA	501.2 (106)	504.6 (81.1)	512.4 (90.7)	537.7 (92.4)	516.2 (83.2)	479.2 (91.3)	482.0 (86.6)	511.2 (86.8)	497.2 (83.9)	469.2 (95.9)	517.2 (94.5)	550.6 (96.0)	468.9 (86.7)	523.0 (86.0)
Student background variables														
PIRLS														
Female	0.50 (0.50)	0.49 (0.50)	0.50 (0.50)	0.52 (0.50)	0.49 (0.50)	0.50 (0.50)	0.51 (0.50)	0.50 (0.50)	0.48 (0.50)	0.48 (0.50)	0.48 (0.50)	0.49 (0.50)	0.49 (0.50)	0.49 (0.50)
Age	10.02 (0.41)	10.51 (0.45)	10.54 (0.50)	10.21 (0.30)	10.12 (0.50)	9.95 (0.44)	10.67 (0.52)	9.72 (0.29)	9.85 (0.37)	11.05 (0.48)	9.97 (0.33)	10.05 (0.36)	10.28 (0.63)	10.80 (0.32)
Parents' origin	0.39 (0.49)	0.12 (0.32)	0.25 (0.43)	0.33 (0.47)	0.30 (0.46)	0.19 (0.39)	0.07 (0.25)	0.13 (0.34)	0.12 (0.32)	0.35 (0.48)	0.18 (0.38)	0.41 (0.49)	0.24 (0.43)	0.24 (0.43)
Language	0.16 (0.37)	0.07 (0.25)	0.10 (0.31)	0.12 (0.32)	0.13 (0.34)	0.06 (0.24)	0.04 (0.21)	0.12 (0.32)	0.04 (0.19)	0.09 (0.28)	0.08 (0.28)	0.16 (0.37)	0.15 (0.35)	0.10 (0.30)
Books at home														
< 11	0.06 (0.24)	0.01 (0.12)	0.06 (0.24)	0.07 (0.25)	0.10 (0.30)	0.10 (0.30)	0.04 (0.20)	0.01 (0.11)	0.12 (0.32)	0.03 (0.18)	0.02 (0.14)	0.06 (0.24)	0.10 (0.30)	0.03 (0.18)
11-25	0.12 (0.33)	0.08 (0.26)	0.12 (0.33)	0.11 (0.31)	0.14 (0.35)	0.16 (0.37)	0.07 (0.26)	0.05 (0.22)	0.21 (0.41)	0.07 (0.26)	0.05 (0.23)	0.11 (0.32)	0.16 (0.37)	0.07 (0.25)
26-100	0.37 (0.48)	0.37 (0.48)	0.36 (0.48)	0.34 (0.47)	0.35 (0.48)	0.44 (0.50)	0.27 (0.44)	0.27 (0.44)	0.36 (0.48)	0.32 (0.47)	0.26 (0.44)	0.35 (0.48)	0.35 (0.48)	0.25 (0.43)
101-200	0.20 (0.40)	0.24 (0.42)	0.18 (0.38)	0.21 (0.41)	0.17 (0.38)	0.13 (0.34)	0.22 (0.40)	0.26 (0.44)	0.14 (0.35)	0.23 (0.42)	0.22 (0.42)	0.21 (0.40)	0.17 (0.38)	0.22 (0.42)
>200	0.24 (0.43)	0.30 (0.46)	0.27 (0.45)	0.28 (0.45)	0.23 (0.42)	0.16 (0.37)	0.40 (0.49)	0.40 (0.49)	0.17 (0.38)	0.35 (0.48)	0.45 (0.50)	0.28 (0.45)	0.21 (0.41)	0.42 (0.50)
Parents' educ.														
No Second.	0.03 (0.18)	0.04 (0.20)	0.12 (0.32)	0.35 (0.48)	0.31 (0.46)	0.17 (0.37)	0.08 (0.28)	0.13 (0.34)	0.30 (0.46)	0.05 (0.21)	0.03 (0.17)	0.04 (0.20)	0.04 (0.19)	0.06 (0.24)
