School Quality, Family Background and Student Achievement: the Case of Cebu

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Abstract

The paper investigates the effects of school quality characteristics on the achievement of Filipino adolescents. The rich data from the Cebu Longitudinal Health and Nutrition Survey (CLHNS) allow us to control for student's ability, family background and community characteristics. The analysis of the sensitivity of the results to the omission of key exogenous variables reveals that ignoring either a measure of the child's ability or community characteristics does not lead to statistically significant changes in the estimated coefficients. In contrast, omission of family background characteristics introduces a considerable bias. Bootstrap test statistics indicate that this bias is statistically significant. Even larger bias is introduced when one fails to control for both family background and student's ability. Failure to control for family background characteristics inflates estimated effects of school quality and, as the result, spuriously improves statistical significance of the estimates making them significant at 5% or even 1% significance level.

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I. Introduction

This study analyzes the effects of elementary school quality on several student outcomes in Cebu, Philippines. The Cebu region has been undergoing a rapid transition from agriculture and low-skill manufacturing to a service and technology oriented economy, with substantial population growth as well as rapid economic growth. This is the type of transition that one can expect many other developing countries to be going through in the next few decades. Therefore, the results of our study are potentially relevant to many developing countries. The knowledge of what resources are relatively cost-effective can be crucial for government decision making with respect to investments in school resources, given the lack of sufficient school funding in developing countries. A secondary but important issue examined in this paper is the sensitivity of the results to the omission of key explanatory variables including family background characteristics. Such a study is important because, frequently, surveys containing information on school characteristics have almost no measures of family background.

The data come from the Cebu Longitudinal Health and Nutrition Survey (CLHNS). The CLHNS provides detailed information on individual and family background characteristics as well as detailed information on the characteristics of schools children attended. Completion of elementary school by age 13, completion of high school by age 18 as well as Math and English achievement tests results are modeled as the outcomes of interest.

The estimation results reveal, for example, that decreasing pupil-teacher ratio by 10 implies, on average, a 3.02 percentage point increase in the probability of elementary school completion ceteris paribus. Similarly, increasing number of books per pupil by 5 implies a 3.85 percentage point increase in the probability of elementary school completion. Alternative school quality measures do not reveal any statistically significant effects on the outcomes. As for high school completion, elementary school quality effects are generally much weaker and statistically indistinguishable from zero.

The analysis of the sensitivity of our results to the omission of key explanatory variables reveals that ignoring either the child's ability measure or community/regional measures does not lead to statistically significant changes in the estimated coefficients. However, the omission of family background characteristics introduces a statistically significant bias in the estimate of pupil-teacher ratio effects (for instance, the bias is over 60% for the completion of elementary school outcome). An even larger bias is received if both family background measures and the child's ability measure are omitted. Failure to control for family background characteristics inflates estimated effects of school quality and, as a result, this bias spuriously improves the statistical "significance" of the estimates.

The paper is organized in the following way. Section II examines the literature on school quality effects. Section III includes a description of the data, constructed variables and the model. The empirical results are presented in Section IV.

II. Literature Overview

The question of school quality effects in the context of US educational system is one of the most controversial in economics literature. For example, two recent reviews of the literature on the topic of school quality effects provide conflicting interpretations of the literature (Krueger (1998) and Hanushek (1998)). Below I provide more details on the existing dispute in the literature.

The vast majority of the studies on school quality effects, starting from the widely cited Coleman report (Coleman et al., 1966), used primarily test scores as a measure of student outcomes. Hanushek's (1986, 1989) surveys of the literature suggested that most of these studies found little or no effect of school resources (more precisely, teacher-pupil ratios, teacher education, teacher experience, teacher pay, spending per pupil) on students' test scores. His explanation to this phenomenon was that additional school resources are not effectively used by schools to improve students' outcomes. A few years later, however, Hedges, Laine, and Greenwald (1994) reexamined in their meta-analysis the studies analyzed by Hanushek and argued that school quality does affect test scores. According to their conclusion data revealed "systematic positive relations between resource inputs and school outcomes" (Hedges et al. (1994, p. 5)). Recently Krueger (1999) analyzed the results of project STAR in Tennessee and showed that smaller class size has a positive effect on standardized tests results. So, even if we take one type of students' outcomes i.e. standardized test scores, there is no consensus among the economists on whether school quality affects students' tests results.

Even more controversy has been brought to the literature by Card and Krueger (1992). In that paper the authors pointed out that labor market earnings might be a more relevant measure of student's success than standardized test scores. In their study they used 1980 census data on earnings of white men born between 1920 and 1949 (the available sample of men was divided into three 10-year birth cohorts, 1920-29, 1930-39, 1940-1949) to estimate, first, the rate of return to education for each of the birth cohorts in each of the states of birth, and then, in the second stage, to estimate the relationship between the return to schooling and such measures of school resources as pupil-teacher ratios, relative wages of teachers and the length of the school term (average values of these measures were used for each state of birth). As the result, Card and Krueger found that additional school resources tend to increase the return to education from any extra year of schooling. For example, they found that a decrease in the pupil-teacher ratio of five students corresponds to .4 percentage point increase in the rate of return to schooling and a 10 percent increase in teachers' salary corresponds to .1 percentage point increase in the rate of return to education.

Nevertheless, using earnings as a measure of students' success did not resolve the conflict in the literature. Betts (1995) in his study analyzed the effects of school quality measures on students' subsequent earnings using micro data on school quality and failed to capture any of those effects. Card and Krueger (1996a) attributed Betts' results to the peculiarities of the NLSY data that Betts used (i.e. young age of individuals in the NLSY and small sample size that led, in their opinion, to large standard errors of the estimates) and concluded that "the finding that school quality raises wages is not found in every data set" (Card and Krueger (1996a, p. 39)).

Several studies, however, raised the issue of data aggregation. Betts (1996) showed that most of the studies that did not find a significant relationship between school inputs and student outcomes measured school resources at the level of actual schools attended; in contrast, studies that found significant effects of school quality typically used aggregate school inputs at the state level. Hanushek et al. (1996) argued that the use of aggregated measures aggravates omitted variables bias and suggested that as the result of this fact "…aggregation inflates the coefficients on school resources." (Hanushek et al. (1996, p. 611)). However, the implications of using aggregate school quality measures seem to be more complex than that. Potentially aggregation can decrease biases arising from measurement errors in school quality variables. For instance, school level studies tend (due to the nature of the micro-data) to use measures of school quality for the particular classroom in the particular school year. However, students attend various classrooms throughout their educational careers. Hence, an average measure of school quality (over a district or a state) may be a more accurate assessment of the average school inputs received by a student over her/his total schooling than a single school-level measure (Loeb and Bound, 1996; Card and Krueger, 1996a)[1]. More importantly, as Card and Krueger (1996a, 1996b) point out, aggregation can mitigate the endogeneity problem of parents choosing the school based on school quality characteristics. For example, children who perform below the average might be attending schools with small classroom size as the result of parents' decision-making. If so, the use of school-level data will introduce a downward bias in the estimates of school quality effects. On the other hand, students with performance above the average might be sorted to schools with high level of resources per pupil resulting in upward-biased estimates (Card and Krueger, 1996a). In either case, the use of aggregate school quality characteristics could give more accurate effects.

Unlike the literature on school quality effects in the US, the literature on school quality and student's achievement in the context of developing countries is less voluminous. Several potentially serious estimation problems arise in the context of developing countries. First, children are not restricted to attending a particular school in most of developing countries. Therefore, parents might be placing their children into schools based on schools' characteristics. But if, for example, more able individuals go to better schools, then one can expect a positive association between school quality and test scores to hold even if there is no causal relationship between school quality and student's achievement. Another common problem is early dropping out of school. As a result, whenever a study is focused on school students a sample selection bias is likely since school students are not representative of all children their age. In addition, the amount of schooling completed at the time tests are taken is potentially endogenous.

One of the few studies that relate school characteristics to student achievement in developing countries while addressing the aforementioned issues is the work of Glewwe and Jacoby (1994). In their study Glewwe and Jacoby analyzed the impact of school characteristics on the achievement of middle school students (grades seven to ten) in Ghana. Grade attainment and math and reading test results were chosen as measures of student success. Within a structural framework Glewwe and Jacoby addressed a selectivity issue of the sorting of higher ability students in better schools by explicitly modeling parents' school choice (comparing indirect utility functions). They also tried to control for two additional sources of sample selection bias: starting school later than at a normal age and dropping out of school prior to the survey. Surprisingly, the results did not reveal any strong selectivity bias. The authors attributed this fact to a certain aspect of the education system in Ghana: its lenient promotion policy. The results revealed that condition of classrooms is important. Namely, children enrolled in schools with leaking classrooms do significantly worse on the

[1] An alternative view at this problem is the idea that it is better to have the measure of school quality from the actual school attended by individuals than an average school quality measure by district or state which might suffer from measurement error (Betts, 1995).

tests. The impact of instructional materials on test scores is found to be mixed, with only blackboards achieving statistical significance in both math and reading test scores regressions. Neither teacher's schooling nor experience is significant in the tests equations. Unlike most of the previous research on school quality in developing countries (for review, see, for instance, Fuller, 1986) Glewwe and Jacoby found only weak effects of textbooks and desks.

An interesting analysis is presented in Hanushek and Luque (2003). Using data from the Third International Mathematics and Science Study (TIMSS) they investigate the contribution of family background and school characteristics to within and between country variations in student performance. Cross-country analysis yields the estimates of the wrong sign on all three resource measures that are used, that is, expenditure per pupil, proportion of GDP devoted to public education, and pupil-teacher ratio in primary schools. However, cross-country analysis ignores any possible differences in the school systems across countries and, therefore, the estimates might be biased. For this reason the authors provide a country-level analysis. They use several school quality characteristics with particular emphasis on teacher characteristics and class size. The results reveal that the overall strength of resources in achieving better student performance on the tests is rather limited across over 40 countries surveyed by TIMSS. For example, for the younger age group (9 year olds) smaller classes have the expected negative sign in 14 out of 17 countries, but the effect is statistically significant (at 10% significance level) for only three countries. For the older age group (13 year olds) the effect is positive and statistically significant in over half of the countries with only two countries having a negative and significant effect. The study also does not find support for the diminishing marginal returns to added school quality resources: there is no clear differential effect by the level of national income. In other words, the effects of school characteristics are not more substantial in the poorer countries or in the countries that begin with lower levels of resources.

Summing things up, there is a strong disagreement among economists on whether school quality affects students' success in the U.S. One group of economists (Hanushek, Betts among many others) believe that additional school resources contribute to students' success neither in school nor later on in their lives. They find small and statistically insignificant effects of school quality. The other group of economists (Card and Krueger among few others), however, believe in the opposite, that there is a positive effect of certain school quality characteristics on students' success. The studies on school quality effects in developing countries generally tend to find positive effects of school quality on student's achievement. At the same time, types of school quality characteristics that have significant effects on student's success vary across studies. Some studies find no positive relationship between school quality and student's outcomes in developing countries.

III. Analysis
III.1. Overview of the data and dependent variables

1. The Sample

The data come from the Cebu Longitudinal Health and Nutrition Survey (CLHNS). For the past 20 years the CLHNS has followed up a representative cohort (random sample from 33 barangays[2]) of children born between April 1983 and May 1984. In our study, the surveys of interest are 1991-92, 1994-95, 1998-99, 2002-2003 follow-up surveys. The corresponding datasets provide a rich array of variables on each child up to date.

To get the final sample of interest the following was done. First, complete schooling trajectories were constructed for each child in the sample[3]. Then those who attended a school with more than 6 grades in it were dropped out of the sample, that is 359 people out of 2,151 (i.e. 16.73%) were lost (school quality variables could not be constructed for any school with more than 6 grades in it). Additionally, 23 people were lost due to missing information on the schools they attended (17 schools). Five schools were dropped as obvious outliers in school characteristics distribution. That resulted in 21 more people lost.

2. Student's Outcomes

Two major outcomes I am interested in are 'completion of elementary school' and 'completion of high school'. These outcomes are important for several reasons. First, they are related to earnings. Literature provides strong evidence on positive association between educational attainment and earnings. The corresponding estimates generally imply a positive rate of return on investment in additional schooling in the range of 5-12 percent (Burtless, 1996). The rate is even higher for developing countries. Psacharopoulos (1994) reports the average private return to education in developing countries to be 29% for primary education, 18% – for secondary, and 20% – for higher education. Second, these outcomes are socially important.

