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The Determinants of German Students' Achievement in the PISA 2000 Study

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Who's to Blame? The Determinants of German Students' Achievement in the *PISA 2000* Study

by

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May 2003

Abstract. The publication of the *OECD* report on the *PISA 2000* study induced a public outcry in Germany. On average, German students participating in this standardized test performed considerably below the *OECD* average and substantially worse than those of other European countries, like Finland or Ireland. However, the results presented by the report consist mainly of country averages which do not take into account any other covariates of individual student achievement. This paper provides a comprehensive econometric analysis of the association of the individual-level reading test scores of German students with individual and family background information and with characteristics of the school and class of the 15 to 16 year old respondents in Germany to the survey. The results of several quantile regression analyses demonstrate that many popular explanations, like too much regulation of schools or the substantial share of non-citizens among the participating students, are by no means supported by the data. Rather results point towards a considerable impact of schools aiming at a more homogenous body of students in terms of their educational achievement.

JEL-Classification: I21.

Keywords: Student Achievement, School Quality, Quantile Regression.

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1 Introduction

In the aftermath of the (OECD (2002)) report, the *Programme for International Student Assessment* (PISA 2000) examination has initiated an intense debate in the media, among politicians and the public on the causes of the results and the consequences to be drawn. German students' average performance was relatively poor, especially compared to other industrialized countries like Finland, Ireland, Australia or Canada. However, the results presented by the report consist mostly of country averages which do not control for any other covariate of individual student achievement. Despite these shortcomings, many commentators blamed the German educational system, specific ingredients of it or the non-native student population as being responsible for this disappointing result.

In general, there were almost as many recommendations for the putative causes as there were commentators on it. None of them, however, was able to support his or her argument empirically since national averages in test scores hide more than they reveal. Specifically, whether the education system operates under similar or vastly different conditions regarding students' family background and intergenerational skill transmission, has not been explored by the *OECD* report. Furthermore, the impact of potentially important individual class and school characteristics was completely neglected. Yet, the publicly available background information (*http://www.pisa.oecd.org*) collected in *PISA 2000* together with the test results, family and individual characteristics and a rich set of school-related variables allows for a deeper analysis.

This paper therefore contributes to the received literature by providing a detailed analysis of German students' individual achievement in the reading examination of *PISA 2000*. The reading examination part of the study provides the largest set of complete observations and is conceptually the most sophisticated test since it requires the most *know-how* and the least *know-that* compared to the math and science component[1]. The ultimate aim of this paper is to clarify to what extent certain characteristics of German schools are responsible for the rather disappointing performance of their students in this examination. This paper, furthermore, serves as a complement to several other studies utilizing individual level data from the *PISA 2000* study. Before proceeding with a description of the dataset, the next paragraphs briefly describe these studies.

Fertig and Schmidt (2002) provide detailed information on the correlates of the reading performance of students from *all* participating countries in the *PISA 2000* study. By estimating conditional national performance scores, this paper aims at identifying that part of international differences which is attributable to genuine differences in education systems. Their empirical results suggest that even after adjusting for a large set of background factors, significant differences between countries remain. However, school conditions including teacher provision account for a sizeable fraction of student's individual success in *PISA 2000*. Moreover, results indicate that the students in the bottom of the performance distribution suffer most if their education environment is lacking.

Fertig (2002) analyzes the impact of students' peer group heterogeneity on individual achievement in 136 US-american schools. The impact of a student's peer group

[1]For sample questions of all parts of the *PISA 2000* study see *http://www.pisa.oecd.org*.

is measured by the coefficient of variation in achievement of a student's peers within the same school after excluding this particular student from the calculations. The paper utilizes an instrumental variable approach to account for the potential endogeneity of students' peer group choice. Empirical results suggest that heterogeneous peer groups have a strong detrimental impact on individual achievement. Moreover, it becomes transparent that contextual variables are important for the extent of peer group effects and the endogeneity of peer group formation.