Upper Second.	0.26 (0.44)	0.66 (0.47)	0.23 (0.42)	0.17 (0.38)	0.20 (0.40)	0.28 (0.45)	0.57 (0.50)	0.42 (0.49)	0.46 (0.50)	0.35 (0.48)	0.44 (0.49)	0.34 (0.47)	0.27 (0.44)	0.36 (0.48)
Post-Second.	0.37 (0.48)	0.07 (0.26)	0.36 (0.48)	0.03 (0.18)	0.16 (0.37)	0.23 (0.42)	0.03 (0.18)	0.10 (0.30)	0.04 (0.19)	0.34 (0.47)	---	0.22 (0.42)	0.42 (0.49)	0.23 (0.42)
University	0.32 (0.47)	0.22 (0.42)	0.27 (0.44)	0.36 (0.48)	0.23 (0.42)	0.23 (0.42)	0.30 (0.46)	0.33 (0.47)	0.18 (0.38)	0.26 (0.44)	0.53 (0.50)	0.37 (0.48)	0.27 (0.44)	0.35 (0.48)
School location														
City	0.37 (0.48)	0.19 (0.39)	0.31 (0.46)	0.38 (0.49)	0.21 (0.41)	0.38 (0.48)	0.42 (0.49)	0.35 (0.48)	0.16 (0.37)	0.44 (0.50)	0.24 (0.43)	0.45 (0.50)	0.56 (0.50)	0.19 (0.40)
Town	0.53 (0.50)	0.69 (0.47)	0.66 (0.47)	0.59 (0.49)	0.69 (0.46)	0.56 (0.50)	0.52 (0.50)	0.47 (0.50)	0.80 (0.40)	0.45 (0.50)	0.56 (0.50)	0.44 (0.50)	0.44 (0.50)	0.73 (0.44)
Rural	0.10 (0.30)	0.14 (0.35)	0.02 (0.14)	0.03 (0.17)	0.10 (0.30)	0.06 (0.24)	0.06 (0.24)	0.18 (0.39)	0.04 (0.19)	0.11 (0.31)	0.20 (0.40)	0.11 (0.31)	---	0.08 (0.27)
Parents' attit.														
High	0.64 (0.48)	0.64 (0.48)	0.55 (0.50)	0.69 (0.46)	0.53 (0.50)	0.64 (0.48)	0.74 (0.44)	0.67 (0.47)	0.56 (0.50)	0.48 (0.50)	0.73 (0.44)	0.65 (0.48)	0.51 (0.50)	0.71 (0.45)
Medium	0.32 (0.47)	0.32 (0.47)	0.35 (0.48)	0.26 (0.44)	0.43 (0.50)	0.31 (0.46)	0.23 (0.43)	0.30 (0.46)	0.37 (0.48)	0.50 (0.50)	0.23 (0.42)	0.30 (0.46)	0.45 (0.50)	0.24 (0.43)
Low	0.04 (0.19)	0.04 (0.20)	0.10 (0.30)	0.06 (0.23)	0.04 (0.21)	0.06 (0.23)	0.03 (0.16)	0.03 (0.18)	0.07 (0.25)	0.03 (0.16)	0.04 (0.20)	0.05 (0.22)	0.05 (0.22)	0.05 (0.22)
PISA														
Female	0.50 (0.50)	0.53 (0.50)	0.50 (0.50)	0.50 (0.50)	0.51 (0.50)	0.50 (0.50)	0.50 (0.50)	0.51 (0.50)	0.50 (0.50)	0.51 (0.50)	0.49 (0.50)	0.50 (0.50)	0.50 (0.50)	0.49 (0.50)
Age	15.79 (0.28)	15.72 (0.28)	15.70 (0.28)	15.62 (0.29)	15.79 (0.28)	15.70 (0.27)	15.71 (0.28)	15.63 (0.28)	15.72 (0.28)	15.72 (0.28)	15.73 (0.28)	15.70 (0.28)	15.70 (0.28)	15.72 (0.28)

