Why Barbie Says "Math is Hard"

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I am grateful for research funding from the National Science Foundation and confidential data for an anonymous large Florida school district. I alone am responsible for any errors of analysis or interpretation.

Harvard President Lawrence Summers touched off a firestorm of controversy in January 2005 with his oft-cited statement that genetic differences may play a role in the differential selection of men into advanced work in mathematics and science. The ensuing debate concentrated on arguments concerning the physiological, cultural and environmental factors that may differentially affect men and women. Men and women may have innate differences that could influence their adult choices, and their differences could also be affected by differential cultural expectations that in turn help determine their identity and aspirations.

There exists a vast literature on male-female differences in mathematics and science. Numerous authors (e.g., Benbow and Stanley, 1980; Hedges and Nowell, 1995; Stumpf and Stanley, 1998) document persistent sex differences in mathematical achievement, and a variety of biological and sociological explanations for these differences have been proposed. As the recent controversy surrounding Summers's comments make clear, the argument concerning whether biology or socialization is dominant is still very active. At the same time, there exists evidence that women are less likely to choose careers in mathematics and science than are comparably-skilled men. Xie and Shauman (2003) find that the relationship between mathematics aptitude and selection into science is considerably weaker for women than for men. And Weinberger (2005) demonstrates that high-performing women are less likely to select into mathematics and science careers than are high-performing men. Many authors have proposed cultural and sociological explanations for why women may tend to shy away from careers in mathematics and science and mathematics (a few recent examples are Betz, 1997; Hyde, 1997; Leslie, McClure and Oaxaca, 1998; and Steele, 1997). All of these papers focus on aggregate male-female differences; looking at heterogeneity among women, however, could lead to new insights about these male-female differences.

In this paper I adopt a novel approach to discerning one pathway through which family and cultural expectations and resultant identity-formation could influence young women's choices about studies and potential future careers. I posit that a girl with a more feminine name may be treated systematically differently by parents, teachers and peers, or may herself relate to more feminine stereotypes. In such a circumstance, girls with more feminine names may be more likely to select coursework that is more "traditionally" female – such as the humanities and foreign languages – and shy away from coursework that is more "traditionally" male – such as advanced math and science.

Several recent papers have considered the causal effects of first names in different settings. Fryer and Levitt (2004) show women with names more frequently given to African-Americans tend to have no worse adult outcomes when the researcher controls for a large set of socio-economic characteristics. They conclude that the neighborhood in which women with distinctively African-American names grew up, and not the name itself, leads to lower adult outcomes. Figlio (2005), in a study of siblings, also finds that children with distinctively African-American names per se do not suffer academically, in terms of reading and mathematics performance. However, he finds large effects of having a name that linguistically signals low status. Bertrand and Mullainathan (2004) suggest that distinctively African-American names may be a signal of race, and could discourage prospective employers from interviewing a job candidate. Aura and Hess (2005) use national survey data and provide suggestive evidence that adults with names that end in certain letters or have different levels of complexity may have different life outcomes. The Aura-Hess paper, however, only considers a few basic linguistic attributes of a name and does not consider particular outcomes in depth. My current paper is the first to look at the role that a name could have in the academic choices of individuals.

Of course, names are not exogenously given to girls. Parents often pay great attention to the names they give their children, and parents with different proclivities toward mathematics and science, say, may systematically select different names for their daughters. In order to avoid confounding unmeasured family-specific factors with causal effects of names, I utilize a unique dataset of pairs of highly-achieving sisters provided to me by a large Florida school district. I then relate the name that a given high-achieving sister has to her propensity to take calculus and physics in high school, as compared with her high-achieving sisters with different names. Parents often give pairs of sisters very different names in terms of their femininity, offering me the opportunity to directly test the presumption that a name can have causal influences on a girl's academic development.

Many sibling-comparison studies suffer from the fact that unmeasured parental treatment of one sibling versus another influences sibling behaviors. This is not a concern in this study; indeed, differential parental treatment may in fact be a consequence of the names that parents give their daughters. I could find no evidence that sisters with more feminine names differ at birth from their sisters with less feminine names; there is no correlation with birth order, birth outcomes, or prenatal care, for instance. It is possible that parents have in mind differential femininity for their daughters from birth and prospectively name their daughters differently based on their chosen femininity paths for their daughters, but it is as least as likely that parents choose names that they find attractive, and they and others subsequently treat the sisters differently.