Wolter and Vellacott (2002) analyze the effect of sibling size and birth-order on educational achievement in Switzerland. In sum, the authors find a rather small sibling size and birth-order effect which, however, turns out to be quite heterogeneous among subgroups of the population. Finally, Fertig (2003) investigates *within-country* and *between-country differences* in the socio-economic determinants of individual educational achievement. The author investigates the contribution of various explanatory factors to individual educational success utilizing quantile regression techniques for the following country groups: European countries, Australia/New Zealand, USA/Canada, Eastern European transition economies, and Mexico/Brazil. Empirical results suggest that there are considerable differences in the impact of school resources on individual school success both within and between the country groups. However, one also observes a substantial intergenerational dependence in educational attainment.

The structure of this paper is as follows. The next section briefly describes the design of the *PISA 2000* study. Section 3 then discusses the econometric approach, an individually based quantile regression analysis of the *PISA 2000* reading test score on a set of individual characteristics, family background information, as well as class and school characteristics. Section 4 reports the empirical finding of the mean as well as the quantile regressions and the final section offers some conclusions.

2 The Design of the *PISA 2000* Study

The *PISA 2000* study was conducted among the 28 OECD countries plus Brazil, Latvia, Liechtenstein and the Russian Federation in the first half of 2000. The target population are 15 to 16 year old students enrolled in an educational institution at the time of the survey (the first half of 2000). The primary sample unit, however, were schools. In a second step, in every school a random sample of students from the target population was drawn. The examination conducted among the students in the sample consisted of a reading, math and science literacy test.

The particular test score of an individual student is not the direct share of correct answers. Rather, it is computed based on a procedure originating in *Item Response Theory* (see e.g. Hambleton and Swaminathan (1989)). Calculated scores are weighted averages of the correct responses to all questions of a specific category (e.g. reading literacy) with the difficulty of the question serving as weight (see e.g. Warm (1989)). These individual test scores are standardized in a subsequent step so that the unconditional sample mean of the *PISA 2000* scores equals 500 and their unconditional sample standard error equals 100. The dependent variable in our analysis is the reading score of *PISA 2000*,

since this part of the study requires the most *know-how* and the least *know-that* compared to the math and science component.

Furthermore, a wide variety of background information on the students was collected by student questionnaires. Among this individual information is the family background of the student, his or her familiarity to use computers or the Internet, his or her learning strategy, a self-assessment of reading pleasure etc. Furthermore, the study also conducted a interviews among the principals of the respective schools in order to collect information on the school resources, the number of teachers in the school, the responsibility of the school regarding school relevant decisions, the principles of selecting students etc.

The sample for this paper consists of 3,696 students in 172 German schools. The explanatory variables[2] comprise individual and family background characteristics, like the students' gender and the education levels of their parents as well as several school characteristics, like the schools' student-teacher ratios or an indicator for schools with poor building conditions. All individual and family characteristics as well as the class size information stem from the student questionnaire, whereas school information is provided by the questionnaire of the schools' principals. Finally, three indicators reflecting the students' access to modern information technology are employed. These information are conducted in a separate student questionnaire, the so-called computer familiarity questionnaire.

These variables are included since the debate around the the causes and consequences of the *OECD* report in Germany also often concerned schools' endowment with modern information technology equipment. Although the literature on the effect of computer use on wages (see e.g. DiNardo and Pischke (1997), Entorf et al. (1999), Haisken-DeNew and Schmidt (1999) and Krueger (1993)) and on student learning (for a recent contribution see Angrist and Lavy (2001)) is anything but unambiguous, the inclusion of these variables provides a first, albeit crude, test whether individual test success is associated with IT-related variables. The *Computer Familiarity Questionnaire* also conducted information on the actual use of computers. However, it turns out that computer access and computer usage are closely related. Students having access to it, apparently use it regularly as well.