Parents' origin	0.31 (0.46)	0.08 (0.27)	0.21 (0.41)	0.18 (0.38)	0.25 (0.43)	0.11 (0.31)	0.04 (0.19)	0.06 (0.24)	0.05 (0.22)	0.40 (0.49)	0.11 (0.31)	0.37 (0.48)	0.13 (0.33)	0.21 (0.41)
Language	0.11 (0.32)	0.01 (0.07)	0.08 (0.27)	0.04 (0.20)	0.05 (0.22)	0.03 (0.16)	---	0.02 (0.13)	0.18 (0.38)	0.07 (0.25)	0.06 (0.24)	0.10 (0.30)	0.07 (0.26)	0.07 (0.26)
Books at home														
< 11	0.06 (0.24)	0.03 (0.16)	0.08 (0.28)	0.09 (0.28)	0.12 (0.32)	0.11 (0.32)	0.05 (0.21)	0.03 (0.17)	0.09 (0.29)	0.04 (0.19)	0.07 (0.25)	0.06 (0.24)	0.07 (0.26)	0.06 (0.23)
11-25	0.18 (0.38)	0.11 (0.32)	0.20 (0.40)	0.21 (0.41)	0.22 (0.41)	0.28 (0.45)	0.14 (0.34)	0.11 (0.31)	0.21 (0.41)	0.10 (0.30)	0.14 (0.35)	0.17 (0.38)	0.17 (0.38)	0.14 (0.35)
26-100	0.20 (0.40)	0.21 (0.41)	0.23 (0.42)	0.21 (0.41)	0.22 (0.42)	0.27 (0.44)	0.20 (0.40)	0.21 (0.41)	0.23 (0.42)	0.19 (0.39)	0.19 (0.39)	0.22 (0.41)	0.20 (0.40)	0.18 (0.39)
101-200	0.24 (0.43)	0.28 (0.45)	0.21 (0.41)	0.21 (0.41)	0.22 (0.41)	0.17 (0.38)	0.22 (0.41)	0.26 (0.44)	0.21 (0.41)	0.28 (0.45)	0.23 (0.42)	0.23 (0.42)	0.22 (0.42)	0.24 (0.43)
>200	0.32 (0.47)	0.36 (0.48)	0.28 (0.45)	0.28 (0.45)	0.22 (0.42)	0.17 (0.38)	0.40 (0.49)	0.40 (0.49)	0.26 (0.44)	0.40 (0.49)	0.37 (0.48)	0.32 (0.47)	0.33 (0.47)	0.37 (0.48)
Parents' educ.														
No Second.	0.06 (0.24)	0.01 (0.11)	0.07 (0.25)	0.07 (0.26)	0.14 (0.34)	0.15 (0.36)	0.06 (0.23)	0.13 (0.33)	0.26 (0.44)	0.03 (0.18)	0.07 (0.26)	0.06 (0.24)	0.03 (0.16)	0.06 (0.24)
Upper Second.	---	0.29 (0.46)	0.41 (0.49)	0.30 (0.46)	0.22 (0.41)	0.05 (0.22)	0.29 (0.46)	0.24 (0.42)	0.12 (0.33)	0.03 (0.18)	0.15 (0.35)	0.26 (0.44)	0.03 (0.16)	0.08 (0.28)
Post-Second.	0.27 (0.44)	0.45 (0.50)	0.11 (0.31)	0.09 (0.28)	0.15 (0.36)	0.24 (0.43)	0.36 (0.48)	0.21 (0.41)	0.36 (0.48)	0.48 (0.50)	0.22 (0.41)	0.08 (0.28)	0.50 (0.50)	0.24 (0.43)
University	0.66 (0.47)	0.25 (0.43)	0.40 (0.49)	0.52 (0.50)	0.46 (0.50)	0.43 (0.50)	0.28 (0.45)	0.37 (0.48)	0.21 (0.41)	0.45 (0.50)	0.54 (0.50)	0.57 (0.49)	0.45 (0.50)	0.60 (0.49)
School location														
City	---	0.30 (0.46)	0.24 (0.43)	0.35 (0.48)	0.19 (0.39)	0.33 (0.47)	0.42 (0.49)	---	0.29 (0.46)	0.30 (0.46)	0.11 (0.32)	0.46 (0.50)	0.37 (0.48)	0.17 (0.38)
Town	---	0.61 (0.49)	0.69 (0.46)	0.56 (0.50)	0.74 (0.44)	0.63 (0.48)	0.56 (0.50)	---	0.69 (0.46)	0.47 (0.50)	0.49 (0.50)	0.42 (0.49)	0.32 (0.47)	0.60 (0.49)
Rural	---	0.09 (0.28)	0.07 (0.26)	0.09 (0.28)	0.07 (0.25)	0.05 (0.21)	0.02 (0.15)	---	0.02 (0.14)	0.23 (0.42)	0.40 (0.49)	0.13 (0.33)	0.31 (0.46)	0.22 (0.42)
Parents' attit.														
High	0.15 (0.36)	0.09 (0.29)	0.09 (0.29)	0.13 (0.33)	0.20 (0.40)	0.15 (0.36)	0.23 (0.42)	0.17 (0.38)	0.27 (0.44)	0.22 (0.41)	0.10 (0.29)	0.16 (0.36)	0.23 (0.42)	0.09 (0.29)
Medium	0.70 (0.46)	0.69 (0.46)	0.70 (0.46)	0.73 (0.44)	0.69 (0.46)	0.74 (0.44)	0.67 (0.47)	0.67 (0.47)	0.63 (0.48)	0.66 (0.47)	0.68 (0.47)	0.70 (0.46)	0.62 (0.49)	0.71 (0.45)
Low	0.15 (0.35)	0.22 (0.41)	0.21 (0.40)	0.14 (0.35)	0.10 (0.30)	0.11 (0.31)	0.09 (0.29)	0.16 (0.36)	0.10 (0.30)	0.12 (0.33)	0.22 (0.42)	0.15 (0.36)	0.15 (0.36)	0.20 (0.40)

