An International Investigation into the Relationship Between School Resources, Policy, and Math Performance Among Low Socioeconomic Status Students

Katherine Baird
Associate Professor of Economics
University of Washington Tacoma
Tacoma, Washington U.S.A.
and
Fulbright Lecturer
Departamento de Fundamentos del Análisis Económico II
Universidad del País Vasco
Bilbao, España
fax: +34 94 601 7123
tele: +34 94 601 3770
email: kebaird@u.washington.edu

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Abstract

This paper investigates gaps in math performance among students from high and low socioeconomic groups (SES). It does this through an examination of TIMSS math scores in 19 high income countries. On average, the math scores of students with indicators of high socioeconomic status are over 1 standard deviations above those with low scores, although the gap ranges from a high of 1.5 standard deviations in Taiwan, to a gap of less than .6 standard deviations in Hong Kong. We estimate education production functions for each country, and then examine the extent to which differences in math test scores within countries can be attributed to differences in classroom- and school-level resources available to students from different SES backgrounds. We discuss the differences in patterns found among countries. Comparing low SES student test scores across countries, we also find that controlling for a wide range of student, family, school and classroom variables, the average performance of students with indicators of low SES background varies considerably between countries, with students in some countries scoring more than one standard deviation below those in others. The paper investigates the extent to which national level policies are associated with these differences.

Keywords: math performance, educational policies, disadvantaged students

Purpose

Much attention is being placed on the role played by educational systems in contributing to or weakening the intergenerational transmission of social status (Beller & Hout, 2006; Wößmann, 2003; Mulligan & Han, 2000). Through an analysis of 2003 TIMSS math scores among 8th graders, this study examines gaps in human capital accumulation among students from low and high socioeconomic backgrounds in 19 high-income countries. The study pursues two objectives. First, by examining relative performance differences among low and high SES students, we investigate the extent to which differences in school and classroom-level resources explain these gaps. Second, a cross national analysis of the performance of students with similar markers of low socioeconomic standing examines the extent to which absolute differences in performance across nations can be explained by different national policies. The study´s overall purpose is to use within and between country

variation in disadvantaged students´ test scores to focus specific attention on the policy-relevant factors that explain their performance relative to high SES students in their own country, and to similar students in other countries.

Significance

International analyses of students´ test scores consistently find that everywhere, test scores are closely associated with students´socioeconomic status (Hanushek & Luque, 2003; Wößmann, 2003; Schutz, Ursprung & Wößmann, 2005). This paper estimates the importance of school and classroom-level resources in explaining this link. A common critique of the U.S.´s educational system, for instance, is that students receive different school and classroom-level resources based on their SES background (Cogan, Schmidt, & Wiley, 2001; Arroyo, 2008). And even though we know the importance of SES on educational outcomes varies by country (Cavanagh, 2007; Wößmann, 2003), we lack a good understanding of the extent to which these differing outcomes can be traced to variation in school level resources.

While the first part of this study will examine educational resource distribution within the 19 countries, and the role this plays in explaining test score gaps by SES, more striking than test score variation within countries is variation in performance across countries. Controlling for a wide range of student, family, school and classroom variables, the average performance of students with indicators of low socioeconomic status in some countries is more than one standard deviation below the average performance of these same students in other countries, as is shown in Figure 1 below.

[take in Figure 1 about here]

Thus, to investigate absolute differences in low SES students' performance, this study also examines the extent to which international differences in low SES students´ performance is associated with country-level policies. Cross national investigations into student outcomes often concluded that country-specific factors, such as the presence of central examinations and other organizational features of countries, help explain aggregate differences among countries in student performance (Hanushek & Luque, 2003; Jürges & Schneider, 2004; Wößmann, 2003; Fuchs & Wößmann, 2004). To our knowledge, the extent to which these features of school systems aid low SES students in particular has not been investigated. It could be that in the aggregate some national-level factors are associated with higher test scores, but the association may be stronger for some groups of students in the country than for others.

Methodology and Data Sources

Our analysis is based on 2003 TIMSS 8th graders´math scores. To limit the amount of variation among countries, the study uses the subset of countries identified by the World Bank in 2005 as high income economies. While some of the "countries" in the study are in fact regions of countries, here we refer to these regions as countries.

The reported number of books in the household is used to approximate students´ SES. This provides us with many more observations than would parent education, since students were more much more likely to answer this question than they were questions about their parents´ educational attainment. The correlation between books in the household and parents´ educational attainment is about .36. We label a student as high SES when she reported that her household had at least 3 cases of books in the house (bsbgbook=5), and low SES where she reported that the household had at most 10 books in the house (bsbgbook=1). We also select for those students who report being born in the country (bsbgborn=1), and who at home primarily speak the test language (bsbgolan = 1 or 2). This selection criteria reduces the number of observation from 85,387 to 68,765 students.

From these 68,765 observations, we undertake country-specific "production function" regressions. We use multi-level statistical techniques to account for the structural feature of the data, and permit observations within the same classroom to be correlated with one another. The TIMSS data do not have enough classes within the same school to permit a three level hierarchical analysis. For this reason, school level features are entered at the classroom level.