3 Determinants of Individual School Achievement

To assess the impact of different aspects of educational success it is necessary to compare the test scores of comparable individual students. Naturally, educational achievement is an inherently individual phenomenon. Furthermore, a large body of literature demonstrates that there exists a considerable persistence across generations in educational achievement (see e.g. Currie and Thomas (1999), Fertig and Schmidt (2002), Miller et al. (1997)). In consequence, it is necessary to control for individual characteristics and family background in analyzing individual differences in test scores. Finally, it is also necessary to include school and class specific information to control for the tangible aspects

[2] **Table A1** in the appendix provides the definition of the variables in the dataset and **Table A2** reports some summary statistics.

of institutional arrangements.

The explanatory variables utilized in this paper are described in detail in **Table A1** in the Appendix. **Table A2** in the Appendix reports some descriptive statistics. Due to students with missing observations for some variables that were deleted from the sample, the unconditional sample mean of the test score slightly deviates from 500 and the sample standard error from 100.

Finally, this paper uses quantile regression techniques introduced by KOENKER AND BASSETT (1978) to infer on the determining factors of individual achievement. This technique has found many empirical applications in different fields in recent years (see e.g. CHAMBERLAIN (1994), EIDE AND SHOWALTER (1998), FITZENBERGER (1999) or LEVIN (2001)). Quantile regression aims at providing an exhaustive analysis of the effect of the explanatory variables on the *complete* conditional distribution of the test score. Contrary to the usual OLS mean regression, the most prominent quantile regression, i.e. the median regression estimator, minimizes the sum of *absolute* errors instead of *squared* errors as in the usual OLS (mean) regression. Correspondingly, all other conditional quantile functions minimize an asymmetrically weighted sum of absolute errors. Quantile regression is widely regarded as a robust estimation technique which is substantially less sensitive to outliers than usual regression techniques (see GOULD AND ROGERS (1994)).

4 Empirical Results

OLS and quantile regression estimation results of the preferred specification are reported in **Table 1**. The preferred specification is the result of a serious of tests applying linear restrictions on the estimated coefficients (especially for differences in the education categories between both parents) and tests for joint significance for several parameters[3].

4.1 The Center of the Performance Distribution

Mean and median regression results reveal that many *individual and family background* characteristics exhibit a statistically significant impact on individual test success. Female students and students with highly educated fathers and mothers perform considerably *better* than the typical male student which parents hold a medium schooling degree. The latter result confirms the substantial intergenerational dependence of educational achievement found in other studies. Furthermore, one observes a statistically significant *positive* impact of a fully employed father and of the variable indicating whether the student was never late in the two weeks preceding the test. Since being late at school might be interpreted as an approximation of self-discipline of the student, the latter result suggests that the more disciplined or better self-organized students perform better than their peers.

On the other hand, estimation results suggest a statistically significant *negative* impact of less educated mothers whereas the impact of the low education category of the father is insignificant. Furthermore, there is apparently also no significant impact by all

[3]These tests are not reported in the table but are available from the author upon request.

variables indicating whether the student or her parents are non-citizens or foreign-born. The same conclusion holds for students who regularly speak another language than the test language at home. Although these variables are individually not significant, the null hypotheses that all or some of them are jointly insignificant as well, can be rejected on a high level of significance.