Values are weighted by the sampling probability of the students. Standard deviations are reported in parentheses. For scores, all observations with imputed values were dropped. For student background variables, only the observations for which values of the respective variable were missing were dropped.

Table A4: Missing values in percent

	CAN	CZE	DEU	ENG	FRA	GRC	HUN	ISL	ITA	LVA	NOR	NZL	RUS	SWE
PIRLS														
Parents' origin	16.08	12.11	12.03	44.69	10.13	12.63	4.41	15.98	3.60	4.45	9.03	15.34	1.42	9.08
Language	2.42	1.16	3.23	0.35	2.31	1.41	1.31	2.67	0.29	1.13	1.51	1.46	1.20	2.11
Books at home	10.76	3.73	8.26	4.03	6.97	2.91	4.06	5.75	2.46	5.34	1.83	7.81	5.16	2.90
Parents' educ.	18.30	14.94	34.96	48.62	20.92	16.22	8.97	16.20	4.20	11.55	10.06	17.82	1.54	9.42
School location	9.03	16.47	27.73	26.74	24.69	19.17	40.47	28.47	2.51	28.00	19.78	14.89	34.38	10.87
Parents' attit.	17.46	17.24	14.72	45.62	13.85	14.61	6.43	18.02	13.19	8.23	10.98	17.33	6.99	9.36
PISA														
Parents' origin	0.59	0.56	1.91	1.92	5.41	2.99	2.18	1.69	1.19	1.69	2.61	1.93	1.62	0.80
Language	2.08	0.85	8.57	0.91	3.25	1.07	100.00	0.47	5.27	1.85	6.84	4.49	0.85	2.77
Books at home	0.60	0.29	1.49	1.21	0.82	0.50	0.64	0.16	0.54	0.96	0.76	1.07	0.97	0.28
Parents' educ.	4.74	4.33	18.35	15.36	12.04	6.53	5.53	8.36	4.41	12.21	10.78	26.79	20.04	10.06
School location	99.77	0.00	9.66	7.62	10.53	1.62	0.52	100.00	0.00	16.32	4.09	0.00	0.00	1.79
Parents' attit.	0.89	0.33	1.57	1.19	0.93	0.96	0.31	0.56	0.46	0.68	0.64	0.74	2.75	0.46

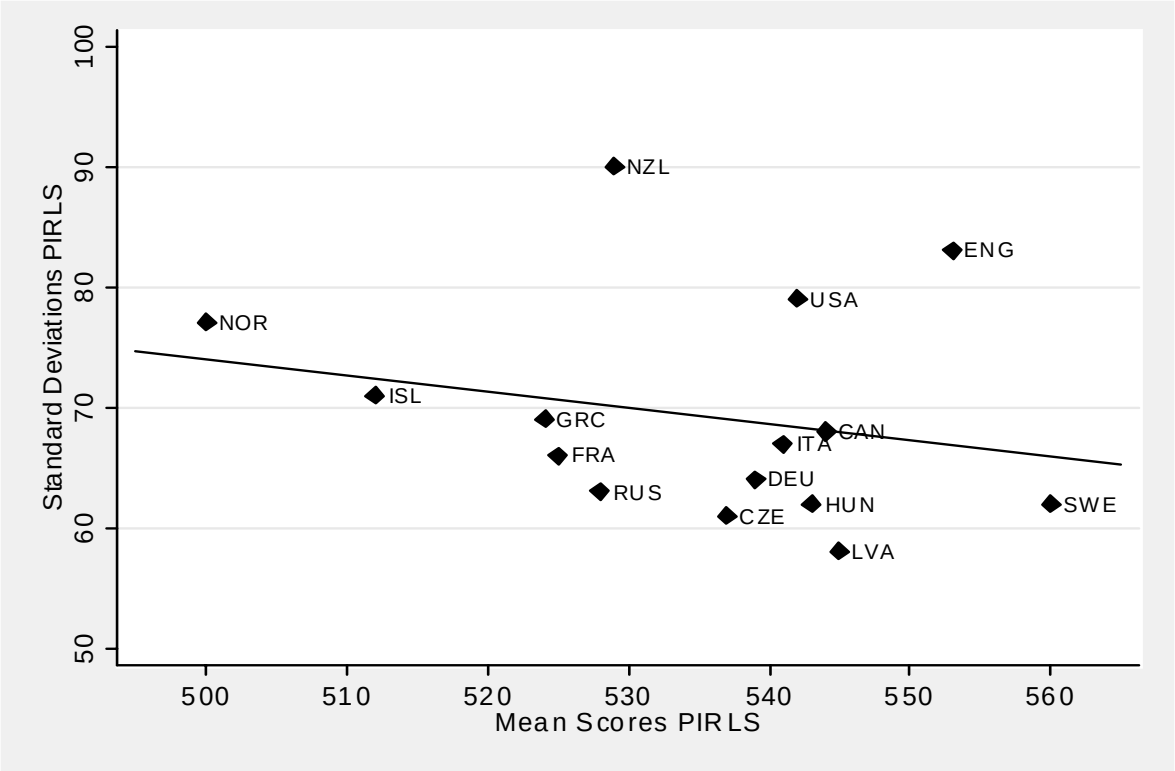

Figure A 1: Mean scores and standard deviations for PIRLS (slope not significant)