Course selection

For this paper, I utilize high school transcript data from a large Florida school district that provided me these data under conditions of anonymity. I observe all courses taken by students and their standardized reading and mathematics test scores for all students enrolled in the school district between 1995 and 2001. In these transcript data, I only observe courses attempted and completed (though failure counts as completion); hence, students who enrolled in a class but changed their mind and dropped it are not included. In high school, however, dropped classes are rare; in interviews with two high school principals in the school district in question, I learned that fewer than one percent of students request to drop classes after the beginning of the semester, and even then, usually because of scheduling conflicts with a class that would be necessary for graduation – not the set of students who are considered in the present analysis.

It is often believed that girls are less likely than boys to take advanced mathematics and science classes. In fact, the noteworthy factor of mathematics and science is that they are the fields in which girls and boys tend to be more equal; in other disciplines girls tend to be considerably more likely to take advanced courses than do boys. Table 1 illustrates this tendency: In general, girls are taking more advanced courses than are boys in this school district. I stratify students based on their ninth grade mathematics test score and compare boys' and girls' likelihood of taking various specific advanced classes. One observes that across ninth grade performance levels and for numerous subjects, girls are more likely to take advanced subjects than are boys. In the case of advanced placement English, for instance, girls are significantly more likely than boys to eventually take that course for every initial math ability group over the 50th national percentile, and the girl-boy gap monotonically increases with ninth grade performance. Gaps open up for the top three performance groups with regard to advanced placement history (either American, European or world history) and they are present for all performance groups with regard to students who took four or more years of a foreign language through high school.

With regard to calculus and physics, however, the girl-boy gaps are not as pronounced, and at the very top of the distribution, nonexistent. While boys are never observed to be *more* likely than girls to take these courses, the very top-performing boys are as likely as the very top-performing girls to take calculus and physics in high school, a result not found in the other subjects. The purpose of this paper is to investigate whether girls' names have something to do with girls' selection into mathematics and physics. If so, this could help to explain why girls dominate the other academic subjects in question, but not the most advanced mathematics and science classes.

Feminine names

In order to conduct the analysis in this paper, I must identify names that are more or less "feminine." I calculate the empirical femininity of a name by parsing each name into its phonemic components – the presence and order of particular letters and syllables. Using all births in Florida from 1989 through 1996, I regress all the phonemic characteristics of a name against whether the holder of that name is female. I can then predict the likelihood that the holder of any given name is female, based solely on the phonemic attributes of the name and independent any cultural connotations of the name.

One observes from Table 2 that the most common girls' names in America thusfar in the 21st century vary dramatically in terms of their predicted femininity. Some names, such as Kayla and Isabella, are so phonemically feminine that their predicted probability feminine exceeds 100 percent (this occurs because the predictions are drawn from linear probability models.) At the other end of the spectrum, Taylor, Madison and Alexis are phonemically predicted to be more than twice as likely to be boys' names as girls' names. One should note that this is a close representation of reality: Alexis and Taylor were historically boys' names, and the other historically boys' name on the list of top 20 girls' names – Ashley – also ranks among the least feminine popular girls' names.

Within-family differences

In order to determine the degree to which names relate to behavior and outcome, it is first necessary to disentangle the effect of a name from the effect of a family. If families with particular unobservables are more likely to give their children feminine names and they in turn are also more or less likely to be academically inclined (or inclined toward a particular set of subjects) then a finding of relationship between names and outcomes may simply be capturing unobserved family attributes. My identification strategy addresses this concern by comparing sisters within a given family.

While within-family similarities in name femininity are higher than the similarities between two random girls in a school, families do engage in a large degree of name-mixing. Table 3 presents a cross-tabulation of the femininity of successive sisters' names in the school district that provided me with data. I divide the first observed sister's name into quartiles based on name femininity (<.67 predicted femininity, .67-.83 predicted femininity, .83-.98 predicted femininity, and >.98 predicted femininity) and for each quartile measure the femininity of her next sister's name.

