School Choice and Academic Achievement in Comparative Perspective

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Background and Hypotheses

This study explores the relationship between school choice and reading and math achievement scores of fifteen-year-old students internationally. We will try to gain an understanding of the factors that contribute to achievement scores and how it is that school choice impacts test scores after a range of other variables are taken into account.

There are two competing hypotheses regarding the effects of school choice. The first argues that school choice improves outcomes, as it provides incentives for schools to improve by letting parents choose the best school and it gives principals more autonomy to change and improve schools (Friedman 1955, Greene 2005). If this is true, the effects of competition, dependent private schools, and autonomy should be both significant and positive. The second hypothesis states that selection bias is the root of the seemingly positive effect of school choice (Carnoy 2007, Ravitch 2010). If the effect of competition becomes spurious with the inclusion of school-level socioeconomic status, this hypothesis is supported.

Data

This analysis uses data collected in the 2009 Programme for International Student Assessment, referred to as PISA. This data set includes information from sixty-five countries, although France is not included in this analysis, as France did not provide responses to the school survey. In the remaining sixty-four countries, a total of 476831 fifteen-year-old students were randomly selected to take the standardized test, which assessed their academic achievement in reading and mathematics. The students also completed surveys regarding personal characteristics, including socioeconomic status and language spoken in the home. The administrators of the 16977 corresponding schools completed school-level surveys. This information allows for PISA to provide data regarding a range of topics (PISA 2009).

Although not a part of the PISA data, the 2009 Human Development Index, referred to as HDI, is used to assess socioeconomic status at the country level through an assessment of the country's level of development. The HDI is constructed using three dimensions, specifically health, standard of living, and education, which are made up of four indicators of development: life expectancy, gross national income per capita, mean years of schooling, and expected years of schooling. Minimums and maximums for each dimension are standardized so that a country's standing can be found on a scale ranging from 0-1, where 1 is very high human development and 0 is low human development (United Nations Development Programme 2010).

Variables

Dependent Variables:
- Math Achievement Score
- Reading Achievement Score

Key Independent Variables:
- One other school to choose from
- Two other schools to choose from

Country-Level Independent Variable:
- Human Development Index

School-Level Independent Variables:
- School Sector
- Size of Community (omit City)
- Principal Autonomy
- School Level Socioeconomic Status
- School Selection Policies (omit Never)
- Teacher Characteristics
- School Characteristics
  - Resource Construct accounts for lack of qualified science, math, reading, and other teachers, library staff and other support personnel, shortage or inadequacy of science laboratory equipment, instructional materials, computers, computer software, internet connectivity, library materials, and audio-visual resources

Student-Level Independent Variables:
- Opportunity to Learn
- Student Characteristics

*See Table of Means and Descriptive Statistics for full list of Variables

Means and Standard Deviations

	MEAN	SD
Level 3 Variables		
Human Development Index	0.8	0.09
Level 2 Variables		
Amount of Competition		
One other school choice	0.15	0.35
Two or more schools to choose from	0.62	0.48
School Sector		
Dependent Private School	0.11	0.31
Independent Private School	0.07	0.25
Size of Community		
Village	0.13	0.34
Small Town	0.21	0.4
Town	0.29	0.45
Large City	0.13	0.34
Principal Autonomy		
P. can hire teachers	0.59	0.49
P. can fire teachers	0.474	0.5
P. in charge of budget	0.66	0.47
P. in charge of curriculum	0.23	0.42
School Level SES		
SES	-0.37	0.85
School Selection Policies		
Residence, Always Important	0.36	0.48
Residence, Sometimes Important	0.19	0.39
Academic Record, Always Important	0.31	0.46
Academic Record, Sometimes Important	0.22	0.41
Feeder School, Always Important	0.16	0.36
Feeder School, Sometimes Important	0.33	0.47
Parent' endorsement, Always Important	0.19	0.39
Parents' endorsement, Sometimes Important	0.18	0.38
Special Program, Always Important	0.23	0.42
Special Program, Sometimes Important	0.38	0.48
Family member preference, Always Important	0.16	0.36
Family member preference, Sometimes Important	0.28	0.45
Teacher Characteristics		
Percent with University Degree	0.77	0.34
Percent with Certification	0.76	0.378
School Characteristics		
Student-Teacher Ratio	16.132	14.234
School Size	757.624	692.262
Resource Construct	1.96	0.65
Level 1 Variables		
Opportunity to Learn		
Time Out of School in Reading Classes	54.35	102.452
Time Out of School in Math Classes	75.598	114.854
Time In School in Reading Classes	226.542	97.686
Time In School in Math Classes	227.18	103.534
Enrichment Reading Classes	0.15	0.35
Enrichment Math Classes	0.24	0.43
Remedial Reading Classes	0.13	0.34
Remedial Math Classes	0.22	0.41
Student Characteristics		
Same Language at Home as in School	0.89	0.32
Female	0.51	0.5
Student Level SES Construct	-0.29	1.14

Models

This data analysis was conducted using hierarchical linear modeling, in which the the student level is nested within the school level, which is then nested within the country level. Refer to the "Variables" section for details regarding the composition of each level.