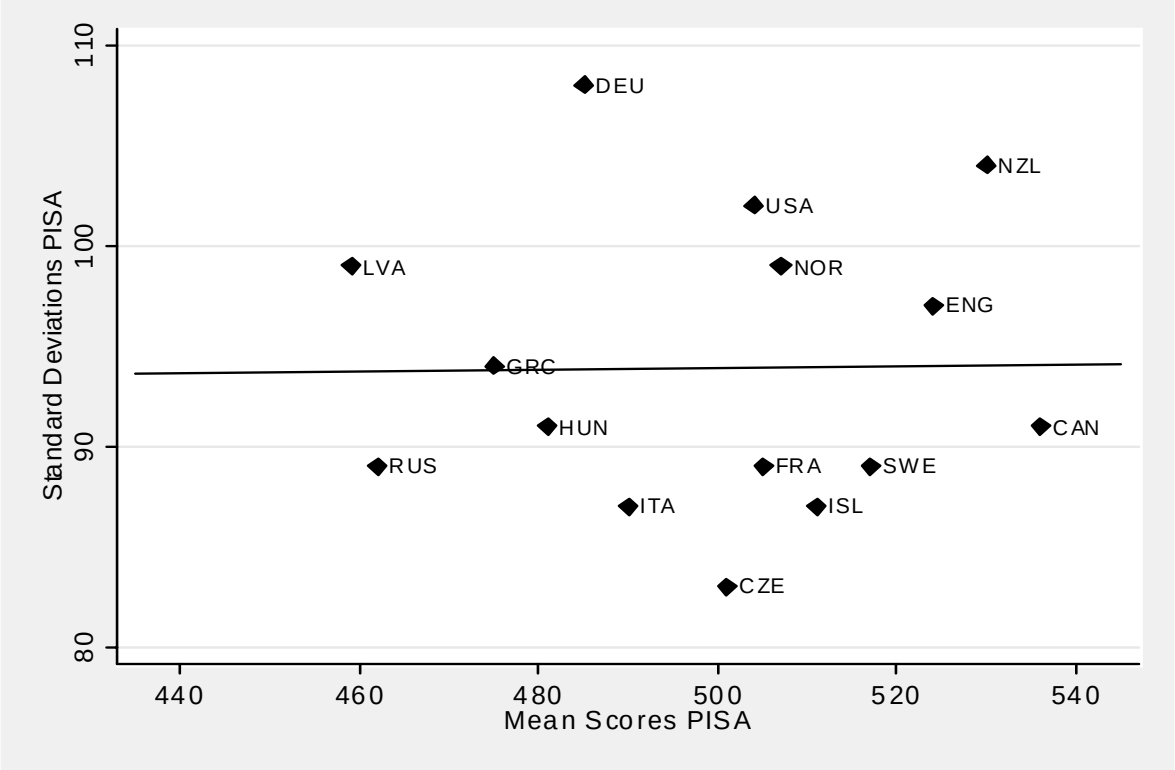

Figure A 2: Mean scores and standard deviations for PISA (slope not significant)

Table A5: Correlation of variables between PIRLS and PISA

	Including imputed values	Without imputed values
Parents' origin	0.84	0.84
Language	0.13	0.04
Books at home		
< 11	0.73	0.83
11-25	0.65	0.79
26-100	0.52	0.77
101-200	0.80	0.79
>200	0.80	0.80
Parents' education		
No Second.	0.43	0.67
Upper Second.	0.05	0.20
Post-Second.	0.16	0.19
University	0.53	0.72
School location		
City	0.42	0.48
Town	0.59	0.56
Rural	0.12	0.32

Correlation coefficients of country means.