For the purpose of our analysis, conditioning these outcomes on age is crucial. School quality might be affecting educational attainment through grade repetition, which is very common in Cebu. Children could be repeating grades due to poor school quality they experience and ignoring this fact could put a downward bias on the effects of school quality. Hence, I use "completion of elementary school by age 13" and "completion of high school by age 18" as the primary outcomes. I expect children to enter the school by the time they are 7 years old (92.76% of the sample went to school at the age of 7 or earlier). Adding 6 years of elementary school yields the age of 13 that I condition on. Four more years of high school gives the age of 17. Nevertheless, I condition on 18 since that seems to be a more reasonable and socially optimal age of high school completion. By doing that, however, I implicitly allow for repeating one grade. At the age of 18 exactly 59 children were interviewed in 2002-2003 survey while attending the last grade of high school i.e. there is no information on whether they successfully completed the last grade of high school. Given that they were in

[2] A "barangay" is the smallest administrative unit in Cebu and can be thought of as a community.

[3] That was done as part of the ongoing CPC project I am involved in. Data from 1994-95, 1998-99, and 2002-2003 follow-up surveys were used to construct the trajectories. As a result, the sample is limited only to those who participated in all three surveys, 1982 individuals. For comparison, the largest number of people for whom schooling data were available in a single survey is 2174 people in 1994-1995 survey.

the last grade of high school and they did not drop out of school as of the time of interviews, makes me believe that most likely they completed this grade successfully. Hence, I assume that these 59 people completed high school successfully at the age of 18. The two dummy variables corresponding to "completion of elementary school by age 13" and "completion of high school by age 18" are "elemyes" and "highyes" respectively.

As separate outcomes I analyze achievement tests results. Cognitive achievement tests have become popular in empirical research on the returns to education in developing countries as measures of human capital productivity (for example, Boissiere et al. (1985), Psacharopoulos and Velez (1992), Alderman et al. (1996a), and Glewwe (1996)). Therefore, it is important to know whether school quality affects this type of outcomes. In the CLHNS three achievement tests (Math, English, Cebuano) were administered during the period of 1995-1996[4]. I look at Math and English tests.

III.2. The Model

Formally, I estimate the following linear probability model for all binary outcomes of interest:

$$y_i = \beta_0 + \beta_1' X_{1i} + \beta_2' X_{2i} + \beta_3' X_{3i} + \beta_4' Q_i + \varepsilon_i \qquad (1)$$

where y_i is a binary outcome (see above), X_{1i} is a vector of family background characteristics, X_{2i} contains individual characteristics, X_{3i} represents community and regional characteristics, Q_i is a vector of school quality characteristics.

For achievement tests I estimate:

$$SCORE_i = \beta_0 + \beta_1' X_{1i} + \beta_2' X_{2i} + \beta_3' X_{3i} + \beta_4' Q_i + \varepsilon_i \qquad (2)$$

where $SCORE_i$ stands for achievement test result, coefficients β_4 will reflect both the direct effect of school quality on test scores and any indirect effect of school quality on test scores via its effect on educational attainment (in our case, for instance, by the time the tests were administered a child may have dropped out of school and, consequently, received less schooling, due to poor school quality he/she experienced). Note that the tests were administered to all children independent of schooling status.

In my analysis I believe that all children living in the same barangay share a common unobservable effect that I cannot control for. Consequently, I treat the barangays of living as clusters i.e. I assume that individuals' errors, ε_i's, are correlated within a cluster while clusters are independent[5]. That affects the calculation of standard errors when running regressions. Most econometric packages correct standard errors if requested.

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[4] At the time the achievement tests were administered most of the children were in grade 5 or 6 (ALL of them were still in elementary school), which is good since I analyze the effects of elementary school quality.

[5] More precisely, an error term ε_i is a composed error that can be thought of as "$v_s + u_{si}$", where v_s is an unobservable effect of barangay (cluster) *s* and u_{si} is a idiosyncratic unobservable of individual *i* from cluster *s*.

III.3. Exogenous Variables

The school quality variables are constructed from both the School Administrator Survey (which was a part of the 1994-95 follow-up survey), and 1996 World Bank follow-up survey[6]. Together these two surveys provide information on 299 schools while the number of unique schools actually attended by index children is 198. The surveys provide detailed information on school characteristics. Most of them represent the actual resources available in schools, e.g. whether teachers have enough chalk, what percentage of classrooms has usable blackboard, etc. As for school quality characteristics that are commonly used in the literature on school quality in the US, the following two were created: 1) pupil/teacher ratio, 2) number of books per pupil. It was possible to construct these two measures for elementary schools (grades 1-6) only, which implies I analyze only elementary school quality effects in my work. In the data on schools, 84.28% of the schools are at most elementary schools (i.e. schools that have 6 grades or less). In our sample, 83.27% of the children attended this type of schools. The analysis is limited to these children only.

To construct school-level school quality variables, data on schools were matched with the children from our sample. For each child the most recently attended school, as of the time of 1994-1995 follow-up survey, was taken. Not all of the children attended only one school. 197 children changed schools at least once. 79 out of these 197 spent one year or less in the previously attended school and, perhaps, they do not represent a problem. For the other 118 children school quality characteristics of the most recently attended school might be not the most accurate measures of the actual school quality these children experienced. However, there is no information on how long a child attended each of the schools if more than one school was attended (that info would have been necessary if we wanted to construct a weighted average of school characteristics across all schools a child attended). Hence, I use the most recently attended school for all children in the sample.

The school quality variable "ptratio_94", pupil-teacher ratio, was constructed by computing total number of pupils in grades 1-6 (in 94-95 survey the only questions asked with respect to number of pupils were "How many boys/girls do you have in grade 1?", …, "How many boys/girls do you have in grade 6?"). Then this number was divided by the total number of teachers in the school[7].

The school quality variable "bkpst_94", books per pupil, was constructed by dividing the total number of books in the school library by the total number of pupils in grades 1-6.

I do not include a dummy for the type of school, public vs. private, since 98.17% of our sample attended public school.

Child's individual characteristics are represented by two variables – "boy" (sex of a child) and "iqvar" (a measure of child's IQ). It is worth mentioning a few words on the latter. The IQ variable was constructed using the results of nonverbal intelligence test administered during the 1991-1992 follow-up survey. At that time some of the children aged 6-7 years old were already in school. The test consisted of 100 equally weighted questions. As part of the ongoing CPC project that I am involved in I worked on the creation of an IQ measure from

[6] As of the time of 94-95 follow-up survey all of the children acquired no more than elementary schooling i.e. elementary school quality measures were taken at the time children were still in elementary school.

[7] I.e. if a school has more than 6 grades there is no way to compute pupil-teacher ratio accurately since in the data I have the number of pupils for grades 1-6 only while the number of teachers is reported for the whole school. That is why all the schools with more than 6 grades in them were excluded from the analysis.

the results of this test. At some point it was decided to drop the last 50 questions since many of them require knowledge of basic algebra that is usually taught during the first years in school. The first 50 questions require logical and abstract thinking and thus should provide a much better measure of child's IQ as a proxy for 'innate' ability. The variable "iqvar" represents a total number of correctly answered questions[8].

Family characteristics variables are used to account for the differences in parental inputs and family environment a child is exposed to. Family background characteristics along with the 'ability' measure are cited in the literature as the most important variables to control for. The family variables I use are the following.

"chsibl" – total number of child's siblings in the family.

"mchtog" – a dummy controlling for whether mother is alive and lives with the child in one household as of the time of 94-95 survey.

"fatheduc" – father's education, measured as a total number of years of schooling completed.

"motheduc" – mother's education, measured as a total number of years of schooling completed.

"log_percapinc94" – logarithm of per capita family income measured in local currency, pesos. I use logarithm of income since I believe that 100 extra pesos for a family in the bottom of income distribution will have a different (presumably a larger) effect on child's schooling compared to a family in the top of income distribution. I use per capita measure since the size of a family varies in Cebu (its mean is 7.06 and standard deviation is 2.27)[9].

Since family variables were constructed using income sections of the 1994-1995 follow-up survey some observations for these variables were missing. In order not to lose the missing observations I imputed them with the respective mean values and created corresponding dummies.

"impfaed" – a dummy for imputed father's education, 209 observations imputed.

"impmoed" – a dummy for imputed mother's education, 107 observations imputed.

"impsibl" – a dummy for imputed number of child's siblings, 116 observations imputed.

"impinc94" – a dummy for imputed income variable, 117 observations imputed.

Community and regional variables are represented by the following variables.

"urban" – dummy variable for the type of the barangay – urban/rural. This variable should control for any differences in the effects of living in urban area as opposed to rural.

"municipal1", …, "municipal9" – dummies for 9 municipalities. A municipality in Cebu is the largest administrative unit. These variables should account for possible macroeconomic effects of living in different municipalities.

A summary of exogenous as well as dependent variables is provided in Table 1.

[8] The distribution of the correctly answered questions does not have any heaping in the tails, so I do not use quintiles. However, if there are significant nonlinearities in the effect of IQ, then quintiles might be preferable.
[9] Using log of total income (instead of per capita) yields very similar results.

Table 1. A Summary of the Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
elemyes	1750	.724	.4471446	0	1
highyes	1750	.552	.4974308	0	1
englscore	1744	26.707	9.995388	0	59
mathscore	1744	29.84633	10.87769	0	58
cebuscore	1744	12.957	5.989941	0	29
ptratio_94	1750	39.90452	6.484528	16.28572	66.42857
bkpst_94	1750	.9831085	1.389113	0	13.95349
boy	1750	.5142857	.4999387	0	1
iqvar	1750	32.45314	6.644861	6	45
chsibl	1750	4.064765	2.217744	0	13
mchtog	1750	.9091429	.287488	0	1
fatheduc	1750	6.844567	3.153464	0	18
motheduc	1750	6.635135	3.110185	0	17
log_percap~94	1750	3.998124	.7528791	0	8.445475
urban	1750	.6811429	.4661668	0	1
municipal1	1750	.384	.4864969	0	1
municipal2	1750	.0771429	.2668943	0	1
municipal3	1750	.1497143	.3568931	0	1
municipal4	1750	.1411429	.3482684	0	1
municipal5	1750	.0245714	.1548592	0	1
municipal6	1750	.0171429	.1298407	0	1
municipal7	1750	.1171429	.3216824	0	1
municipal8	1750	.0885714	.2842054	0	1
municipal9	1750	.0005714	.0239046	0	1
impfaed	1750	.1182857	.3230384	0	1
impmoed	1750	.0605714	.2386107	0	1
impsibl	1750	.0657143	.2478528	0	1
impinc94	1750	.0662857	.248852	0	1

IV. Results
IV.1. Completion of elementary school

Column 1 of Table 2 provides the estimates of the equation (1) with "completion of elementary school by age 13" as a dependent variable. In a linear probability model the estimates are straightforward to interpret. As we can see both pupil-teacher ratio and books per pupil have the expected signs. The numbers suggest that decreasing pupil-teacher ratio by 10 will result in 3.02 percentage point increase in probability of child's completion of elementary school. The estimated coefficient on pupil-teacher ratio is significant only at 10% significance level. The estimated effect of books per pupil is 3.85 percentage point (0.0077*5) increase in probability when books per pupil are increased by 5. This coefficient is not statistically significant though.

Child's individual characteristics have relatively large and significant effects. Boys are, on average, 11.01 percentage points less likely to complete elementary school than girls, ceteris paribus. The IQ variable is highly significant and implies that, on average, answering correctly 10 more questions on IQ test corresponds to 19.38 percentage point increase in the probability.

Table 2. Elementary school completion by age 13. School-level analysis.