One observed that for families that give their girls names in the middle quartiles of the name distribution, there is no apparent correlation between a girl's name femininity and the femininity of her next sister's name. However, if one sister has a name along the extremes of femininity, her younger sister is considerably more likely to have a similar name; for instance, a girl with a lowest-quartile name is fifty percent more likely to have a sister with a lowest-quartile name than she is to have a sister with a highest-quartile name, and vice versa. Not reported in the tables are the results for even more extreme names; if a sister is in the ten percent least feminine girls' names (<.44), her next sister is 85 percent more likely to be in the lowest quartile of name femininity than in the highest quartile, and if a sister is in the ten percent most feminine girls' names (>1.07), her next sister is 93 percent more likely to be in the highest quartile of name femininity than in the lowest quartile. However, even in these cases, we observe that there are very many families that choose dramatically different names for their pairs of daughters. Even in the case of twins, where families name their children similarly, there is still a fair amount of intentional or unintentional name-mixing. For example, the top three pairs of girl twin names in America in 2004, according to the Social Security Administration, are Faith-Hope, Madison-Morgan, and Mackenzie-Madison. While the first two pairs of names are very similar, the third pair is linguistically substantially different. Families with one twin named Madison (with a femininity rating of 0.28) were almost as likely to choose Mackenzie (with a femininity rating of 1.07) as Morgan (with a femininity rating of 0.27) as a twin name. Madison, Mackenzie and Morgan all fit into the popular recent trend of giving children surnames as first name, but linguistically the names are quite different. Numerous other examples exist on the list of most popular twin names.

Do names reflect differences at birth?

While this study is not susceptible to many of the problems associated with studies of sibling comparisons, it may still be the case that sisters with more feminine names and sisters with less feminine names may be born under different circumstances. If a family's home life (e.g., poverty status or marital status) has changed or if there were differences in the nature of the births, and these differences affect naming patterns, one might expect that these other factors might themselves be driving any estimated relationships between names and later outcomes.

To study this question, I employ data on Florida births from 1989 through 1996. I compare the sister with the most feminine name to the sister with the least feminine name for each sister in 37,702 Florida families with multiple girls born during this time period. Table 4 shows the result of this analysis. One observes that under the objective measures in the birth vital records, there is no within-family correlation between name femininity and birth conditions. For instance, the difference in birth weight between the two groups averages only six grams (the standard deviation is 608 grams). Likewise, the two groups differ in their likelihood of having labor or delivery complications by only three-tenths of one percent. The two groups are virtually identical in the number of prenatal care visits (11.46 versus 11.47), parental marital status (56.5 versus 56.2 percent), and whether the child's delivery was Medicaid-funded (58.9 versus 58.8 percent). The last two columns of Table 4 repeat the exercise for the set of families with large differences in daughters' name femininity – more than 0.5 difference in the femininity index between the least feminine observed name and the most feminine observed name; the results are virtually the same.

The only difference that I observe between the most feminine name and the least feminine name in a family involves birth order; the daughter with the most feminine name is slightly (two percentage points) more likely to be the older of the two siblings than is the daughter with the least feminine name. These differences, though small, are still potentially meaningful. This small difference, however, is due completely to a general slow trend toward less feminine-named girls through the 1990s; when this birth order comparison is made controlling for birth year, there is no remaining difference.

There is also very little difference between the femininity of a mother's name and the femininity of her daughters' names. Table 5 shows the average daughter name femininity index for mothers, broken down by quartile of mother name femininity. One observes that the average femininity index of a daughter's name is very similar across the range of mother name femininity. Mothers with the most feminine names are slightly more likely to give daughters more feminine names themselves, but the difference between average name femininity across mother name groups is one-tenth of a standard deviation in the daughter name femininity index. Likewise, the average difference between oldest and youngest observed daughters is quite small, suggesting that daughter name femininity is not particularly related to either birth order or maternal name femininity.