Table A6: Estimates for grade 4 (PIRLS) without imputed values

	CAN	CZE	DEU	ENG	FRA	GRC	HUN	ISL	ITA	LVA	NOR	NZL	RUS	SWE
Female	17.14*	10.47*	8.81*	18.82*	7.39†	17.40*	15.40*	20.47 *	6.91*	20.02*	18.53*	30.40*	12.54*	21.78*
Age	-4.44	-1.36	-8.18*	45.03*	-21.49*	1.59	-9.46*	25.63 *	12.95*	-8.67*	25.28*	12.44‡	-5.42	4.44
Parents' origin	-4.59‡	-7.02	-15.77*	4.92	-6.72‡	-11.35*	-6.36	-9.51 †	-16.73*	-0.59	2.80	4.85	-16.51*	-9.41*
Language	-25.52*	-23.58*	-25.28*	-49.44*	-21.37*	-15.85†	-42.67*	-28.56 *	-29.27*	-12.35‡	-34.61*	-44.21*	-36.75*	-27.36*
Books at home														
26-100	6.68‡	15.48*	13.38*	7.86	8.39†	17.76‡	16.75*	3.36	14.27*	5.20	20.69†	9.20	4.91	12.17*
101-200	10.86†	27.71*	31.26*	31.39*	21.74*	30.15*	20.16*	15.45 †	22.90*	10.62†	35.49*	14.15	13.03†	15.07*
>200	18.93*	36.00*	38.63*	28.71*	29.10*	39.81*	37.08*	24.44 *	38.47*	14.99*	41.17*	24.78*	16.88†	25.14*
Parents´ educ.														
Upper Second.	11.14‡	16.56†	27.49*	6.73	15.40*	12.99*	24.13*	25.08 *	19.58*	18.78*	20.27‡	18.19‡	6.49	16.60*
Post-Second.	24.86*	31.10*	21.70*	26.94‡	26.35*	22.46*	25.80*	33.64 *	10.02	18.90*	--	35.33*	13.45‡	23.72*
University	48.52*	37.18*	35.50*	34.35*	37.51*	46.19*	53.78*	54.20 *	27.42*	42.82*	45.44*	59.47*	29.52*	39.81*
School location														
City	2.10	11.20†	-5.53	5.12	5.46	9.28	2.97	3.67	-4.54	8.31‡	15.39†	21.71*	-0.10	2.59
Rural	-11.08†	-2.30	3.88	-4.77	8.68	-3.31	-5.83	-1.20	-26.54†	-5.56	7.17	-7.77	--	-1.15
Parents´ attit.														
High	12.86*	10.17*	12.46*	25.86*	11.69*	9.76†	9.66*	-0.78	18.56*	9.22*	12.76†	32.99*	11.29*	9.40*
Low	-10.07‡	-1.33	0.28	-4.20	-2.48	7.98	6.70	-5.12	-2.12	-15.04‡	2.16	-2.46	3.42	-8.44
Observations	5,288	1,948	3,066	1,095	1,783	1,610	2,376	1,954	2,838	1,740	2,297	1,537	2,315	4,631
R-Square	0.16	0.16	0.28	0.21	0.27	0.24	0.28	0.17	0.17	0.20	0.16	0.25	0.15	0.18

Coefficients from cluster-robust linear regressions (CRLR), weighted by students'sampling probabilities.
Significance-levels: * 1 percent, † 5 percent, ‡ 10 percent. Dependent variable: PIRLS reading literacy score.
All observations with imputed values have been dropped.

Table A7: Estimates for grade 9/10 (PISA) without imputed values

	CAN	CZE	DEU	ENG	FRA	GRC	HUN	ISL	ITA	LVA	NOR	NZL	RUS	SWE
Female	26.74*	20.60*	20.44*	20.87*	15.39*	33.15*	23.34*	34.58*	25.29*	43.90*	33.66*	35.55*	30.00*	27.92*
Age	-0.96	-29.27*	-49.51*	16.75*	0.69	8.42	-35.30*	9.37‡	11.63*	-22.65*	20.52*	27.62*	-10.43‡	15.53*
Parents' origin	2.46	7.61†	-5.39	6.27	-8.81*	4.91	-3.27	-7.41	10.94†	-10.14‡	-3.22	1.53	6.19	-3.84
Language	-28.98*	16.10	-42.94*	-33.31*	-21.93*	-27.11*	--	-31.57†	-27.28*	-8.92	-49.01*	-73.12*	-7.08	-39.79*
Books at home														
26-100	19.27*	24.06*	26.37*	24.64*	17.19*	18.17*	24.35*	16.07*	15.70*	1.24	18.64*	20.96*	14.74*	25.51*
101-200	28.91*	41.90*	41.47*	50.67*	28.78*	28.58*	48.11*	35.98*	28.00*	24.87*	47.44*	42.37*	42.46*	36.60*
>200	39.35*	61.91*	61.59*	68.86*	40.31*	42.94*	69.11*	50.57*	36.20*	42.01*	56.80*	54.57*	51.02*	60.20*
Parents´ educ.														
Upper Second.	--	1.89	28.43*	18.80*	3.01	17.53*	25.91*	18.39*	12.99*	13.70	16.15†	29.18*	23.95†	9.10
Post-Second.	--	25.52*	37.58*	53.63*	9.44†	28.25*	51.39*	21.57*	22.41*	24.55*	8.89	44.28*	37.48*	13.75†
University	21.51*	56.90*	52.00*	35.44*	8.85†	39.71*	75.20*	30.30*	27.08*	31.75*	19.35*	47.57*	45.16*	11.95†
School location														
City	--	-0.33	-5.73	0.72	5.59	13.49	16.78†	--	5.21	17.59‡	3.18	12.76†	17.85†	5.79
Rural	--	-20.05*	-33.49*	-7.76	-0.279	-13.24	-28.44‡	--	6.44	-32.90*	-9.76‡	-14.55†	-17.54†	-6.93‡
Parents´ attit														
High	21.91*	9.38†	10.98†	29.47*	7.35*	6.01	7.83*	13.93*	1.59	12.59*	23.19*	20.76*	8.45*	14.84*
Low	-26.01*	-20.71*	-21.91*	-26.31*	-11.28*	-19.98*	-11.15*	-27.73*	-21.94*	-15.69*	-33.91*	-19.94*	-18.37*	-32.23*
Observations	26,815	4,865	3,398	7,007	3,353	4,036	4,401	2,868	4,283	2,711	3,160	2,526	5,087	3,728
R-Square	0.20	0.30	0.37	0.22	0.50	0.23	0.42	0.16	0.26	0.29	0.20	0.22	0.22	0.22

Coefficients from cluster-robust linear regressions (CRLR), weighted by students'sampling probabilities.
Significance-levels: * 1 percent, † 5 percent, ‡ 10 percent. Dependent variable: PIRLS reading literacy score.
All observations with imputed values have been dropped.