	Complete equation (1)	NO family (2)	NO IQ (3)	NO Community (4)	NO family AND ability (5)
ptratio_94	**-0.00302**	**-0.00506**	**-0.00297**	**-0.00245**	**-0.00644**
	(0.00175)*	(0.00185)***	(0.00178)*	(0.00182)	(0.00206)***
bkpst_94	**0.00770**	**0.01532**	**0.00701**	**0.00044**	**0.01914**
	(0.00954)	(0.01050)	(0.00967)	(0.01094)	(0.01075)*
boy	-0.11011	-0.10741	-0.11366	-0.11184	-0.11171
	(0.01892)***	(0.02029)***	(0.01973)***	(0.01879)***	(0.02162)***
iqvar	0.01938	0.02423		0.01955	
	(0.00194)***	(0.00203)***		(0.00186)***	
chsibl	-0.02346		-0.02958	-0.02342	
	(0.00432)***		(0.00429)***	(0.00441)***	
mchtog	-0.01159		0.03690	-0.01117	
	(0.05429)		(0.06738)	(0.05401)	
fatheduc	0.00926		0.01421	0.00804	
	(0.00288)***		(0.00384)***	(0.00273)***	
motheduc	0.01431		0.02114	0.01506	
	(0.00328)***		(0.00332)***	(0.00334)***	
log_percapinc94	0.02286		0.04488	0.02312	
	(0.01619)		(0.01653)***	(0.01621)	
urban	0.02636	0.08405	0.04568		0.15475
	(0.03251)	(0.03563)**	(0.03236)		(0.04175)***
municipal2	0.00590	0.00548	-0.01422		-0.02171
	(0.04722)	(0.04830)	(0.04323)		(0.04672)
municipal3	-0.00333	0.00463	0.00970		0.02852
	(0.02495)	(0.02504)	(0.02968)		(0.03271)
municipal4	0.12474	0.15368	0.13518		0.19003
	(0.02641)***	(0.02733)***	(0.02820)***		(0.03501)***
municipal5	0.15580	0.16913	0.23983		0.29480
	(0.09256)*	(0.08957)*	(0.10551)**		(0.10977)***
municipal6	0.14297	0.21052	0.13518		0.24159
	(0.05193)***	(0.06603)***	(0.05293)**		(0.08838)***
municipal7	0.06163	0.06837	0.08482		0.10441
	(0.03728)	(0.04055)*	(0.04284)**		(0.05558)*
municipal8	0.01817	0.02209	0.01220		0.01505
	(0.03238)	(0.03104)	(0.03602)		(0.03461)
municipal9	-0.16601	-0.04317	-0.55138		-0.52341
	(0.05881)***	(0.06182)	(0.04035)***		(0.04563)***
impfaed	-0.05565		-0.04097	-0.05703	
	(0.02937)*		(0.03172)	(0.02889)*	
impmoed	0.22441		0.26506	0.22047	
	(0.17708)		(0.18856)	(0.17856)	
impsibl	-0.35445		-0.45160	-0.36029	
	(0.17657)**		(0.18846)**	(0.17241)**	
impinc94	0.06355		0.13831	0.06790	
	(0.04943)		(0.05498)**	(0.04323)	
R-squared	0.22	0.18	0.16	0.21	0.05

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

All family characteristics except the mother-and-child-together dummy and income measure have statistically significant effects. One additional sibling decreases child's chances of elementary school completion by 2.35 percentage points. One extra year of father's schooling contributes 0.93 percentage points to the probability. Mother's education seems to matter more – one additional year of mother's schooling corresponds to 1.43 percentage point change in the child's probability of elementary school completion. The coefficient on the log of per capita family income is quite small, implying that 10% per capita income increase will result, on average, in 0.23 percentage point increase in the probability.

Those living in urban areas are more likely to finish elementary school, by 2.29 percentage points, than those living in rural areas. This estimate is, however, statistically insignificant. As for the regional effects, all the effects are relative to the omitted municipality where the largest fraction (38.4%) of the sample lives – Cebu City. For example, children living in municipality 4 have 12.47 percentage points higher probability of elementary school completion than those living in Cebu City. For residents of municipality 9 the same difference is negative, -16.60 percentage points.

Columns 2, 3, 4 and 5 in Table 2 represent the analysis of sensitivity of our results to the omission of certain groups of variables.

As we can see from column 2 omitting all family characteristics induces a significant upward bias in most of the estimates. For instance, the effect of pupil-teacher ratio is now 68% higher compared to the initial estimate in column 1. It also becomes significant at 1% significance level. The estimate of the coefficient at books per pupil variable almost doubles (99% bias). The estimated effect of IQ measure increases by 25% of the original estimate. Living in urban area implies 8.40 percentage points (compare it to 2.29 percentage points in column 1) higher probability of finishing elementary school than living in rural area. This estimate also becomes statistically significant at the conventional 5% significance level.

Omitting only the child IQ measure (Column 3) introduces a slight downward bias in school quality effects. The absolute value of the estimated coefficient on pupil-teacher ratio decreases by 1.7% of the estimate in column 1. The one on books per pupil goes down by 9%. For several variables the omission of ability measure results in an upward bias. For instance, for number of siblings, father's education, mother's education and log of per capita family income the biases are 26%, 53%, 48%, and 96% respectively.

Omission of community and regional variables (Column 3) results in larger downward biases for school quality variables than the omission of IQ measure. For pupil-teacher ratio and books per pupil variables the biases, in absolute terms, are 19% and 94%.

Even more interesting results are in the last fifth column of Table 2 where the case of omitting both family characteristics and ability measure is presented. The omission of these variables inflates the estimates quite a bit. The biases are larger than the ones from omitting only family variables. The effect of pupil-teacher ratio is biased now by 113% (compare to 68% in column 2), the effect of books per pupil is spuriously increased by 149% (compare to 99% in column 2). Books per pupil estimated coefficient now becomes significant at 10% level.

Trying to evaluate whether the biases mentioned above are statistically significant I bootstrapped the differences in the estimated coefficients on school quality variables. The results, presented in Appendix B1, show that for pupil-teacher ratio the bias appears to be statistically significant (at conventional 5% significance level) only in two cases: 1) omission of family variables (column 2, Table 2) and 2) joint omission of family and IQ variables (column 5, Table 2). As for books per pupil the only marginally significant difference (at 10% significance level) appears to be for the case of omitted family characteristics.

IV.2. Completion of high school

The results for the other outcome, completion of high school by age 18, are presented in Table 3.

Table 3. High school completion by age 18. School-level analysis.

	Complete equation (1)	NO family (2)	NO IQ (3)	NO Community (4)	NO family AND ability (5)
ptratio_94	**0.00043**	**-0.00219**	**0.00033**	**0.00105**	**-0.00344**
	(0.00195)	(0.00202)	(0.00193)	(0.00261)	(0.00217)
bkpst_94	**0.01718**	**0.02659**	**0.01641**	**0.01158**	**0.02934**
	(0.01238)	(0.01336)**	(0.01228)	(0.01435)	(0.01320)**
boy	-0.18832	-0.18605	-0.19124	-0.18855	-0.18990
	(0.02035)***	(0.02072)***	(0.02058)***	(0.02048)***	(0.02084)***
iqvar	0.01464	0.02044		0.01491	
	(0.00168)***	(0.00170)***		(0.00164)***	
chsibl	-0.02034		-0.02401	-0.02021	
	(0.00517)***		(0.00530)***	(0.00533)***	
mchtog	0.12637		0.15616	0.12209	
	(0.06220)**		(0.06827)**	(0.06345)*	
fatheduc	0.01606		0.02000	0.01377	
	(0.00332)***		(0.00380)***	(0.00355)***	
motheduc	0.01320		0.01774	0.01379	
	(0.00482)***		(0.00438)***	(0.00490)***	
log_percapinc94	0.04390		0.05917	0.04198	
	(0.01844)**		(0.01879)***	(0.01882)**	
urban	0.00338	0.07642	0.02101		0.13699
	(0.04435)	(0.04934)	(0.04404)		(0.05543)**
municipal2	-0.00295	-0.00387	-0.01980		-0.02857
	(0.04895)	(0.04654)	(0.04715)		(0.04447)
municipal3	-0.04909	-0.03166	-0.03818		-0.01115
	(0.03756)	(0.03992)	(0.03979)		(0.04566)
municipal4	0.14237	0.18087	0.14675		0.20676
	(0.05638)**	(0.05779)***	(0.05976)**		(0.06592)***
municipal5	0.26958	0.28670	0.33288		0.39155
	(0.07679)***	(0.07824)***	(0.08474)***		(0.09443)***
municipal6	0.01187	0.09467	0.00644		0.11903
	(0.06996)	(0.09314)	(0.07488)		(0.11609)
municipal7	0.02509	0.03934	0.04624		0.07351
	(0.05016)	(0.05566)	(0.05220)		(0.06573)
municipal8	-0.00259	0.00559	-0.00845		-0.00172
	(0.04221)	(0.04515)	(0.04313)		(0.04777)
municipal9	-0.07947	0.08026	-0.37204		-0.32672
	(0.06096)	(0.06018)	(0.05715)***		(0.05789)***
impfaed	-0.04448		-0.03263	-0.04538	
	(0.03422)		(0.03430)	(0.03487)	
impmoed	-0.03312		-0.00432	-0.02863	
	(0.18074)		(0.18965)	(0.18196)	
impsibl	-0.18657		-0.26695	-0.20310	
	(0.15707)		(0.16011)*	(0.15514)	
impinc94	0.20895		0.26588	0.21286	
	(0.05714)***		(0.05778)***	(0.05878)***	
R-squared	0.20	0.14	0.16	0.18	0.07

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

We have to keep in mind that the effects of school quality presented in Table 3 are the effects of *elementary* school characteristics. Column 1 in Table 3 reveals that the effect of pupil-teacher ratio on the probability of high school completion has now a positive sign and is even smaller in absolute terms, 0.43 percentage points compared to 3.02 in Table 2, while the standard error has gone up. As for the estimated coefficient on books per pupil, it more than doubles: increasing books per pupil by 5 implies 8.59 percentage point increase in the probability. However, this estimate is not statistically significant even at 10% significance level. Most likely, the data show no effects of elementary school characteristics on high school completion, at least we are not capturing these effects.

There might be several explanations to this. Since over 80% of our sample went to schools that have at most grades 1-6, it means if continuing their education and going to high school children had to change schools. As a result, characteristics of high schools do not have to be similar to those of elementary schools that we have since the schools are different. Hence, while we are not capturing the effects of elementary school characteristics on high school completion there still might be positive significant effects of high school characteristics. On the other hand, since most of the high schools in Cebu are located in urban areas, for those children who move from rural barangays this change might represent some type of a shock affecting their performance in high school (for instance, they might be forced to work while in school in order to keep up with higher costs of living).

As for the other variables in Column 1 of Table 3, some of them have larger and some have smaller effects (compared to Column 1 of Table 2). Additionally, both the mother-and-child-together dummy and family income variable become significant at 5% significance level. The mother-and-child-together dummy now has a positive sign and implies that those with mother alive and living together (as of the time of 94-95 survey) have 12.64 percentage points higher probability of high school completion than those living without mother in the household. The effect of the log of per capita family income now is almost twice as large: a 10% increase in per capita income corresponds, on average, to 43.90 percentage point increase in the probability ceteris paribus.

The omission of certain groups of variables illustrated in columns 2-5 reveals patterns similar to what we found in Table 2. For instance, omitting family characteristics leads to the inflation of estimated coefficients in both school quality measures. An even larger change in the estimates is from the joint omission of family characteristics and IQ variable. Again, trying to evaluate whether these differences in the estimated coefficients are statistically significant I did bootstrapping. The results are presented in Appendix C1 and tell the story very similar to the case of elementary school completion. Namely, the difference in the estimated coefficients on pupil-teacher ratio variable appears to be statistically significant (at 1% significance level) in two cases – 1) omission of family variables (column 2, Table 3) and 2) joint omission of family and IQ variables (column 5, Table 3). As for books per pupil variable the only marginally significant difference (at 10% significance level) is in the case of omitted family characteristics.

IV.3. Possible problems

1. Measurement error in income variable

It is quite possible that the income measure used in the regressions suffers from the measurement error. To see if this is true I instrument log of per capita family income (constructed from 1994-1995 survey) with the log of per capita family income constructed from 1991-1992 survey data. In order to show how strong the instrument is I report first-stage regression results (see Staiger and Stock (1997) on this issue) in Appendix B3, Table B3.1., (elementary school completion) and in Appendix C3, Table C3.1., (high school completion). In both cases *t* and *F* statistics are fairly large. Surprisingly, instrumenting does not change the coefficients significantly (see Appendix B3, Table B3.2., and Appendix C3, Table C3.2.). To be rigorous I bootstrap the differences in the estimated coefficients of pupil-teacher ratio, books per pupil and income variables from running regression with and without instrumenting income. The results of bootstrapping (see Appendix B2 and Appendix C2) show that the differences in coefficients are very small and they are not statistically significant. In other words, we do not get any reasonable gains from instrumenting the income measure with lagged income.

2. Measurement error and endogeneity bias in school quality variables

It very well might be that our school quality characteristics are measured with errors, and that introduces a downward bias in our estimates of school quality effects. Additionally, as it was discussed earlier, the estimates might suffer from the endogeneity bias arising from the selective placement of children into schools by parents. To resolve both problems I instrument school-level school quality measures with aggregate measures. Aggregation is done around the place of living of a child (as of the time of 1994 survey) within a certain radius. I aggregate across all schools except the actual school the child attended since the presence of correlated measurement error in our instrument is undesirable. I aggregate within the radii of 1km, $\sqrt{2km}$, $\sqrt{3km}$, $\sqrt{4km}$, and $\sqrt{5km}$ (the area corresponding to each of these radii is 3.14 sq. km., 6.28 sq. km., 9.42 sq. km., 12.57 sq. km, and 15.71 sq. km., respectively). The motivation for choosing these exact radii and more details on the construction of aggregate measures are presented in Appendix D.