We next estimate the importance of class and school resource differences between high and low SES students in explaining the SES test gap. As shown in Table 1, differences in class, teacher and school resources among low and high SES students can be quite large in some countries. Each number in Table 1 indicates the difference in standard deviations in average resources for low versus high SES students. To identify the importance of resource differences in explaining the test score gap, we calculate the counterfactual: what would low SES students' average test score in the country have been had they had (on average) the same teacher, class and school level resources (while retaining their home and other individual characteristics) as (on average) high SES students. This part of the study, which is currently underway, allows us to decompose the socioeconomic gap to that due to class and school level resources and practices, due to student background factors, and that left unexplained.

[take in Table 1 about here]

A second part of the study strictly examines the subset of low SES students (N=8376) to analyze the features of country-level policies that explain why holding many variables constant, low SES students perform much more highly in some countries than in others.

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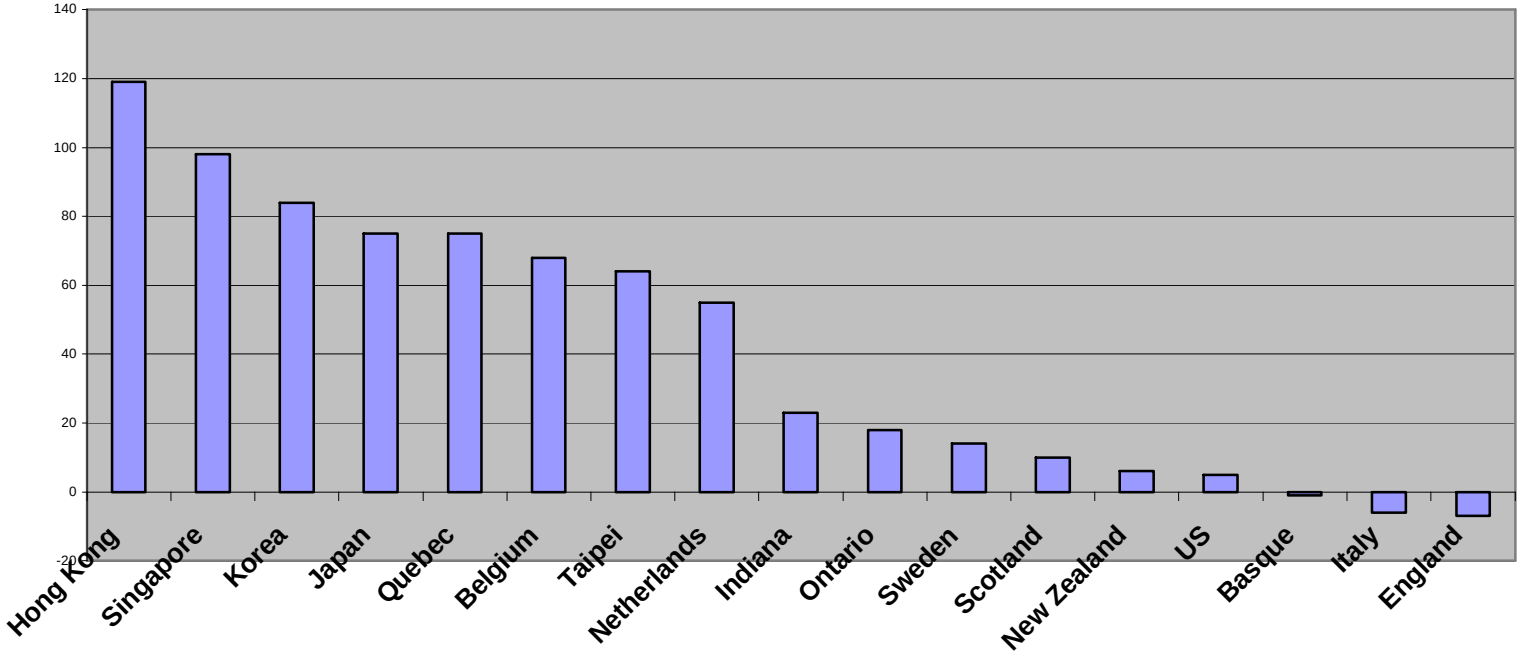
Table 1
Summary of Country Differences in Teacher, Class and Curriculum, and School-Level Resources Between Students from Low and High SES Backgrounds

	Teacher	Class/Curr	School
Taiwan	0,14	0,03	0,16
Korea	0,00	0,07	0,10
Sweden	-0,05	0,22	0,22
Basque	0,00	0,16	0,16
Singapore	0,11	0,22	0,19
England	0,20	0,37	0,37
Scotland	0,10	0,20	0,36
Netherlands	0,18	0,22	0,44
US	0,12	0,07	0,36
New Zealand	-0,04	0,03	0,34
Norway	0,02	0,00	0,04
Australia	0,00	0,14	0,29
Indiana	0,09	0,20	0,35
Ontario	0,13	0,02	0,18
Japan	0,05	0,03	0,05
Belgium	0,17	0,25	0,19
Italy	0,01	0,02	0,18
Quebec	0,07	0,04	0,17
Hong Kong	0,13	0,03	0,22

Source: Author calculation based on TIMSS 2003 data.

Note: Numbers indicate differences in terms of standard deviation. Each of the three categories consists of up to a dozen different measures of resources. The standard deviation reported is the average number of standard deviation across each of the variables in each category. Additional detail available from author.

Table 1: Average Difference in Test Score Among Low SES Students



Note: Reported here is country fixed effects based on a regression of only low SES students' test scores, and controlling for a wide range of student, school and classroom level variables. The reference country is Australia.