Model 1: Achievement = f(HDI, Competition)
Model 2: Achievement = f(HDI, Competition, Size of Community)
Model 3: Achievement = f(HDI, Competition, Size of Community, School Sector)
Model 4: Achievement = f(HDI, Competition, Size of Community, School Sector, Principal Autonomy)
Model 5: Achievement = f(HDI, Competition, Size of Community, School Sector, Principal Autonomy, School Selection Policies, Teacher Characteristics, School Characteristics)
Model 6: Achievement = f(HDI, Competition, Size of Community, School Sector, School Selection Policies, Teacher Characteristics, School Characteristics, Opportunity to Learn, Student Characteristics)
Model 7: Achievement = f(HDI, Competition, Size of Community, School Sector, School Selection Policies, Teacher Characteristics, School Characteristics, Opportunity to Learn, Student Characteristics, School-level

Table of Results: Mathematics

	Model 1 Coef. S.E.	Model 2 Coef. S.E.	Model 3 Coef. S.E.	Model 4 Coef. S.E.	Model 5 Coef. S.E.	Model 6 Coef. S.E.	Model 7 Coef. S.E.
Level 3 Variables							
Human Development Index	450.37 [201.9] *	436.64 [135] *	433.56 [110.1] *	424.39 [125.4] *	395.9 [86.94] *	314.15 [88.52] *	160.65 [1227.9]
Level 2 Variables							
Amount of Competition							
One other school choice	14.68 [4.37] *	9.62 [3.92] *	9.1 [3.99] *	8.9 [3.97] *	8.7 [3.67] *	7.71 [3.20] *	4.21 [7.39]
Two or more schools to choose from	25 [4.16] *	14.75 [4.11] *	12.26 [4.09] *	11.98 [4.14] *	11.32 [3.45] *	9.95 [2.81] *	4.46 [3.26]
School Sector							
Dependent Private School			12.03 [8.71]	7.44 [8.67]	4.79 [5.92]	1.11 [4.17]	-8.28 [4.49] *
Independent Private School			30.98 [11.02] *	27.31 [12.72] *	21.08 [8.71] *	11.12 [6.10] +	-11.03 [5.69] *
Size of Community							
Village		-32.3 [6.48] *	-30.31 [9.24] *	-29.95 [8.76] *	-14.74 [9.05]	-5.89 [8.64]	15.98 [6.27] *
Small Town		-19.94 [5.11] *	-17.23 [5.85] *	-17.21 [5.83] *	-11.02 [6.34] +	-6.59 [5.50]	3.54 [3.03]
Town		-7.28 [4.27] +	-5.84 [4.51]	-5.7 [4.29]	-2.97 [4.24]	-1.77 [3.53]	2 [2.18]
Large City		5.16 [6.92]	4.67 [6.45]	4.23 [6.27]	1.74 [5.62]	0.2 [4.94]	-3.28 [3.58]
Principal Autonomy							
P. can hire teachers				4.95 [5.34]	5.61 [5.37]	4.62 [4.76]	1.44 [3.51]
P. can fire teachers				3.16 [1.90] +	1.32 [1.92]	0.57 [1.78]	-2.1 [2.12]
P. in charge of budget				2.22 [4.08]	0.03 [4.23]	-0.42 [3.63]	0.59 [1.73]
P. in charge of curriculum				0.73 [2.55]	0.94 [2.81]	0.65 [2.53]	-0.5 [2.00]
School Level SES							
SES							46.31 [8.43] *
School Selection Policies							
Residence, Always Important					-9.1 [2.44] *	-6.06 [2.02] *	-6.36 [1.57] *
Residence, Sometimes Important					-2.21 [3.84]	-2.21 [3.58]	-2.76 [2.95]
Academic Record, Always Important					32.52 [6.54] *	27.65 [6.14] *	13.99 [3.70] *
Academic Record, Sometimes Important					8.73 [2.71] *	5.71 [2.61] *	2.43 [2.43]
Feeder School, Always Important					-10.57 [6.13] +	-8.77 [5.78]	-4.66 [4.40]
Feeder School, Sometimes Important					-3.3 [3.14]	-3.07 [2.76]	-2.22 [2.51]
Parent' endorsement, Always Important					7.2 [4.08] +	6.52 [3.65] +	2.08 [2.57]
Parents' endorsement, Important					4.12 [2.54]	3.45 [2.40]	1.94 [2.27]
Special Program, Always Important					-11.61 [4.75] *	-11.4 [3.90] *	-9.58 [2.80] *
Special Program, Sometimes Important							2.5
Family member preference, Always Important					-3.61 [2.84]	-3.31 [2.75]	-1.469
Family member preference, Important					0.88 [3.09]	-0.30 [2.66]	-3.55 [2.33]
Family member preference, Sometimes Important					-4.75 [2.91]	-4.74 [2.54] +	-5.82 [1.95] *
Teacher Characteristics							
Percent with University Degree					20.16 [11.93] +	16.45 [10.57]	7.79 [8.64]
Percent with Certification					2.54 [5.40]	1.45 [4.57]	-2.36 [3.84]
School Characteristics							
Student-Teacher Ratio					-0.57 [0.27] *	-0.45 [0.24] +	-0.19 [0.17]
School Size					0.01 [0.00] *	0.01 [0.00] *	0 [0.00]
Resource Construct					-17.08 [2.73] *	-13.35 [2.12] *	-4.64 [1.56] *
Level 1 Variables							
Opportunity to Learn							
Time Out of School in Math Classes						-0.02 [0.01]	-0.02 [0.01]
Time In School in Math Classes						0.03 [0.01] *	0.03 [0.01] *
Remedial Math Classes						-3.59 [1.10]	-3.52 [3.09]
Enrichment Math Classes						-20.67 [2.70] *	-20.33 [2.70] *
Student Characteristics							
Same Language at Home as in						5.65 [3.71]	4.5 [4.04]
Female						-16.03 [1.93] *	-16.09 [1.94] *
Student Level SES Construct						18.54 [2.20] *	15.41 [2.27] *
Intercept	84.38 [164.58]	112.08 [110.31]	111.49 [90.92]	113.43 [101.19]	148.31 [71.61] *	221.98 [75.79] *	363.29 [1003.29]
Level 1 Variance	4673.2	4673.0	4673.1	4673.1	4673.3	4336.5	4337.3
Level 2 Variance	3169.2	3052.5	2978.6	2971.3	2637.4	2179.9	1610.7
Level 3 Variance	1885.1	1732.6	1784.5	1698.3	1466.3	1427.2	1797.2