Table A8: Results from two-step model

	School types	Instruction time	Share of students in private schools	School autonomy
Female	0.94	0.006	-0.77	-1.47
	(2.37)	(0.006)	(0.86)	(0.79)
Parents' origin	**15.43***	-0.002	-1.95	**-3.90‡**
	(3.22)	(0.001)	(2.26)	**(1.70)**
Language	-4.84	0.003	-3.01	-0.48
	(7.50)	(0.002)	(3.13)	(4.33)
>200 Books at home	0.05	-0.003	**8.57***	3.24
	(8.33)	(0.002)	**(1.57)**	(3.63)
One parent univ. deg.	**14.43†**	-.0003	-0.07	0.77
	(5.94)	(0.002)	(2.86)	(3.81)
School location				
City	2.09	0.0003	-0.60	-1.01
	(4.19)	(0.0008)	(1.72)	(2.02)
Rural	9.04	-0.002	-1.44	-3.48
	(6.69)	(0.002)	(3.20)	(3.32)
Parents' attitude				
High	**-6.55‡**	0.0001	1.94	2.09
	(3.47)	(0.001)	(1.55)	(1.87)
Low	0.96	0.0008	1.53	1.94
	(3.31)	(0.0007)	(1.07)	(1.39)

WLS regressions, each cell represents a separate regression. Coefficients significant at the 10 percent-level are printed in bold. Standard errors in parentheses. Significance-levels: * 1 percent. † 5 percent. ‡ 10 percent. Estimated using equation (8) for autonomy and equation (7) for other institutions.