Table 1: Estimation Results of Quantile Regressions for Reading Score

Explanatory Variable	OLS – Mean Regression		10% Quantile		Median Regression		90% Quantile	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Constant	273.94	13.80	9.08	0.29	249.43	9.46	458.18	12.90
Individual Characteristics and Family Background								
Female	21.71	7.93	21.25	4.41	23.24	6.38	17.38	3.91
Full working mother	-2.32	-0.82	1.52	0.30	-7.24	-1.92	-2.47	-0.54
Full working father	10.24	2.61	8.56	1.24	15.05	2.89	3.21	0.51
Low education - Mother	-40.59	-4.38	-46.06	-2.86	-32.73	-2.67	-38.14	-2.62
High education - Mother	21.17	6.49	13.99	2.47	23.18	5.35	26.78	5.18
Low education - Father	-0.64	-0.06	-8.25	-0.49	-2.22	-0.17	9.09	0.60
High education - Father	21.69	7.03	15.55	2.88	20.58	5.02	23.53	4.86
Student non-citizen	-13.30	-1.04	-6.50	-0.25	-15.80	-0.93	-13.64	-0.80
Student second generation	0.64	0.06	-3.74	-0.19	-1.29	-0.09	11.31	0.74
Mother non-citizen	-12.35	-1.41	-17.18	-1.03	-10.48	-0.91	-4.83	-0.38
Father non-citizen	-17.25	-1.93	-17.85	-1.09	-21.68	-1.83	-18.67	-1.44
Other language at home	-14.19	-1.92	-34.76	-2.58	-18.40	-1.88	-16.50	-1.47
Never late	13.35	4.36	12.89	2.35	11.09	2.72	16.60	3.39
Class and School Characteristics								
Class size	3.85	13.11	4.78	9.03	3.58	9.20	3.04	6.65
Share of girls	278.02	5.78	712.36	11.10	386.92	6.05	100.27	1.03
Share of girls squared	-122.85	-3.06	-429.54	-6.90	-218.59	-4.10	20.31	0.27
Index of school autonomy	-14.07	-5.08	-17.73	-3.49	-14.13	-3.85	-15.13	-3.75
Student-teacher ratio	-1.24	-3.83	-0.99	-1.89	-0.95	-2.21	-1.89	-3.58
Private school	6.08	0.78	8.53	0.59	13.93	1.34	-2.04	-0.16
Selective school	17.07	5.44	21.31	3.81	16.03	3.84	8.59	1.74
Poor conditions	-8.45	-1.56	-9.56	-0.98	-2.19	-0.30	-12.59	-1.42
Teacher shortage	-21.40	-6.50	-19.98	-3.28	-26.33	-6.02	-23.87	-4.64
Regular tests	0.95	0.11	0.28	0.02	-2.47	-0.21	2.86	0.25
Transfer of low achievers	34.78	10.85	38.18	6.99	33.26	7.81	24.98	4.76
Transfer of high achievers	-6.21	-0.50	-30.09	-1.40	1.78	0.11	18.40	0.94
Learning needs transfer	-13.22	-3.41	-12.93	-1.82	-8.49	-1.65	-5.88	-0.96
Access to Modern Information Technology								
No access to PC at school	2.12	0.70	-0.11	-0.02	1.75	0.44	3.37	0.70
No access to PC at home	-23.93	-5.56	-26.00	-3.40	-17.78	-3.10	-21.01	-3.04
No access to Internet	-9.47	-2.94	-5.57	-0.94	-11.27	-2.63	-6.80	-1.32

Number of observations: 3,696; See Appendix **Table A1** and **Table A2** for a description of the explanatory variables and some summary statistics.

Regarding the *class and school characteristics*, mean and median regression estimation results reveal a statistically significant *positive* impact of the size of the students class,

the variable indicating whether a school is selective upon entry, and whether students with low achievement are likely to be transferred to another school. The latter result suggests that in schools which aim at a more homogenous body of students regarding their educational achievement individual students do better. Furthermore, the share of girls in the respective school also exhibits a positive impact but with a decreasing slope. This suggests that schools with a mixture of both genders provide a better learning environment than schools in which students are segregated by gender.

On the other hand, the index of school autonomy exhibits a statistically significant *negative* impact on individual test success. That is, the *higher* school autonomy, the *lower* individual test performance. The same conclusions are suggested for the variable indicating whether the school suffers from a teacher shortage. We do not observe any significant impact of private schools, poor school conditions, and regular tests. The same conclusion holds for the variable indicating whether it is likely for a certain school that students with high educational achievement are transferred to another school.

Finally, regarding the set of variables approximating the access to modern information technology, estimation results suggest a substantial and statistically significant *negative* impact of having no access to a computer at home. Having no access to the Internet has also a *negative* effect but it is quantitatively less pronounced. To the contrary, the variable indicating whether a students has access to computers at school exhibits no significant impact whatsoever.