Instrumenting both pupil-teacher ratio and books per student simultaneously gives the estimates with unreasonably high standard errors (for example, see Appendix B4, Table B4.1.). A close look at the first-stage regression reveals that aggregate measures of pupil-teacher ratio and books per pupil are too weak to instrument books per pupil variable measured at school level (see Appendix B4, Table B4.2.). So instead of instrumenting both school quality measures I instrument only the pupil-teacher ratio. I run TSLS using as instruments five different aggregate measures (that corresponds to five different radii mentioned above), one at a time. Aggregation at radius equal to $\sqrt{2km}$ gives the strongest instrument based on *t* and *F* statistics from the first stage regressions (the results of the first and second stages of estimation are reported in Appendix B5)[10]. Intuitively, aggregation within 1km radius yields a weaker instrument because the number of schools within 1km is relatively low (2.997 schools, on average) while, as mentioned previously, the actual school the child attended is excluded from aggregation. Aggregation at radii larger than $\sqrt{2km}$ produces, most likely, too much noise in school quality measures.

As we can see from Appendix B5 the estimated coefficient on pupil-teacher ratio is more than three times the size of the estimate without instrumenting i.e. -0.00925 compared to -0.00302 from Table 2. However, this coefficient is not statistically significant even at 10% significance level. To see whether the changes in the estimates are statistically

[10] Using another outcome variable, completion of high school by age 18, gives similar patterns of results (see Appendix C5).

significant, I bootstrap the differences in the estimated coefficients of pupil-teacher ratio and books per pupil from running regression with and without instrumenting the pupil-teacher ratio. The results of bootstrapping (see Appendix B6) show that the differences in coefficients are statistically indistinguishable from zero.

3. Do we have good measures of school quality?

While a pupil-teacher ratio is a common measure used in the studies on the effects of school quality, a books per pupil measure is less common. As we can see in the previous tables the estimated coefficients on books per pupil variable are relatively noisier than the ones on pupil-teacher ratio. It is possible that books per pupil measure that we have is not a good measure of the actual school quality. One of the reasons for this could be, for example, a possibility that pupils are required to buy the books and consequently library books might be a poor measure of the actual school quality. In an attempt to check if this is true I contacted the Office of Population Studies at the University of San Carlos, Philippines. Here is their reply: "…you are right about books in the library not being a good measure of book availability per student. You are correct in assuming that, in some schools (private schools), students buy their own textbooks, in others, the books are rented out to students. Students at the elementary level do not rely heavily on library resources for textbooks."

This information coupled with the fact that correlation between pupil-teacher ratio and books per student is only -0.26[11] makes me think that books per pupil measure might be a poor measure of school quality in Cebu.

I tried to use several alternative school quality measures that are common in the literature on school quality effects in developing countries. However, many of potentially interesting measures do not provide enough variation. For example, only 3.27% of our sample attend schools that have multi-grade classrooms, only 9% of the sample attend schools that have classes that are regularly held outside, less than 13% of the children attend schools that do not have blackboards in all classrooms. The only two alternative measures I was able to come up with are "enchalk_94" – "Do teachers always have enough of chalk?" (29.36% of the sample attend schools that always have enough chalk), and "electric_94" – "Does this school have electricity?" (84.30% of the children attend schools that have electricity). The results of the regressions are presented in Appendix A1 and Appendix A2. In both cases these alternative measures do not produce any statistically significant effects.

IV.4. Achievement test scores

In this section we look at scores on Math and English achievement tests administered during 95/96 school year. First, I estimate the effects of school quality measures on the results of Math and English achievement tests without controlling for schooling completed at the time the tests were taken. The results presented in Appendices E and F have much in common. For both tests the estimated effect of pupil-teacher ratio is quite small: decreasing the pupil-teacher ratio by 10 would increase, on average, Math test scores by 0.33 score points and English test scores by 0.39 score points. Given the fact that the standard

[11] If both pupil-teacher ratio and books per pupil measure true school quality then one would expect a significant correlation between these two. It is possible, however, that some schools are good in one dimension of school quality, e.g. pupil-teacher ratio, and at the same time poor in another, e.g. availability of books in school. If that is the case for many schools then the correlation of school quality measures is likely to be low.

deviations for the Math and English tests scores are 10.88 and 10.00 score points, respectively, (with the means of 29.85 and 26.71), the effects of pupil-teacher ratio are quite small. Also, they are not statistically significant. The upper bounds of the 95% confidence interval for the pupil-teacher ratio effects on the Math and English tests scores are about four and three times the size of the respective estimated effects. This implies that, while the effects of pupil-teacher ratio on the test scores might be imprecisely estimated, these effects appear to be truly small. The omission of family background characteristics increases the estimates approximately threefold for both tests. The joint omission of family background characteristics and ability measure inflates the estimates even more and causes them to appear statistically significant.

Next, I re-estimate the effects of school quality on the achievement test scores by including in the regressions the highest grade completed as of the time the tests were taken. Such an approach has serious limitations. One is potential endogeneity of the amount of acquired schooling. In other words, schooling variable is likely to be correlated with unobservables determining the test scores. Finding a valid instrument for schooling, however, is difficult since it has to be affecting schooling and has no direct effect on the test scores. Another limitation is a possibility that school quality has an effect, presumably positive, on the amount of schooling acquired at the time of the tests (e.g. fewer grades repeated). If the latter is true, then the total effect of school quality is no longer just a coefficient on school quality measure, but rather a sum of the coefficient on school quality measure and the product of the coefficient on schooling and the effect of school quality on schooling acquired[12]. The results of the estimation, with schooling included, are reported in Appendices G and H. The inclusion of schooling reduces the effects of pupil-teacher ratio and books per pupil in English test regressions and reduces the effect of pupil-teacher ratio in Math test regression. The omission of family background characteristics introduces a pattern similar to the results without the schooling. That is, the estimates of school quality effects increase substantially if one omits family background characteristics.

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[12] If the true equation is $score_i = \alpha + \beta \cdot quality_i + \gamma \cdot schooling_i + \varepsilon_i$, then $\frac{\partial E(score \mid X)}{\partial quality} = \beta + \gamma \cdot \frac{\partial schooling}{\partial quality}$

Conclusion

The paper analyzed the effects of elementary school quality on several student outcomes. Completion of elementary school by age 13, completion of high school by age 18, and achievement tests scores were the outcomes of interest. The pupil-teacher ratio and the number of books per pupil were the major school quality measures examined in the paper. The pupil-teacher ratio measure showed statistically stronger effects on students' outcomes compared to books per pupil, most likely due to the books per pupil measure being a poor school quality measure in Cebu. Alternative school quality measures did not reveal any statistically significant effects on the outcomes.

The analysis suggests that decreasing pupil-teacher ratio by 10 implies, on average, a 3 percentage point increase in probability of elementary school completion ceteris paribus (this estimate is statistically significant at 10% significance level). Taking care of the endogeneity bias and the possible measurement error in the pupil-teacher ratio variable, by instrumenting it with a more aggregate measure of the pupil-teacher ratio, raises our estimate of pupil-teacher ratio effect almost threefold. This increase, while quite large, appears to be statistically insignificant.

As for high school completion the elementary school pupil-teacher ratio effect is much weaker and statistically is indistinguishable from zero. Since we do not have measures of high school quality, we cannot say anything about the effects of high school quality on high school completion. The effects of elementary school characteristics, as measured by pupil-teacher ratio and books per pupil, on cognitive achievement tests results are found to be small.

The analysis of the sensitivity of our results to the omission of key explanatory variables reveals that ignoring either ability measure or community/regional measures does not lead to statistically significant changes in the estimated coefficients. However, the omission of family background characteristics introduces a substantial statistically significant bias in the estimate of pupil-teacher ratio effects (e.g. the bias is over 60% for the completion of elementary school outcome). An even larger bias is received if family background characteristics and ability measure are jointly omitted. In both cases the biases spuriously improve statistical "significance" of the estimates making them sometimes "significant" at 1% significance level. By failing to control for family background characteristics one can easily obtain inflated and highly significant estimates of school quality effects that do not exist when one uses a richer set of background variables. This is true for all outcomes of interest in this study. These results do not have to be limited to the case of developing countries. The omission of family background characteristics can be inflating the effects of school quality in the U.S. as well. For example, it is unclear to what extent the omitted family background variables contribute to the size and significance of school quality effects in Card and Krueger (1992)[13], a widely cited paper in economic literature.

[13] Card and Krueger do not have information on the education of individuals' parents. They try to partially control for family background by including the median level of education among adults and the log of per capita income in the state at the time cohorts attended school. Such proxies have statistically insignificant effects in the regression and do not change the estimated school quality effects.

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Appendix A1

	Complete equation	NO family	NO IQ	NO Community	NO family AND ability
ptratio_94	-0.00325	-0.00554	-0.00316	-0.00258	-0.00696
	(0.00177)*	(0.00188)***	(0.00182)*	(0.00188)	(0.00210)***
enchalk_94	**0.00261**	**0.01219**	**0.01136**	**-0.02150**	**0.03403**
	(0.02572)	(0.03056)	(0.02829)	(0.02239)	(0.03864)
boy	-0.11036	-0.10781	-0.11379	-0.11187	-0.11202
	(0.01882)***	(0.02021)***	(0.01961)***	(0.01878)***	(0.02155)***
iqvar	0.01935	0.02424		0.01961	
	(0.00192)***	(0.00192)***		(0.00191)***	
chsibl	-0.02351		-0.02961	-0.02345	
	(0.00432)***		(0.00429)***	(0.00440)***	
mchtog	-0.01159		0.03607	-0.00853	
	(0.05502)		(0.06750)	(0.05454)	
fatheduc	0.00939		0.01434	0.00811	
	(0.00282)***		(0.00374)***	(0.00265)***	
motheduc	0.01454		0.02131	0.01513	
	(0.00340)***		(0.00338)***	(0.00356)***	
log_percapinc94	0.02290		0.04441	0.02424	
	(0.01610)		(0.01634)***	(0.01621)	
urban	0.02728	0.08754	0.04715		0.15999
	(0.03274)	(0.03609)**	(0.03242)		(0.04094)***
municipal2	0.00987	0.01509	-0.00815		-0.00483
	(0.04821)	(0.05054)	(0.04436)		(0.04959)
municipal3	-0.01089	-0.00940	0.00428		0.01391
	(0.03379)	(0.03561)	(0.03631)		(0.04040)
municipal4	0.11808	0.14399	0.13327		0.18639
	(0.03654)***	(0.03934)***	(0.03765)***		(0.04658)***
municipal5	0.15082	0.16242	0.23944		0.29483
	(0.09398)	(0.09182)*	(0.10750)**		(0.11313)**
municipal6	0.13511	0.19634	0.12873		0.22481
	(0.05387)**	(0.07157)***	(0.05526)**		(0.09785)**
municipal7	0.05386	0.05553	0.08091		0.09496
	(0.04058)	(0.04554)	(0.04612)*		(0.06020)
municipal8	0.01079	0.00690	0.00532		-0.00457
	(0.03705)	(0.03550)	(0.03995)		(0.03657)
municipal9	-0.16900	-0.04592	-0.54900		-0.51782
	(0.06576)**	(0.07280)	(0.04596)***		(0.05689)***
impfaed	-0.05593		-0.04114	-0.05702	
	(0.02937)*		(0.03170)	(0.02877)**	
impmoed	0.22402		0.26458	0.22182	
	(0.17729)		(0.18907)	(0.17931)	
impsibl	-0.35562		-0.45386	-0.35331	
	(0.17547)**		(0.18726)**	(0.16936)**	
impinc94	0.06430		0.14007	0.06142	
	(0.04777)		(0.05301)***	(0.04101)	
R-squared	0.22	0.17	0.16	0.21	0.05