Results

- In the initial model (Model 1), in which competition and HDI are the only factors, competition has a significant effect, where one other school with which to compete accounts for an increase of 14% of a standard deviation in math score and competition with two or more other schools accounts for an increase of 24% of a standard deviation

- When size of community is added to the model (Model 2), the competition variables remain significant, but the positive effect of competition against one school and two or more schools drop to 9% and 14% of a standard deviation in math score, respectively

- School sector (Model 3) does not greatly alter the effect size of competition, leaving the positive impact of one competing school essentially unchanged, while the effect of two or more choices now indicates an increase of only 12% of a standard deviation in math score

- Measures of principal autonomy (Model 4) also fail to greatly alter the magnitude of the effect of competition, raising scores by approximately 8% of a standard deviation with one competing school and 11% with two or more competing schools

- School selection policies, teacher characteristics, and school characteristics (Model 5) do not alter magnitude severely either, leaving the magnitude of the competition variables approximately equivalent to those seen in Model 4

- The inclusion of student-level traits (Model 6) decreases the magnitude of change, making one competing school add only 7% of a standard deviation to scores and two or more competing schools add just below 10% of a standard deviation to score

- The final model (Model 7) factors in school-level socioeconomic status, at which point significance of both competition variables is lost

- An examination of deviance statistics confirms that Model 7 is the model of best fit, showing the spuriousness of competition's effects

Conclusions

The results of these analyses support the second hypothesis, suggesting that school choice does not, in fact, have an effect on achievement scores, nor do measures of principal autonomy. Because the positive relationship between school choice and achievement becomes spurious after school-level socioeconomic status is taken into account, these results lead to the conclusion that selection bias, stratification, or possibly socioeconomic status based peer effects account for any correlation between students attending schools with greater amounts of competition and higher achievement scores. In sum, voucher schools and schools with a lot of competition perform better because on average, they have a wealthier student body than other schools.

Further, when these analyses are conducted with reading achievement scores and the relevant covariates, the conclusions are consistent with the math analyses. Additionally, these conclusions can be drawn from the analyses of individual countries as well, demonstrating that these conclusions are also consistent internationally. These findings indicate that many of the proposals for education reform, specifically in the United States, should be revisited and revised.

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