Qualitatively, the results of the OLS mean regression and the median regression do not deviate very much. The only qualitative difference concerns the impact of the variable indicating whether in a specific school students with special learning needs are likely to be transferred to another school. The estimated coefficient for this variable is statistically insignificant in the median regression but exhibits a statistically significant and considerably sized *negative* impact in the OLS case. Quantitatively, however, there are substantial differences between OLS and median regressions.

In general, there is no unambiguous direction of change between OLS and median regressions. Rather, we observe an increase of around 50% of the positive impact of a full-time working father, whereas the positive impact of a highly educated father diminishes somewhat. Other quantitatively substantial changes concern the decline in the negative impact of low educated mothers, the effect of the share of girls in a specific school and the influence of having no access to computers at home. In consequence, the more robust estimates of the median regression suggest at least quantitatively different conclusions for the relative importance of some of the socio-economic explanatory variables than that of the OLS regression.

4.2 The Lower Part of the Performance Distribution

Estimation results for the 10% quantile differ from that of the median regression in that the impact of a fully employed father becomes statistically insignificant, whereas students who regularly speak another language than the test language at home perform statistically significant and quantitatively substantial worse. Furthermore, the inverted u-shaped

impact of a higher proportion of girls in the school is more pronounced. Moreover, the impact of no access to a computer at home increases substantially, but no access to the Internet apparently plays no role for this part of the performance distribution.

Again, higher school autonomy has a detrimental *negative* impact on individual test success and all non-citizen indicators for the student and his or her father and mother is still statistically insignificant. Finally, the impact of students' class size becomes relatively large. The estimated coefficient suggests that an increase of five students per class, which is approximately one standard deviation of the class size variable, translates into a 24 points higher individual test score, on average.

4.3 The Upper Part of the Performance Distribution

Estimation results for the 90% quantile reveal that the employment status of both parents is statistically insignificant for the upper part of the performance distribution as well. However, we observe a rather strong influence of high education levels of both mother and father on students' individual test scores. Furthermore, there is a strong payoff of self-discipline as indicated by the rather large and statistically significant *positive* coefficient of the variable indicating whether a student was never late in the weeks prior to the test.

Regarding school characteristics, the share of girls in the school becomes insignificant and the impact of a student's class size declines. An increase in class size of five students now means, on average, a 15 points higher test score. The coefficient of the index of school autonomy is still statistically significant *negative*. The same conclusion holds for the student-teacher ratio for which the estimated coefficient becomes the largest in the upper part of the performance distribution. Poor school conditions as well as regular testing of students does not impinge upon individual success significantly for the 90% quantile as well. Finally, even for high achievers, being in a private schools does not have a significant impact on test success.

4.4 Interquantile Differences

Table 2 reports estimation results for the interquantile differences of German students' reading test scores. This analysis aims at investigating whether the differences in the estimated coefficients between different parts of the performance distribution are statistically significant. **Table 2** reports the t-values of these differences only, since the coefficients of these interquantile differences are simply the differences in the respective coefficients from **Table 1**. Their standard errors are estimated by bootstrap techniques (see e.g. Efron and Tibishirani (1993) or WU (1986)).

Table 2: Interquantile Differences for Reading Score[1]