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix A2

	Complete equation	NO family	NO IQ	NO Community	NO family AND ability
ptratio_94	-0.00359	-0.00567	-0.00335	-0.00274	-0.00661
	(0.00181)**	(0.00191)***	(0.00185)*	(0.00194)	(0.00209)***
electric_94	**-0.04459**	**-0.00971**	**-0.02048**	**-0.03673**	**0.05301**
	(0.03148)	(0.02695)	(0.03679)	(0.03267)	(0.03442)
boy	-0.10961	-0.10774	-0.11353	-0.11141	-0.11328
	(0.01867)***	(0.02017)***	(0.01951)***	(0.01863)***	(0.02171)***
iqvar	0.01946	0.02433		0.01970	
	(0.00196)***	(0.00200)***		(0.00194)***	
chsibl	-0.02343		-0.02961	-0.02356	
	(0.00432)***		(0.00429)***	(0.00443)***	
mchtog	-0.01107		0.03728	-0.01128	
	(0.05428)		(0.06736)	(0.05383)	
fatheduc	0.00969		0.01448	0.00859	
	(0.00285)***		(0.00379)***	(0.00280)***	
motheduc	0.01472		0.02144	0.01529	
	(0.00339)***		(0.00337)***	(0.00349)***	
log_percapinc94	0.02442		0.04570	0.02585	
	(0.01612)		(0.01646)***	(0.01669)	
urban	0.03918	0.08985	0.05189		0.14188
	(0.03471)	(0.03916)**	(0.03486)		(0.04522)***
municipal2	-0.00157	0.00971	-0.01617		-0.00080
	(0.04641)	(0.04961)	(0.04353)		(0.04963)
municipal3	-0.01265	-0.01158	0.00186		0.01001
	(0.03196)	(0.03303)	(0.03525)		(0.03800)
municipal4	0.11803	0.13888	0.12857		0.16878
	(0.03002)***	(0.03208)***	(0.03115)***		(0.03790)***
municipal5	0.16731	0.16071	0.24246		0.25706
	(0.09586)*	(0.09333)*	(0.10872)**		(0.11344)**
municipal6	0.12549	0.19392	0.12351		0.23320
	(0.05614)**	(0.07057)***	(0.05608)**		(0.08948)**
municipal7	0.04009	0.04849	0.07107		0.09786
	(0.04303)	(0.04197)	(0.04679)		(0.05347)*
municipal8	0.01518	0.00806	0.00757		-0.00893
	(0.03735)	(0.03649)	(0.03953)		(0.03729)
municipal9	-0.15422	-0.04692	-0.54852		-0.55046
	(0.06236)**	(0.06852)	(0.04468)***		(0.05175)***
impfaed	-0.05459		-0.04058	-0.05582	
	(0.02905)*		(0.03158)	(0.02847)*	
impmoed	0.21873		0.26232	0.21478	
	(0.17762)		(0.18913)	(0.18034)	
impsibl	-0.33448		-0.44287	-0.32086	
	(0.18015)*		(0.19129)**	(0.18007)*	
impinc94	0.04680		0.13083	0.03336	
	(0.05118)		(0.05643)**	(0.04970)	
R-squared	0.22	0.17	0.16	0.21	0.05

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix B1

Table B1. Completion of elementary school by age 13. Bootstrapping (1,000 replications) the differences in the estimated coefficients of pupil-teacher ratio and books per pupil from running regression with and without certain groups of variables.[14]

diff_ptrat_nofam	-0.00205 (0.00069)***
diff_bkpst_nofam	0.00761 (0.00434)*
diff_ptrat_noiq	0.00004 (0.00065)
diff_bkpst_noiq	-0.00070 (0.00322)
diff_ptrat_nocom	0.00057 (0.00152)
diff_bkpst_nocom	-0.00727 (0.00512)
diff_ptrat_nofam_iq	-0.00343 (0.00143)**
diff_bkpst_nofam_iq	0.01143 (0.00742)

[14] "diff_ptrat_nofam" stands for a bootstrapped difference in estimated coefficients on pupil-teacher ratio from running regression with complete specification and the one with no family variables. "bkpst" part stands for books per student. "Noiq" means "no IQ variable". "Nocom" means "no community" variables. "Nofam_iq" means "no family AND IQ variables".

Appendix B2

Table B2. Completion of elementary school by age 13. Bootstrapping the differences in the estimated coefficients of pupil-teacher ratio, books per pupil and income variables from running regression with and without instrumenting (91 income is an instrument for 94 income).

```
Bootstrap statistics                              Number of obs    =      1750
                                                  N of clusters    =       150
                                                  Replications     =      1000

   ------------------------------------------------------------------------------
       Variable |  Reps  Observed      Bias  Std. Err. [95% Conf. Interval]
   -------------+----------------------------------------------------------------
     diff_ptrat |  1000  1.98e-06 -.0000405  .0003674  -.0007189   .0007229   (N)
                |                                      -.0008443   .0007327   (P)
                |                                      -.0007234   .0008023  (BC)
     diff_bkpst |  1000 -1.77e-06  .0001438  .0008566  -.0016827   .0016792   (N)
                |                                      -.0013905   .0024011   (P)
                |                                      -.0015774   .0019146  (BC)
       diff_inc |  1000  .0002692 -.0066173  .0382502  -.0747907   .0753292   (N)
                |                                      -.0857305   .0685416   (P)
                |                                      -.0711441   .0776816  (BC)
   ------------------------------------------------------------------------------
Note:  N   = normal
       P   = percentile
       BC  = bias-corrected
```

Appendix B3

Table B3.1. First stage regression from instrumenting log of per capita income (94 survey) with the log of per capita income (91 survey). Completion of elementary school is a dependent variable.

First-stage regressions

Source	SS	df	MS
Model	384.185125	22	17.4629602
Residual	607.195159	1727	.351589554
Total	991.380284	1749	.566826921

Number of obs =	1750
F(22, 1727) =	**49.67**
Prob > F =	0.0000
R-squared =	0.3875
Adj R-squared =	0.3797
Root MSE =	.59295

log_perca~94	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ptratio_94	-.0041021	.0027175	-1.51	0.131	-.0094321	.0012278
bkpst_94	.0050691	.0117915	0.43	0.667	-.018058	.0281961
boy	-.0138061	.0285157	-0.48	0.628	-.069735	.0421228
iqvar	.007203	.0023124	3.11	0.002	.0026675	.0117385
chsibl	-.0525175	.0069784	-7.53	0.000	-.0662045	-.0388305
mchtog	-.0323177	.0909966	-0.36	0.723	-.2107929	.1461576
fatheduc	.0237063	.0056506	4.20	0.000	.0126235	.0347891
motheduc	.0140512	.0058236	2.41	0.016	.0026292	.0254732
urban	.1475485	.0498148	2.96	0.003	.0498449	.2452522
municipal2	.1597387	.0578857	2.76	0.006	.0462052	.2732723
municipal3	.1007089	.0454822	2.21	0.027	.0115028	.1899149
municipal4	.1263357	.0531847	2.38	0.018	.0220226	.2306488
municipal5	.2294777	.1108331	2.07	0.039	.0120965	.4468588
municipal6	.0994366	.1206265	0.82	0.410	-.1371527	.336026
municipal7	.0482368	.0692494	0.70	0.486	-.0875848	.1840584
municipal8	.1522768	.0607169	2.51	0.012	.0331903	.2713632
municipal9	.3168504	.5980366	0.53	0.596	-.8561018	1.489803
impfaed	-.031399	.0488578	-0.64	0.521	-.1272257	.0644276
impmoed	.0720031	.2099474	0.34	0.732	-.3397748	.4837809
impsibl	-.5661727	.6394009	-0.89	0.376	-1.820254	.6879089
impinc94	.6467533	.5985301	1.08	0.280	-.5271669	1.820673
log_perca~91	.3830488	.0218837	**17.50**	0.000	.3401275	.4259701
_cons	2.310757	.1807845	12.78	0.000	1.956177	2.665336

Table B3.2. Second stage regression from instrumenting log of per capita income (94 survey) with the log of per capita income (91 survey). Completion of elementary school is a dependent variable.

```
IV (2SLS) regression with robust standard errors       Number of obs =    1750
                                                       F( 20,   149) =       .
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.2230
Number of clusters (curbrgy2) = 150                    Root MSE      =  .39664

------------------------------------------------------------------------------
             |               Robust
     elemyes |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
log_perca~94 |   .0231303   .0460845     0.50   0.616    -.0679334    .1141939
  ptratio_94 |  -.0030163   .0017741    -1.70   0.091     -.006522    .0004894
    bkpst_94 |    .007699   .0095707     0.80   0.422    -.0112127    .0266108
         boy |   -.110112   .0189175    -5.82   0.000    -.1474931   -.0727308
       iqvar |   .0193724   .0020125     9.63   0.000     .0153956    .0233491
      chsibl |  -.0234368   .0052006    -4.51   0.000    -.0337133   -.0131603
      mchtog |  -.0115716   .0539504    -0.21   0.830    -.1181782     .095035
    fatheduc |   .0092486   .0031467     2.94   0.004     .0030307    .0154665
    motheduc |   .0142977   .0034786     4.11   0.000     .0074238    .0211715
       urban |   .0262838   .0338034     0.78   0.438    -.0405121    .0930797
  municipal2 |   .0058358   .0486509     0.12   0.905     -.090299    .1019707
  municipal3 |  -.0033717   .0252639    -0.13   0.894    -.0532935    .0465501
  municipal4 |    .124682    .026916     4.63   0.000     .0714956    .1778683
  municipal5 |   .1556987   .0931927     1.67   0.097    -.0284514    .3398488
  municipal6 |   .1429065   .0521754     2.74   0.007     .0398073    .2460058
  municipal7 |   .0616117   .0374016     1.65   0.102    -.0122943    .1355177
  municipal8 |   .0181187   .0336876     0.54   0.591    -.0484485    .0846858
  municipal9 |  -.1662036   .0653531    -2.54   0.012    -.2953421   -.0370651
     impfaed |  -.0556566   .0294086    -1.89   0.060    -.1137683    .0024552
     impmoed |   .2243807   .1769944     1.27   0.207    -.1253625    .5741239
     impsibl |  -.3543789   .1757473    -2.02   0.046    -.7016578   -.0070999
    impinc94 |   .0634472   .0526394     1.21   0.230     -.040569    .1674634
       _cons |   .0814937   .1983432     0.41   0.682    -.3104351    .4734224
------------------------------------------------------------------------------
Instrumented:  log_percapinc94
Instruments:   ptratio_94 bkpst_94 boy iqvar chsibl mchtog fatheduc motheduc
               urban municipal2 municipal3 municipal4 municipal5 municipal6
               municipal7 municipal8 municipal9 impfaed impmoed impsibl
               impinc94 log_percapinc91
------------------------------------------------------------------------------
```

Appendix B4

Table B4.1. Second stage: instrumenting both pupil-teacher ratio and books per student school-level measures with the respective aggregate measures (radius for aggregation is $\sqrt{2km}$). Dependant variable is elementary school completion.

```
IV (2SLS) regression with robust standard errors       Number of obs =    1750
                                                       F( 20,   149) =       .
                                                       Prob > F      =  0.0000
                                                       R-squared     =       .
Number of clusters (curbrgy2) = 150                    Root MSE      =  7.2357

------------------------------------------------------------------------------
             |               Robust
     elemyes |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  ptratio_94 |   .5966318   73.39671     0.01   0.994    -144.4362    145.6295
    bkpst_94 |  -4.966933   602.1391    -0.01   0.993    -1194.802    1184.868
         boy |  -.3295523   26.50409    -0.01   0.990    -52.70198    52.04288
       iqvar |    .015088   .5106372     0.03   0.976    -.9939379    1.024114
      chsibl |  -.1375596   13.93411    -0.01   0.992    -27.67155    27.39643
      mchtog |   .9623111   118.6042     0.01   0.994    -233.4011    235.3257
    fatheduc |   .1774673   20.47386     0.01   0.993    -40.27915    40.63409
    motheduc |   .2185078    24.7851     0.01   0.993    -48.75717    49.19419
log_perca~94 |   .5246284   61.14833     0.01   0.993    -120.3053    121.3545
       urban |  -1.747397   216.9328    -0.01   0.994    -430.4094    426.9146
  municipal2 |  -.8866563   111.9641    -0.01   0.994    -222.1292    220.3559
  municipal3 |  -6.053956   734.5926    -0.01   0.993    -1457.619    1445.511
  municipal4 |  -6.739057   833.6225    -0.01   0.994    -1653.988     1640.51
  municipal5 |  -14.65397   1805.089    -0.01   0.994    -3581.533    3552.225
  municipal6 |   -9.37878    1158.14    -0.01   0.994    -2297.878    2279.121
  municipal7 |  -12.08315   1477.987    -0.01   0.993    -2932.605    2908.439
  municipal8 |  -12.15723   1482.576    -0.01   0.993    -2941.748    2917.433
  municipal9 |   -4.24825   496.6029    -0.01   0.993     -985.542    977.0455
     impfaed |  -.3153759   31.48687    -0.01   0.992    -62.53385     61.9031
     impmoed |  -.7883367   122.3405    -0.01   0.995    -242.5348    240.9581
     impsibl |   10.86942   1369.892     0.01   0.994    -2696.056    2717.795
    impinc94 |  -10.16206   1249.366    -0.01   0.994    -2478.927    2458.602
       _cons |  -17.42315   2149.605    -0.01   0.994    -4265.071    4230.225
------------------------------------------------------------------------------
Instrumented:  ptratio_94 bkpst_94
Instruments:   boy iqvar chsibl mchtog fatheduc motheduc log_percapinc94
               urban municipal2 municipal3 municipal4 municipal5 municipal6
               municipal7 municipal8 municipal9 impfaed impmoed impsibl
               impinc94 ag_ptratio ag_bkpst
------------------------------------------------------------------------------
```

Table B4.2. First stage: instrumenting both pupil-teacher ratio and books per student school-level measures with the respective aggregate measures (radius for aggregation is $\sqrt{2km}$). Dependant variable is elementary school completion.