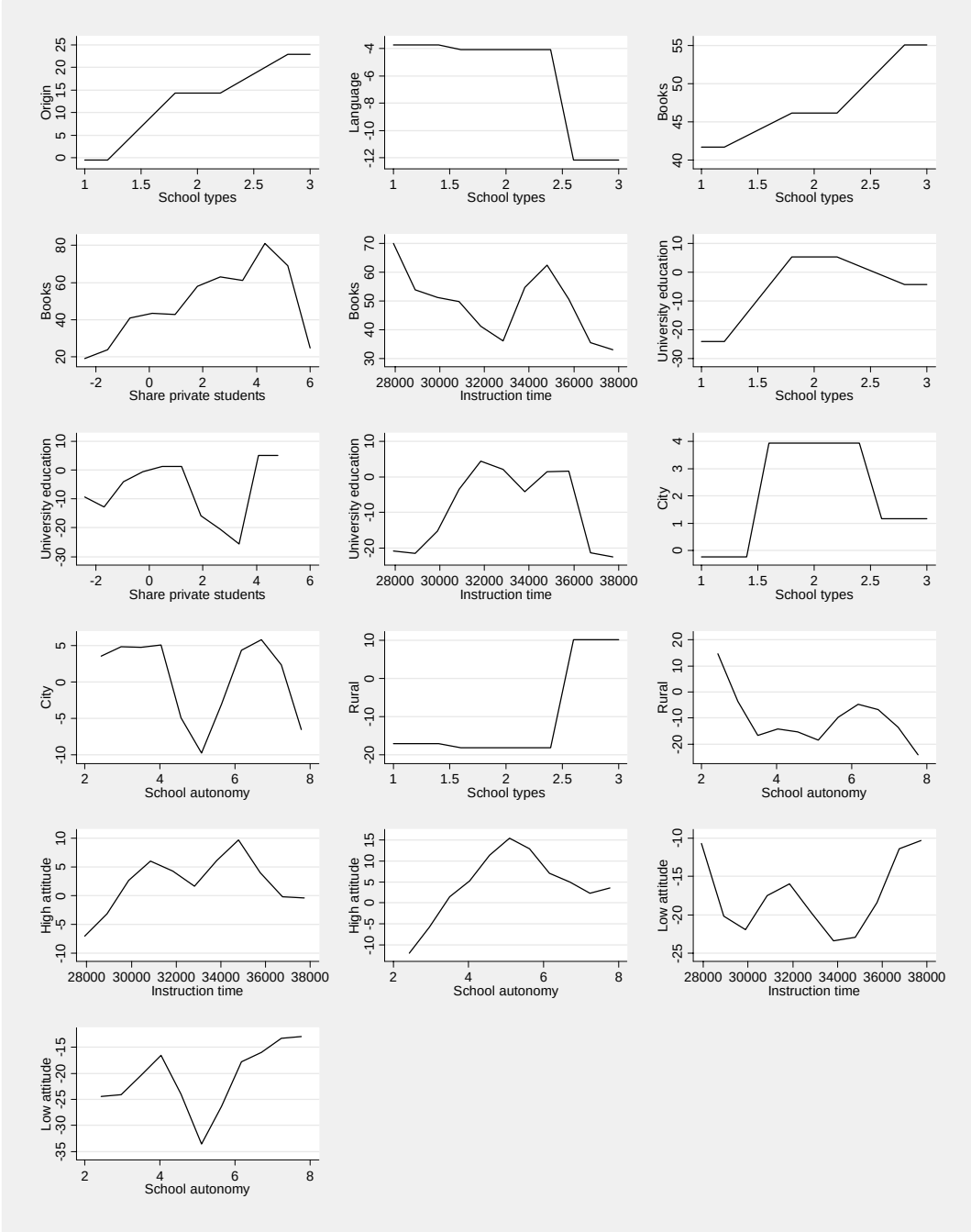

Figure A 3: Non-parametric regression estimates of changes in opportunities on institutional changes

Table A9: Institutional variables

Variable	CAN	CZE	DEU	ENG	FRA	GRC	HUN	ISL	ITA	LVA	NOR	NZL	RUS	SWE
Institutions														
Number of school types in primary education[1]	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Number of school types in lower secondary[1]	1	2	3	3	1	2	2	1	3	1	1	2	2	1
Yearly instruction time in minutes in PIRLS[2]	24,583	24,741	23,560	23,462	23,563	18,152	---	19,614	29,289	14,145	19,742	29,962	16,623	24,243
Yearly instruction time in minutes in PISA[3]	58,576	56,804	54,547	57,369	61,304	47,947	52,231	50,935	61,769	51,142	---	57,881	51,534	53,615
Share of students in private schools in primary education in 2000 (in percent)[4]	6.5	.9	2.2	4.7	15	7	5.1	1.4	6.4	2	1.5	2	0.4	.4
Share of students in private schools in lower secondary education in 2000 (in percent)[4]	8	2	7	7	21	5	5	1	4	4	2	4	1	3
Percentage of women among teaching staff in public and private institutions in primary education, based on head counts[5]	68	84.4	81.2	81.1	80	---	85	77.8	94.8	---	---	83.8	98.7	80.4
Percentage of women among teaching staff in public and private institutions at lower secondary, based on head counts[5]	68	82	59	59	64	64	85	77	73	88	72	65	89	62
Index of school autonomy in lower secondary[6]	5.68	7.77	3.90	6.47	---	3.10	6.89	6.46	2.43	---	5.12	6.67	3.60	6.05
Educational expenditures														
Expenditure on educational institutions as a percentage of GDP 2000[7]	6.4	4.6	5.3	5.3	6.1	4.0	5.0	6.3	4.9	---	5.9	5.8	---	6.5
Private education expenditures as a percentage of total education expenditures (all levels), 1998[8]	11.0	12.8	21.6	5.7	5.8	---	11.6	11.0 (1995)	3.9	---	1.9	2.6 (1995)	---	2.7

Variable	CAN	CZE	DEU	ENG	FRA	GRC	HUN	ISL	ITA	LVA	NOR	NZL	RUS	SWE
Country and population														
Female employment rate in % [9]	74.0	73.7	71.1	73.1	69.6	52.6	61.7	87.4	50.7	---	81.5	70.6	---	81.7
Stock of foreign population in % (1999)[10]	17.4[11]	2.2	8.8	3.8	5.6	2.7	1.3	1.5[12]	2.2	41.8[13]	4.0	24.2[13]	---	5.5
Urban population in % (2003)[14]	80.4	74.3	88.1	89.1	76.3	60.8	65.1	92.8	67.4	66.2	78.6	85.9	73.3	83.4

1 Source: National descriptions in Eurybase; Statistics Canada, New Zealand.
2 Source: PIRLS 2001 database.
3 Source: PISA 2000 databse
4 Source: OECD Education at a Glance 2002, C2.4.
5 Source: OECD Education at a Glance 2002, D8.2.
6 Source: OECD PISA database, 2001, Web Table D5.2.
7 Source: Education at a Glance 2003, Tab. B2.1a.
8 Source: EdStats, http://devdata.worldbank.org/edstats/ThematicDataOnEducation/PrivateEducationExpenditure/tab21.xls
9 Source: http://www.oecd.org/dataoecd/36/7/17652667.pdf
10 Source: http://www.oecd.org/dataoecd/23/41/2508596.pdf
11 1998, source: http://www.oecd.org/dataoecd/10/35/2079451.pdf
12 2002, source: Berliner Institut für Vergleichende Sozialforschung, http://www.emz-berlin.de/Statistik_2/lat/lat_01.htm
13 Source: http://www.nationmaster.com
14 Source: UN Department of Economic and Social Affairs, Population Division, „Urban and Rural Areas 2003“.