Explanatory Variable	90%-10% Difference t-value	50%-10% Difference t-value	90%-50% Difference t-value
Constant	8.57	5.54	5.55
Individual Characteristics and Family Background			
Female	-0.55	0.35	-1.27
Full working mother	-0.62	-1.54	1.00
Full working father	-0.50	0.93	-1.52
Low education - Mother	0.30	0.86	-0.27
High education - Mother	1.47	1.48	0.53
Low education - Father	0.56	0.24	0.62
High education - Father	1.09	0.87	0.51
Student non-citizen	-0.28	-0.42	0.09
Student second generation	0.62	0.13	0.64
Mother non-citizen	0.56	0.40	0.32
Father non-citizen	-0.04	-0.22	0.17
Other language at home	0.80	0.89	0.14
Never late	0.47	-0.29	0.87
Class and School Characteristics			
Class size	-2.53	-2.14	-1.14
Share of girls	-4.39	-2.65	-2.67
Share of girls squared	3.99	2.20	2.52
Index of school autonomy	0.36	0.60	-0.20
Student-teacher ratio	-1.08	0.05	-1.68
Private school	-0.54	0.30	-1.17
Selective school	-1.68	-0.83	-1.29
Poor conditions	-0.25	0.60	-1.09
Teacher shortage	-0.46	-1.08	0.43
Regular tests	0.11	-0.13	0.35
Transfer of low achievers	-1.69	-0.72	-1.65
Transfer of high achievers	1.07	0.83	0.61
Learning needs transfer	0.76	0.56	0.35
Access to Modern Information Technology			
No access to PC at school	0.48	0.34	0.29
No access to PC at home	0.48	1.08	-0.42
No access to Internet	-0.15	-0.92	0.73

Number of observations: 3,696; See Appendix **Table A1** and **Table A2** for a description of variables and summary statistics. 1) Bootstrapped standard errors.

Table 2 reveals that there are no statistically significant differences between different parts of the performance distribution regarding the impact of *individual and family background* variables. Regarding *school characteristics*, only the size of a student's class and the proportion of girls in his or her school exhibit a statistically significant different impact. These results suggest that German students in all parts of the performance distribution suffer equally from higher school autonomy or larger student-teacher ratios and benefit almost equally from schools aiming at a more homogenous body of students by entry exams or transfers of low performing peers.

5 Conclusions

This paper provided a comprehensive analysis of German students' individual achievement in the reading examination of *PISA 2000*. The central aim of this paper was the identification of the decisive factors responsible for the rather disappointing performance of German students. To this end, we estimated the impact of (i) individual and family background variables, (ii) class and school characteristics, and (iii) variables indicating the access of students to modern information technology on individual test scores by OLS and quantile regression techniques. Furthermore, the differences between all quantiles are examined for statistical significance.

A variety of suggestions regarding what or whom to blame for low achievement of German students emerged directly after the publication of the first report on the test results (OECD (2002)). Among these suggestions, the most popular were non-native students (especially for the reading examination), schools without regular tests, too much regulation of schools (i.e. not enough autonomy to decide upon important school relevant issues), poor school conditions and not enough access to modern information technology for the students. However, as the estimation results reported in **Table 1** demonstrate, these variables do anything but explain German students' test performance on the individual level, at least not in the desired direction.

Rather the estimation results suggest that schools aiming at a more homogenous body of students by entry examinations and/or transfers of students lacking behind their peers to other schools, support individual educational achievement considerably. However, we also observe a detrimental impact by higher student-teacher ratios and schools suffering from teacher shortages. That is, some tangible aspects of the institutional arrangements do indeed matter. Furthermore, there is also a substantial impact of students' parental situation.

Clearly, it is anything but trivial, to investigate the extent to which the specific organization of the educational system is able to modify this intergenerational dependence in educational achievement into a less rigid relationship. However, it is clear that for such an endeavor more data on a longitudinal basis has to be collected. Therefore, this question remains unresolved at this point in time. Furthermore, since in Germany the *Bundesländer* are responsible for the school system, but cannot be identified in the current dataset, the publication of the individual data from the *PISA-E* study – the extended sample of German schools in which one could discriminate between different *Bundesländer* – would serve as a basis for a more sophisticated comparison of different educational systems within Germany.