First-stage regressions

Source	SS	df	MS
Model	814.881808	22	37.0400822
Residual	2560.04845	1727	1.48236737
Total	3374.93026	1749	1.92963422

Number of obs	1750
F(22, 1727)	**24.99**
Prob > F	0.0000
R-squared	0.2415
Adj R-squared	0.2318
Root MSE	1.2175

bkpst_94	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
boy	-.0341347	.058594	-0.58	0.560	-.1490574	.0807879
iqvar	-.0019713	.004764	-0.41	0.679	-.0113152	.0073725
chsibl	-.0073171	.0145083	-0.50	0.614	-.0357727	.0211385
mchtog	.0609986	.1867747	0.33	0.744	-.3053298	.427327
fatheduc	.0219803	.0116072	1.89	0.058	-.0007854	.0447459
motheduc	.0334243	.0117949	2.83	0.005	.0102905	.0565581
log_perca~94	.0453056	.0454998	1.00	0.320	-.043935	.1345461
urban	-.0363455	.102996	-0.35	0.724	-.2383556	.1656646
municipal2	.1495693	.1274654	1.17	0.241	-.1004336	.3995721
municipal3	-1.122444	.0923279	-12.16	0.000	-1.30353	-.9413577
municipal4	-1.211929	.1132631	-10.70	0.000	-1.434076	-.9897816
municipal5	-1.400554	.2187374	-6.40	0.000	-1.829572	-.9715357
municipal6	-1.301959	.2463392	-5.29	0.000	-1.785113	-.818804
municipal7	-1.489965	.1378917	-10.81	0.000	-1.760418	-1.219513
municipal8	-1.427652	.1254147	-11.38	0.000	-1.673633	-1.181672
municipal9	-.6963875	1.228555	-0.57	0.571	-3.106001	1.713226
impfaed	-.024779	.1001951	-0.25	0.805	-.2212955	.1717375
impmoed	-.128593	.4314665	-0.30	0.766	-.9748448	.7176587
impsibl	.4721617	1.31006	0.36	0.719	-2.09731	3.041633
impinc94	-.427762	1.226462	-0.35	0.727	-2.833269	1.977745
ag_ptratio	.0141754	.006952	**2.04**	0.042	.0005402	.0278106
ag_bkpst	-.0363184	.0266774	**-1.36**	0.174	-.0886418	.016005
_cons	.7147829	.4138947	1.73	0.084	-.0970047	1.52657

Source	SS	df	MS
Model	26021.3117	22	1182.7869
Residual	47522.5726	1727	27.5174132
Total	73543.8843	1749	42.0491048

Number of obs	1750
F(22, 1727)	42.98
Prob > F	0.0000
R-squared	0.3538
Adj R-squared	0.3456
Root MSE	5.2457

ptratio_94	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
boy	.0821342	.2524522	0.33	0.745	-.41301	.5772783
iqvar	-.0092643	.0205257	-0.45	0.652	-.0495222	.0309936
chsibl	.1293844	.0625088	2.07	0.039	.0067835	.2519853
mchtog	-1.116904	.8047183	-1.39	0.165	-2.695229	.4614208
fatheduc	-.0983892	.0500096	-1.97	0.049	-.196475	-.0003035
motheduc	-.0631761	.0508184	-1.24	0.214	-.1628482	.0364959
log_perca~94	-.4614988	.1960358	-2.35	0.019	-.8459914	-.0770062
urban	2.662526	.4437582	6.00	0.000	1.792166	3.532885
municipal2	2.742329	.5491845	4.99	0.000	1.665192	3.819465
municipal3	.7783751	.3977946	1.96	0.051	-.0018348	1.558585
municipal4	1.395709	.4879937	2.86	0.004	.4385886	2.35283

```
  municipal5 |   13.09197   .9424296    13.89   0.000     11.24355    14.94039
  municipal6 |   5.078433   1.061352     4.78   0.000     2.996762    7.160104
  municipal7 |   7.891801   .5941062    13.28   0.000     6.726557    9.057044
  municipal8 |   8.476729   .5403489    15.69   0.000     7.416922    9.536536
  municipal9 |   1.029088   5.293228     0.19   0.846    -9.352725     11.4109
     impfaed |   .2264702   .4316904     0.52   0.600    -.6202207    1.073161
     impmoed |   .6234747   1.858972     0.34   0.737    -3.022599    4.269549
     impsibl |  -14.80507   5.644392    -2.62   0.009    -25.87563   -3.734506
    impinc94 |     13.509   5.284209     2.56   0.011     3.144874    23.87312
  ag_ptratio |   .1156605   .0299525     3.86   0.000     .0569135    .1744076
    ag_bkpst |  -.3038794   .1149394    -2.64   0.008    -.5293146   -.0784443
       _cons |   35.19805   1.783264    19.74   0.000     31.70046    38.69563
------------------------------------------------------------------------------
```

Appendix B5

Table B5. Instrumenting pupil-teacher ratio school-level measure with the respective aggregate measure (radius for aggregation is $\sqrt{2km}$). Dependant variable is elementary school completion.

First-stage regressions

Source	SS	df	MS
Model	26832.3236	22	1219.65107
Residual	46711.5606	1727	27.0478058
Total	73543.8843	1749	42.0491048

Number of obs =	1750
F(22, 1727) =	**45.09**
Prob > F =	0.0000
R-squared =	0.3648
Adj R-squared =	0.3568
Root MSE =	5.2008

ptratio_94	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
bkpst_94	-.6257054	.1027328	-6.09	0.000	-.8271991	-.4242116
boy	.0842148	.2501761	0.34	0.736	-.4064651	.5748948
iqvar	-.0076051	.0203255	-0.37	0.708	-.0474703	.0322601
chsibl	.1262399	.0619755	2.04	0.042	.0046851	.2477947
mchtog	-1.09508	.797825	-1.37	0.170	-2.659885	.4697246
fatheduc	-.0898936	.0495958	-1.81	0.070	-.1871678	.0073806
motheduc	-.0413362	.0504994	-0.82	0.413	-.1403827	.0577104
log_perca~94	-.4310418	.1944108	-2.22	0.027	-.8123471	-.0497364
urban	2.499106	.4372414	5.72	0.000	1.641528	3.356684
municipal2	2.881296	.5444796	5.29	0.000	1.813387	3.949204
municipal3	.3298578	.4004184	0.82	0.410	-.4554983	1.115214
municipal4	1.036911	.4785701	2.17	0.030	.0982729	1.975549
municipal5	12.20122	.9453785	12.91	0.000	10.34702	14.05543
municipal6	4.628332	1.052549	4.40	0.000	2.563926	6.692737
municipal7	7.460615	.5814477	12.83	0.000	6.320199	8.601031
municipal8	7.530479	.5552852	13.56	0.000	6.441377	8.619581
municipal9	1.225174	5.24363	0.23	0.815	-9.059359	11.50971
impfaed	.1815342	.4278774	0.42	0.671	-.6576783	1.020747
impmoed	.7432399	1.841749	0.40	0.687	-2.869054	4.355534
impsibl	-14.76125	5.595519	-2.64	0.008	-25.73595	-3.78654
impinc94	13.26968	5.239097	2.53	0.011	2.994039	23.54533
ag_ptratio	.1601196	.0270393	**5.92**	0.000	.1070864	.2131527
_cons	33.71536	1.635536	20.61	0.000	30.50752	36.9232

IV (2SLS) regression with robust standard errors

Number of obs =	1750
F(20, 149) =	.
Prob > F =	0.0000
R-squared =	0.2178
Root MSE =	.39798

Number of clusters (curbrgy2) = 150

elemyes	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
ptratio_94	**-.0092465**	.0090876	-1.02	0.311	-.0272036	.0087107
bkpst_94	.0040607	.0107646	0.38	0.707	-.0172102	.0253316
boy	-.1098488	.0192391	-5.71	0.000	-.1478655	-.0718322
iqvar	.019306	.0019499	9.90	0.000	.015453	.023159
chsibl	-.0227796	.0043978	-5.18	0.000	-.0314697	-.0140895
mchtog	-.0177995	.0552117	-0.32	0.748	-.1268986	.0912996
fatheduc	.008534	.0030686	2.78	0.006	.0024705	.0145976
motheduc	.014089	.0033797	4.17	0.000	.0074107	.0207672

```
log_perca~94 |   .0198258    .015603     1.27   0.206    -.0110059    .0506575
       urban |   .0449025   .0436033     1.03   0.305    -.0412581    .1310632
  municipal2 |   .0318501   .0621762     0.51   0.609    -.0910109    .1547112
  municipal3 |   .0000843   .0256338     0.00   0.997    -.0505684    .0507369
  municipal4 |    .135437   .0296194     4.57   0.000     .0769086    .1939653
  municipal5 |   .2401527    .160303     1.50   0.136     -.076608    .5569135
  municipal6 |   .1741514   .0708979     2.46   0.015     .0340561    .3142466
  municipal7 |    .110416   .0825589     1.34   0.183    -.0527214    .2735534
  municipal8 |   .0749043   .0783694     0.96   0.341    -.0799547    .2297632
  municipal9 |  -.1560934    .057099    -2.73   0.007    -.2689217    -.043265
     impfaed |  -.0553086   .0293875    -1.88   0.062    -.1133788    .0027615
     impmoed |   .2308402   .1743692     1.32   0.188    -.1137157    .5753962
     impsibl |  -.4505176   .2067962    -2.18   0.031    -.8591497   -.0418856
    impinc94 |   .1494556   .1300349     1.15   0.252     -.107495    .4064062
       _cons |   .3282796   .3590574     0.91   0.362    -.3812225    1.037782
------------------------------------------------------------------------------
Instrumented:  ptratio_94
Instruments:   bkpst_94 boy iqvar chsibl mchtog fatheduc motheduc
               log_percapinc94 urban municipal2 municipal3 municipal4
               municipal5 municipal6 municipal7 municipal8 municipal9 impfaed
               impmoed impsibl impinc94 ag_ptratio
------------------------------------------------------------------------------
```

Appendix B6

Table B6. Completion of elementary school by age 13. Bootstrapping the differences in the estimated coefficients of pupil-teacher ratio and books per pupil from running regression with and without instrumenting (aggregate measure of pupil-teacher ratio is an instrument for school-level measure of pupil-teacher ratio).

Bootstrap statistics

Number of obs = 1750
N of clusters = 150
Replications = 1000

Variable	Reps	Observed	Bias	Std. Err.	[95% Conf.	Interval]	
diff_ptrat	1000	-.0062279	-.0306876	1.560882	-3.06921	3.056755	(N)
					-.1643741	.1851749	(P)
					-.1692573	.1773809	(BC)
diff_bkpst	1000	-.0036358	-.0350421	1.438186	-2.825848	2.818577	(N)
					-.118829	.1400824	(P)
					-.1167384	.1604594	(BC)

Note: N = normal
P = percentile
BC = bias-corrected

Appendix C1

Table C1. Completion of high school by age 18. Bootstrapping (1,000 replications) the differences in the estimated coefficients of pupil-teacher ratio and books per pupil from running regression with and without certain groups of variables.

diff_ptrat_nofam	-0.00260 (0.00080)***
diff_bkpst_nofam	0.00945 (0.00541)*
diff_ptrat_noiq	-0.00008 (0.00050)
diff_bkpst_noiq	-0.00074 (0.00237)
diff_ptrat_nocom	0.00065 (0.00216)
diff_bkpst_nocom	-0.00557 (0.00659)
diff_ptrat_nofam_iq	-0.00385 (0.00133)***
diff_bkpst_nofam_iq	0.01219 (0.00752)

Appendix C2

Table C2. Completion of high school by age 18. Bootstrapping the differences in the estimated coefficients of pupil-teacher ratio, books per pupil and income variables from running regression with and without instrumenting (91 income is an instrument for 94 income).

Bootstrap statistics

Number of obs = 1750
N of clusters = 150
Replications = 1000

Variable	Reps	Observed	Bias	Std. Err.	[95% Conf.	Interval]	
diff_ptrat	1000	.0002569	.0000167	.0003528	-.0004353	.0009492	(N)
					-.000308	.0010758	(P)
					-.000202	.0012897	(BC)
diff_bkpst	1000	-.0002295	.0000246	.0008367	-.0018715	.0014124	(N)
					-.002382	.0012739	(P)
					-.0042913	.0005134	(BC)
diff_inc	1000	.0349856	-.003856	.0336	-.030949	.1009202	(N)
					-.0351449	.0957986	(P)
					-.0291867	.1029207	(BC)

Note: N = normal
P = percentile
BC = bias-corrected

Appendix C3

Table C3.1. First stage regression from instrumenting log of per capita income (94 survey) with the log of per capita income (91 survey). Completion of high school is a dependent variable.

First-stage regressions

Source	SS	df	MS
Model	384.185125	22	17.4629602
Residual	607.195159	1727	.351589554
Total	991.380284	1749	.566826921

Number of obs	=	1750
F(22, 1727)	=	**49.67**
Prob > F	=	0.0000
R-squared	=	0.3875
Adj R-squared	=	0.3797
Root MSE	=	.59295

log_perca~94	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ptratio_94	-.0041021	.0027175	-1.51	0.131	-.0094321	.0012278
bkpst_94	.0050691	.0117915	0.43	0.667	-.018058	.0281961
boy	-.0138061	.0285157	-0.48	0.628	-.069735	.0421228
iqvar	.007203	.0023124	3.11	0.002	.0026675	.0117385
chsibl	-.0525175	.0069784	-7.53	0.000	-.0662045	-.0388305
mchtog	-.0323177	.0909966	-0.36	0.723	-.2107929	.1461576
fatheduc	.0237063	.0056506	4.20	0.000	.0126235	.0347891
motheduc	.0140512	.0058236	2.41	0.016	.0026292	.0254732
urban	.1475485	.0498148	2.96	0.003	.0498449	.2452522
municipal2	.1597387	.0578857	2.76	0.006	.0462052	.2732723
municipal3	.1007089	.0454822	2.21	0.027	.0115028	.1899149
municipal4	.1263357	.0531847	2.38	0.018	.0220226	.2306488
municipal5	.2294777	.1108331	2.07	0.039	.0120965	.4468588
municipal6	.0994366	.1206265	0.82	0.410	-.1371527	.336026
municipal7	.0482368	.0692494	0.70	0.486	-.0875848	.1840584
municipal8	.1522768	.0607169	2.51	0.012	.0331903	.2713632
municipal9	.3168504	.5980366	0.53	0.596	-.8561018	1.489803
impfaed	-.031399	.0488578	-0.64	0.521	-.1272257	.0644276
impmoed	.0720031	.2099474	0.34	0.732	-.3397748	.4837809
impsibl	-.5661727	.6394009	-0.89	0.376	-1.820254	.6879089
impinc94	.6467533	.5985301	1.08	0.280	-.5271669	1.820673
log_perca~91	.3830488	.0218837	**17.50**	0.000	.3401275	.4259701
_cons	2.310757	.1807845	12.78	0.000	1.956177	2.665336

Table C3.2. Second stage regression from instrumenting log of per capita income (94 survey) with the log of per capita income (91 survey). Completion of high school is a dependent variable.

```
IV (2SLS) regression with robust standard errors       Number of obs =    1750
                                                       F( 20,   149) =       .
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.1937
Number of clusters (curbrgy2) = 150                    Root MSE      =   .4495

------------------------------------------------------------------------------
             |               Robust
     highyes |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
log_perca~94 |   .0788895   .0420866     1.87   0.063    -.0042741    .1620531
  ptratio_94 |   .0006855   .0020092     0.34   0.733    -.0032848    .0046558
    bkpst_94 |   .0169549   .0124767     1.36   0.176    -.0076993     .041609
         boy |  -.188126    .0206928    -9.09   0.000    -.2290153   -.1472367
       iqvar |   .0142793   .0017178     8.31   0.000     .0108849    .0176738
      chsibl |  -.017749    .0058461    -3.04   0.003     -.029301   -.0061971
      mchtog |   .1290044   .0622314     2.07   0.040     .0060343    .2519746
    fatheduc |   .0147423   .0034992     4.21   0.000     .0078278    .0216568
    motheduc |    .011988   .0050777     2.36   0.020     .0019544    .0220217
       urban |  -.006294    .0473488    -0.13   0.894    -.0998559    .0872679
  municipal2 |  -.0109823   .0501443    -0.22   0.827    -.1100681    .0881035
  municipal3 |  -.0547536   .0377848    -1.45   0.149    -.1294168    .0199097
  municipal4 |   .1348697    .058159     2.32   0.022     .0199467    .2497928
  municipal5 |   .2566499   .0794948     3.23   0.002     .0995671    .4137326
  municipal6 |   .0042328   .0694656     0.06   0.951    -.1330322    .1414977
  municipal7 |   .0221374   .0502784     0.44   0.660    -.0772134    .1214883
  municipal8 |  -.0096003   .0430425    -0.22   0.824    -.0946528    .0754522
  municipal9 |  -.1042204   .0705234    -1.48   0.142    -.2435755    .0351348
     impfaed |  -.0455722   .0335248    -1.36   0.176    -.1118176    .0206732
     impmoed |   -.036439   .1815207    -0.20   0.841    -.3951263    .3222483
     impsibl |  -.1769831   .1570284    -1.13   0.262    -.4872732    .1333071
    impinc94 |    .195047   .0598997     3.26   0.001     .0766843    .3134096
       _cons |  -.4071423   .2021498    -2.01   0.046    -.8065931   -.0076916
------------------------------------------------------------------------------
Instrumented:  log_percapinc94
Instruments:   ptratio_94 bkpst_94 boy iqvar chsibl mchtog fatheduc motheduc
               urban municipal2 municipal3 municipal4 municipal5 municipal6
               municipal7 municipal8 municipal9 impfaed impmoed impsibl
               impinc94 log_percapinc91
------------------------------------------------------------------------------
```

Appendix C5

Table C5. Instrumenting pupil-teacher ratio school-level measure with the respective aggregate measure (radius for aggregation is $\sqrt{2km}$). Dependant variable is high school completion.

First-stage regressions

Source	SS	df	MS
Model	26832.3236	22	1219.65107
Residual	46711.5606	1727	27.0478058
Total	73543.8843	1749	42.0491048

Number of obs =	1750
F(22, 1727) =	**45.09**
Prob > F =	0.0000
R-squared =	0.3648
Adj R-squared =	0.3568
Root MSE =	5.2008

ptratio_94	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
bkpst_94	-.6257054	.1027328	-6.09	0.000	-.8271991	-.4242116
boy	.0842148	.2501761	0.34	0.736	-.4064651	.5748948
iqvar	-.0076051	.0203255	-0.37	0.708	-.0474703	.0322601
chsibl	.1262399	.0619755	2.04	0.042	.0046851	.2477947
mchtog	-1.09508	.797825	-1.37	0.170	-2.659885	.4697246
fatheduc	-.0898936	.0495958	-1.81	0.070	-.1871678	.0073806
motheduc	-.0413362	.0504994	-0.82	0.413	-.1403827	.0577104
log_perca~94	-.4310418	.1944108	-2.22	0.027	-.8123471	-.0497364
urban	2.499106	.4372414	5.72	0.000	1.641528	3.356684
municipal2	2.881296	.5444796	5.29	0.000	1.813387	3.949204
municipal3	.3298578	.4004184	0.82	0.410	-.4554983	1.115214
municipal4	1.036911	.4785701	2.17	0.030	.0982729	1.975549
municipal5	12.20122	.9453785	12.91	0.000	10.34702	14.05543
municipal6	4.628332	1.052549	4.40	0.000	2.563926	6.692737
municipal7	7.460615	.5814477	12.83	0.000	6.320199	8.601031
municipal8	7.530479	.5552852	13.56	0.000	6.441377	8.619581
municipal9	1.225174	5.24363	0.23	0.815	-9.059359	11.50971
impfaed	.1815342	.4278774	0.42	0.671	-.6576783	1.020747
impmoed	.7432399	1.841749	0.40	0.687	-2.869054	4.355534
impsibl	-14.76125	5.595519	-2.64	0.008	-25.73595	-3.78654
impinc94	13.26968	5.239097	2.53	0.011	2.994039	23.54533
ag_ptratio	.1601196	.0270393	**5.92**	0.000	.1070864	.2131527
_cons	33.71536	1.635536	20.61	0.000	30.50752	36.9232

IV (2SLS) regression with robust standard errors

Number of clusters (curbrgy2) = 150

Number of obs =	1750
F(20, 149) =	.
Prob > F =	0.0000
R-squared =	0.1952
Root MSE =	.44909

highyes	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
ptratio_94	**-.0018148**	.0119696	-0.15	0.880	-.0254668	.0218372
bkpst_94	.0158724	.014021	1.13	0.259	-.0118333	.0435782
boy	-.1882158	.0205233	-9.17	0.000	-.2287702	-.1476614
iqvar	.0146195	.0016632	8.79	0.000	.011333	.017906
chsibl	-.0200925	.0053793	-3.74	0.000	-.0307221	-.009463
mchtog	.1242572	.064842	1.92	0.057	-.0038716	.2523859
fatheduc	.0157604	.0037988	4.15	0.000	.0082539	.0232669
motheduc	.0131601	.0049635	2.65	0.009	.0033522	.0229681

log_perca~94	.042803	.0189691	2.26	0.025	.0053199	.0802861
urban	.010077	.053771	0.19	0.852	-.0961752	.1163292
municipal2	.0063772	.0709483	0.09	0.928	-.1338176	.146572
municipal3	-.0478539	.0397221	-1.20	0.230	-.1263453	.0306375
municipal4	.1462038	.0608478	2.40	0.018	.0259677	.2664398
municipal5	.2999353	.1734883	1.73	0.086	-.04288	.6427505
municipal6	.023067	.0904702	0.25	0.799	-.1557033	.2018372
municipal7	.04266	.1006991	0.42	0.672	-.1563228	.2416429
municipal8	.0178479	.1091162	0.16	0.870	-.1977671	.233463
municipal9	-.0756939	.0637955	-1.19	0.237	-.2017548	.0503669
impfaed	-.0443845	.0343054	-1.29	0.198	-.1121725	.0234035
impmoed	-.0306276	.1786475	-0.17	0.864	-.3836375	.3223822
impsibl	-.2215756	.2287921	-0.97	0.334	-.6736717	.2305206
impinc94	.2402378	.1773658	1.35	0.178	-.1102393	.5907149
_cons	-.1958438	.492214	-0.40	0.691	-1.168465	.7767776

Instrumented: ptratio_94

Instruments: bkpst_94 boy iqvar chsibl mchtog fatheduc motheduc log_percapinc94 urban municipal2 municipal3 municipal4 municipal5 municipal6 municipal7 municipal8 municipal9 impfaed impmoed impsibl impinc94 ag_ptratio

Appendix D

<u>Construction of aggregate measures:</u>

The aggregate school quality variables are constructed as weighted averages of corresponding school-level school quality characteristics, weighted by the total number of pupils in each school. Weighting was done to approximate the actual distribution of schools that parents are facing i.e. a child has a higher chance of getting into a bigger school when comparing a school with 1,000 pupils to a school with 50 pupils.

School characteristics are aggregated around the place of living of a child as of the time of 1994-95 survey. The data contain geographic coordinates for each household a child lived in as of the time of 94-95 follow-up. There are geographic coordinates for each school that we have data on. Finding the distance between each household and each school is straightforward. Then, the area is defined as a circle around the place of child's living and aggregation is done within a certain radius around the place of living. When aggregating within the smallest radius not all of the children had more than one school within the radius. For such cases aggregation was done across two closest schools. In other words, aggregation is done within a certain radius around the place of living OR across two closest schools if less than two schools are within the radius. Decision on what radius to use was based on the actual distances between households and schools children attended. A detailed summary on variable "distance", the distance between the place of living and the school attended (measured in meters), is presented below:

Percentiles		Smallest		
1%	46.95743	5		
5%	114.9783	18.43909		
10%	178.7568	20.61553	Obs	1767
25%	322.5601	25.31798	Sum of Wgt.	1767
50%	558.5123		Mean	792.5916
		Largest	Std. Dev.	1452.425
75%	910.1143	13027.44		
90%	1356.167	13567.56	Variance	2109539
95%	1902.088	29723.33	Skewness	15.95391
99%	4042.916	38323.32	Kurtosis	353.4783

It was decided to start with the radius equal to 1,000 meters (1km) (using a smaller radius would have resulted in a significant portion of the sample having no schools to aggregate). Then, in order to keep the area increasing by equal increments, the following radii were used – $\sqrt{2km}$, $\sqrt{3km}$, $\sqrt{4km}$, $\sqrt{5km}$ [15]. A square root of 5 kilometers seemed to be a reasonable maximum radius to use since, as the above table shows, 95% of the children attended a school within 1,902 meters ($\sqrt{5km} \approx 2,236$ meters).

For illustrative purposes, the average number of schools within the radii of 1km, $\sqrt{2km}$, $\sqrt{3km}$, $\sqrt{4km}$, $\sqrt{5km}$ are 2.997 (1.468), 5.457 (3.128), 7.631 (4.309), 9.760 (5.436), and 11.925 (6.370) respectively[16].

---

[15] The area of the circle is πr^2, therefore, I increase the area twice, threefold, fourfold, and fivefold respectively.

[16] Standard deviations are in parentheses.

Appendix E

Table E. Results of the math achievement test are the dependent variable.