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Appendix

Table A1: Description of Variables

Variable	Description
Reading Score	Difficulty-adjusted test score in the reading literacy test
Demographic and Family Background	
Female	1 if student is female; 0 otherwise
Full working mother	1 if student's mother is working full-time; 0 otherwise
Full working father	1 if student's father is working full-time; 0 otherwise
Low education - Mother	1 if highest schooling degree of student's mother is completed primary education; 0 otherwise
High education - Mother	1 if highest schooling degree of student's mother is completed upper secondary or tertiary education; 0 otherwise
Low education - Father	1 if highest schooling degree of student's father is completed primary education; 0 otherwise
High education - Father	1 if highest schooling degree of student's mother is completed upper secondary or tertiary education; 0 otherwise
Student non-citizen	1 if student is not a citizen of the country of residence; 0 otherwise
Student second generation	1 if student is a citizen and his or her parents are non-citizens of the country of residence; 0 otherwise
Mother non-citizen	1 if student's mother is not a citizen of the country of residence; 0 otherwise
Father non-citizen	1 if student's father is not a citizen of the country of residence; 0 otherwise
Diff. Language at Home	1 if the regular language at student's home is different from the respective test language; 0 otherwise
Never late	1 if student never arrived late for school in the last two weeks preceding the test; 0 otherwise
Class and School-Related Information	
Class Size	Average number of students in class
Share of girls	Share of girls in the school
Share of girls squared	Squared share of girls in the school
Index of school autonomy	The index of school autonomy was derived from the number of categories below that principals classified as not being a school responsibility. Negative values indicate lower levels of school autonomy. The categories are: appointing and dismissing teachers; establishing teachers' starting salaries and determining their increases; formulating and allocating school budgets; establishing student disciplinary and student assessment policies; approving students for admission; choosing textbooks; determining course content; and deciding which courses were offered.
Student-teacher ratio	Ratio of students to teachers in a school
Private School	1 if the school is a private school; 0 otherwise
Selective School	1 if admission to school is based on student's record of academic performance including placement tests; 0 otherwise

Table A1 cont'd: Description of Variables

Variable	Description
Poor Conditions	1 if school is suffering from poor conditions of building structure, poor heating/cooling/lighting systems, lack of instruction space or material; 0 otherwise
Teacher Shortage	1 if school suffers from a teacher shortage or test language teacher shortage; 0 otherwise
Regular Tests	1 if students are assessed four or more times a year using standardized or teacher-developed tests; 0 otherwise
Transfer of low achievers	1 if it is very likely that a student would be transferred to another school due to low academic achievement; 0 otherwise
Transfer of high achievers	1 if it is very likely that a student would be transferred to another school due to high academic achievement; 0 otherwise
Learning needs transfer	1 if it is very likely that a student would be transferred to another school due to special learning needs; 0 otherwise
Access to Modern Information Technology	
No access to IT at school	1 if student has no computer available to use at school
No access to IT at home	1 if student has no computer available to use at home
No access to Internet	1 if student never uses the Internet

Number of observations: 3,696. Data source:OECD (2002). All explanatory variables except class size, share of girls, student-teacher ratio and the index of school autonomy are categorical.

Table A2: Summary Statistics

Variable	Mean	Standard Error
Reading Score	506.506	97.188
Explanatory Variables		
Female	0.511	0.500
Full working mother	0.358	0.480
Full working father	0.862	0.345
Low education - Mother	0.030	0.170
High education - Mother	0.304	0.460
Low education - Father	0.023	0.151
High education - Father	0.415	0.493
Student non-citizen	0.091	0.287
Student second generation	0.091	0.288
Mother non-citizen	0.145	0.352
Father non-citizen	0.154	0.361
Other language at home	0.050	0.219
Class size	24.278	4.782
Never late	0.741	0.438
Share of girls	0.504	0.107
Share of girls squared	0.266	0.129
Index of school autonomy	-0.989	0.504
Student-teacher ratio	18.125	4.553
Private school	0.042	0.200
Selective school	0.303	0.460
Poor conditions	0.068	0.253
Teacher shortage	0.226	0.419
Regular tests	0.974	0.158
Transfer of low achievers	0.245	0.430
Transfer of high achievers	0.012	0.110
Learning needs transfer	0.145	0.352
No access to IT at school	0.283	0.451
No access to IT at home	0.114	0.317
No access to Internet	0.227	0.419

Number of observations: 3,696; Data source:OECD (2002).