	Complete equation	NO family	NO IQ	NO Community	NO family AND ability
ptratio_94	-0.03333	-0.09307	-0.03450	0.07557	-0.13685
	(0.05038)	(0.05313)*	(0.05327)	(0.05345)	(0.06112)**
bkpst_94	-0.11068	0.12011	-0.15228	-0.46551	0.21404
	(0.18396)	(0.22757)	(0.19628)	(0.16211)***	(0.27529)
boy	-3.74142	-3.66671	-3.95670	-3.89517	-3.88980
	(0.56417)***	(0.61767)***	(0.58573)***	(0.54801)***	(0.67008)***
iqvar	0.63168	0.76559		0.64319	
	(0.02756)***	(0.03002)***		(0.03238)***	
chsibl	-0.30565		-0.50352	-0.30939	
	(0.08101)***		(0.08740)***	(0.08394)***	
mchtog	2.49045		3.39625	2.69333	
	(0.98748)**		(1.01109)***	(0.93693)***	
fatheduc	0.41271		0.56220	0.38089	
	(0.06888)***		(0.08426)***	(0.07359)***	
motheduc	0.49349		0.70714	0.46705	
	(0.06447)***		(0.07831)***	(0.06767)***	
log_percapinc94	0.51175		1.13607	0.71452	
	(0.35937)		(0.35597)***	(0.39931)*	
urban	-0.19382	1.60794	0.41439		3.70550
	(0.84131)	(0.76258)**	(0.76802)		(0.76634)***
municipal2	1.49553	1.40838	0.71889		0.41079
	(1.42514)	(1.25186)	(1.51292)		(1.35951)
municipal3	3.01111	3.22170	3.43093		3.94096
	(0.62902)***	(0.67268)***	(0.80414)***		(0.96941)***
municipal4	2.19875	3.04677	2.43704		4.02589
	(0.68489)***	(0.64555)***	(0.58989)***		(0.62781)***
municipal5	7.19796	7.25851	9.71191		10.93968
	(1.77976)***	(1.71535)***	(2.11937)***		(2.17834)***
municipal6	1.69150	3.46351	1.25978		4.15542
	(1.63132)	(2.16773)	(1.60818)		(2.79149)
municipal7	2.33670	2.61148	2.99849		3.61644
	(1.49892)	(1.45537)*	(1.42493)**		(1.50120)**
municipal8	5.39231	5.32033	5.17231		5.03638
	(1.23459)***	(1.00148)***	(1.37019)***		(1.04408)***
municipal9	0.00030	2.03634	-12.71808		-13.36443
	(1.15781)	(0.94522)**	(0.93845)***		(0.86439)***
impfaed	-1.14858		-0.78037	-1.34271	
	(0.61032)*		(0.64049)	(0.61197)**	
impmoed	0.23944		1.70770	-0.04261	
	(2.82027)		(3.74343)	(2.86172)	
impsibl	3.29493		-0.77269	4.87240	
	(3.15269)		(4.01676)	(2.95228)	
impinc94	-1.52165		1.09109	-2.90063	
	(1.45905)		(1.69598)	(1.14817)**	
R-squared	0.35	0.29	0.23	0.33	0.08

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix F

Table F. Results of English achievement test are the dependent variable.

	Complete equation	NO family	NO IQ	NO Community	NO family AND ability
ptratio_94	-0.03986 (0.03623)	-0.10036 (0.04299)**	-0.03719 (0.04037)	0.03248 (0.03996)	-0.13347 (0.05381)**
bkpst_94	0.06997 (0.18514)	0.31839 (0.24504)	0.04541 (0.19241)	-0.20406 (0.14355)	0.40595 (0.28668)
boy	-4.30432 (0.38664)***	-4.18984 (0.44105)***	-4.40371 (0.41802)***	-4.42543 (0.37165)***	-4.31353 (0.49710)***
iqvar	0.49629 (0.02966)***	0.64265 (0.03110)***		0.50379 (0.03104)***	
chsibl	-0.25543 (0.09035)***		-0.40476 (0.07647)***	-0.27044 (0.09322)***	
mchtog	0.18437 (1.23486)		1.34646 (1.33990)	0.39763 (1.19038)	
fatheduc	0.44116 (0.07161)***		0.55651 (0.07273)***	0.44378 (0.07446)***	
motheduc	0.55529 (0.05837)***		0.73060 (0.06608)***	0.53368 (0.06030)***	
log_percapinc94	0.70323 (0.31593)**		1.18670 (0.33237)***	0.91340 (0.32870)***	
urban	0.26462 (0.67106)	2.32049 (0.62804)***	0.72965 (0.68276)		4.05770 (0.78972)***
municipal2	0.33510 (0.60333)	0.27852 (0.66766)	-0.26174 (0.70066)		-0.55148 (0.91054)
municipal3	2.64515 (0.73015)***	2.81183 (0.79590)***	3.10149 (0.88618)***		3.54540 (1.07369)***
municipal4	1.36523 (0.68826)**	2.30326 (0.67897)***	1.51838 (0.58988)**		3.09779 (0.66241)***
municipal5	4.11131 (1.13843)***	4.18331 (1.08147)***	6.08745 (1.42861)***		7.25200 (1.58212)***
municipal6	2.00984 (0.99553)**	3.83012 (1.65575)**	1.68012 (1.15984)		4.42222 (2.39334)*
municipal7	1.47450 (1.19463)	1.81608 (1.22154)	1.93761 (1.20076)		2.58169 (1.44266)*
municipal8	4.19028 (1.38209)***	4.01841 (1.15052)***	4.03767 (1.47760)***		3.78376 (1.16153)***
municipal9	7.75211 (1.19754)***	9.62155 (1.00573)***	-2.20199 (0.78398)***		-3.32440 (0.84417)***
impfaed	-0.66946 (0.56334)		-0.28611 (0.58418)	-0.80847 (0.56610)	
impmoed	0.90511 (3.08446)		2.03688 (3.61551)	0.55129 (3.13036)	
impsibl	-7.48089 (2.93999)**		-10.28981 (3.60514)***	-5.47248 (2.81708)*	
impinc94	6.81652 (1.41107)***		8.89632 (1.59542)***	5.16112 (1.08172)***	
R-squared	0.36	0.28	0.27	0.34	0.10

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table G. Results of the math achievement test are the dependent variable. Schooling at the time of the test is added.

	Complete equation	NO family	NO IQ	NO Community	NO family AND ability
ptratio_94	-0.00048	-0.02969	0.00176	0.10033	-0.04019
	(0.05591)	(0.05675)	(0.06014)	(0.04892)**	(0.06197)
bkpst_94	-0.14124	-0.01296	-0.17027	-0.45500	0.00354
	(0.24370)	(0.27486)	(0.26534)	(0.23438)*	(0.30912)
schooling	4.04406	4.46693	4.87662	4.03454	5.65329
	(0.24891)***	(0.23125)***	(0.23167)***	(0.25463)***	(0.22950)***
boy	-2.73494	-2.58637	-2.65628	-2.88401	-2.41261
	(0.56780)***	(0.59750)***	(0.58956)***	(0.56719)***	(0.63646)***
iqvar	0.43605	0.48786		0.44846	
	(0.03228)***	(0.03007)***		(0.03595)***	
chsibl	-0.08618		-0.15642	-0.08777	
	(0.07159)		(0.07020)**	(0.07513)	
mchtog	2.15155		2.72405	2.35318	
	(0.88941)**		(0.81680)***	(0.83248)***	
fatheduc	0.32115		0.38904	0.30198	
	(0.06371)***		(0.06738)***	(0.07059)***	
motheduc	0.28387		0.37331	0.25110	
	(0.06828)***		(0.07642)***	(0.07053)***	
log_percapinc94	0.24756		0.57637	0.46574	
	(0.32997)		(0.31721)*	(0.37140)	
urban	-0.38983	0.60424	-0.03314		1.45639
	(0.94871)	(0.94280)	(0.91409)		(0.91390)
municipal2	1.51750	1.42046	1.05653		0.91489
	(1.45947)	(1.36591)	(1.56816)		(1.50144)
municipal3	3.38292	3.53937	3.80587		4.10892
	(0.60263)***	(0.65009)***	(0.73977)***		(0.83093)***
municipal4	1.36596	1.73154	1.37025		1.92799
	(0.80725)*	(0.81962)**	(0.75948)*		(0.78751)**
municipal5	5.85993	5.60773	7.21056		7.21278
	(1.76922)***	(1.75843)***	(1.90843)***		(1.89289)***
municipal6	-0.12586	0.57352	-0.73725		0.19977
	(1.70335)	(2.01949)	(1.73639)		(2.27298)
municipal7	1.90060	2.02659	2.33999		2.55532
	(1.71316)	(1.67824)	(1.69498)		(1.66524)
municipal8	5.22323	5.13100	5.11421		5.00483
	(1.00332)***	(0.86826)***	(1.05102)***		(0.86575)***
municipal9	-1.63151	-0.92259	-9.91464		-10.03687
	(1.39501)	(1.29973)	(1.10897)***		(1.07497)***
impfaed	-1.02081		-0.79649	-1.20770	
	(0.59861)*		(0.61883)	(0.59838)**	
impmoed	0.25655		1.22344	-0.08695	
	(2.56974)		(3.39287)	(2.65176)	
impsibl	1.40145		-1.55541	3.14460	
	(3.02095)		(3.93823)	(2.81174)	
impinc94	0.70099		2.85735	-0.73732	
	(1.39265)		(1.52327)*	(1.04768)	
R-squared	0.46	0.44	0.41	0.44	0.37

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table H. Results of English achievement test are the dependent variable. Schooling at the time of the test is added.

	Complete equation	NO family	NO IQ	NO Community	NO family AND ability
ptratio_94	-0.01615	-0.05103	-0.01037	0.05023	-0.05601
	(0.03883)	(0.04197)	(0.04271)	(0.03699)	(0.04783)
bkpst_94	0.04790	0.21482	0.03210	-0.19653	0.23726
	(0.22993)	(0.27665)	(0.24665)	(0.18634)	(0.30739)
schooling	2.91975	3.47659	3.60753	2.89119	4.53073
	(0.21303)***	(0.20262)***	(0.20223)***	(0.21321)***	(0.19925)***
boy	-3.57766	-3.34902	-3.44171	-3.70082	-3.12966
	(0.41950)***	(0.46500)***	(0.45120)***	(0.41425)***	(0.51542)***
iqvar	0.35505	0.42649		0.36425	
	(0.03269)***	(0.03107)***		(0.03510)***	
chsibl	-0.09698		-0.14798	-0.11163	
	(0.09540)		(0.08159)*	(0.09708)	
mchtog	-0.06032		0.84920	0.15386	
	(1.20729)		(1.22591)	(1.15873)	
fatheduc	0.37506		0.42841	0.38723	
	(0.07127)***		(0.06863)***	(0.07431)***	
motheduc	0.40395		0.48365	0.37893	
	(0.05921)***		(0.06604)***	(0.06075)***	
log_percapinc94	0.51249		0.77265	0.73512	
	(0.29305)*		(0.29915)**	(0.30348)**	
urban	0.12310	1.53931	0.39858		2.25519
	(0.74776)	(0.71682)**	(0.77481)		(0.78801)***
municipal2	0.35096	0.28793	-0.01196		-0.14748
	(0.64353)	(0.66414)	(0.77416)		(0.87795)
municipal3	2.91360	3.05907	3.37885		3.68001
	(0.70795)***	(0.77549)***	(0.82200)***		(0.94233)***
municipal4	0.76396	1.27962	0.72921		1.41646
	(0.76782)	(0.78086)	(0.72611)		(0.76021)*
municipal5	3.14527	2.89852	4.23705		4.26513
	(1.18769)***	(1.13784)**	(1.32524)***		(1.31646)***
municipal6	0.69774	1.58085	0.20280		1.25203
	(1.21501)	(1.65008)	(1.37451)		(2.02675)
municipal7	1.15965	1.36086	1.45048		1.73128
	(1.33165)	(1.31157)	(1.34076)		(1.36524)
municipal8	4.06821	3.87105	3.99469		3.75848
	(1.19146)***	(1.00781)***	(1.20928)***		(0.97279)***
municipal9	6.57397	7.31863	-0.12812		-0.65758
	(1.38301)***	(1.19215)***	(0.91413)		(0.89478)
impfaed	-0.57721		-0.29803	-0.71173	
	(0.59839)		(0.62832)	(0.60133)	
impmoed	0.91746		1.67864	0.51952	
	(3.15646)		(3.61761)	(3.25594)	
impsibl	-8.84795		-10.86883	-6.71063	
	(3.13062)***		(3.75709)***	(3.03717)**	
impinc94	8.42124		10.20294	6.71137	
	(1.38110)***		(1.48522)***	(1.02588)***	
R-squared	0.43	0.39	0.39	0.41	0.32

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%