Name femininity and course selection

Given that name femininity appears to be roughly random within a family, I can now turn to the question of whether a sister with a more feminine name is relatively more or less likely to take advanced mathematics and science courses. I concentrate on calculus and physics because these are the advanced mathematics and science courses in high school that tend to be elective for high-achievers; the vast majority of high-achieving high school students take chemistry (and virtually all take biology) as well as algebra II and analytic geometry. Calculus and physics, however, are still taken by a minority of high-achieving students.

I estimate the effects of name attributes on a sister's likelihood of taking calculus or physics. Specifically, I use linear probability models to regress a student's course selection against a vector of name attributes, as well as controls for the student's ninth grade test score (the latest test score observed) and family fixed effects. The name attributes in question are the measure of name femininity and the natural log of the frequency of the name, as observed in Florida. The rationale for including name frequency is that more popular names may have an independent effect, either positive or negative, on a student's self-confidence. Because a student's propensity to take advanced mathematics or science depends on the student's ability level, I interact the name attribute variables with the student's ninth grade test score so that I can separately estimate the effects of name attributes for students of different innate ability levels (as measured by ninth grade mathematics scores.)

In order to ensure that I observe a student's entire academic career, I select only students whose complete transcript is viewable. In addition, I select only students for whom I observe a ninth-grade mathematics test score, so that I can condition on past performance. In 687 families I observe multiple sisters with complete transcript records and ninth-grade test scores – 661 families with two sisters, 25 families with three sisters and one family with four sisters, for a total of 1,401 sisters in the relevant analysis. Sixty-three percent of the sample is white, 24 percent is black and 12 percent is Hispanic.

One-third of the sample enrolled in the free/reduced-price lunch program at some point during high school.[1]

Table 6 presents estimates of the relationships between name femininity, name popularity and student calculus and physics course selection, for two groups of students – students scoring at the 25th percentile of eventual calculus (or physics) takers and those scoring at the 75th percentile of eventual calculus (or physics) takers. One observes that name femininity and name popularity are both related to a high-achieving girl's propensity to take calculus and physics, as compared with her sisters. A one-standard-deviation increase in name femininity is associated with 2.1 percentage points reduced likelihood of taking calculus for a girl at the 25th percentile of calculus takers, and 2.6 percentage points reduced likelihood of taking calculus for a girl at the 75th percentile of calculus takers. While the estimated effect of name femininity on physics-taking is not statistically significant for girls who are below-average for physics takers, a one-standard-deviation increase in name femininity is associated with 3.6 percentage points reduced likelihood of taking physics for a girl at the 75th percentile of physics takers.

The results are mixed with regard to name popularity. Doubling name popularity is estimated to increase the likelihood of a girl taking calculus by about two percentage points, but is not related to the likelihood of a girl taking physics.

[1] This is an understatement of the true level of free/reduced-price lunch eligible students in the sample. Students are considerably less likely to enroll in subsidized lunch programs in middle and high school than they are in elementary school, in part because of fear of social stigma.

One can combine these estimated effects of name popularity and name femininity on course-taking to compute an estimated likelihood that a girl with a given ninth-grade test score will take calculus or physics. Table 7 presents predicted likelihoods of a girl at the 90th percentile of the ninth grade mathematics distribution taking calculus, depending on the attributes of her first name. For convenience, I include the most popular first name in the United States, as well as the 51st most popular name, the 101st most popular name, and so on, according to the Social Security Administration. I plot name femininity against name frequency. Combining name femininity and name frequency, I find that a girl named Emily with these test scores has an 18 percent chance of taking calculus. Girls named Sophie and Aubrey who have similar name femininity but are less popular have 14 or 15 percent chances of taking calculus. Girls named Meagan have lower name popularity but also lower name femininity, and also are predicted to have a 15 percent chance of taking calculus, while girls named Haylie have similar name popularity to Meagan, but their name femininity implies that they would take calculus 7 percent of the time. As Table 7 makes clear, name femininity and name popularity both sizably impact calculus-taking behavior.

Name femininity and girls' test scores

The previous analysis shows that high-achieving girls with feminine names tend to be less likely than their high-achieving sisters with less feminine names to take advanced mathematics and science courses. But might the femininity of a girl's name influence whether the girl becomes high-achieving at all? In order to understand the pathways through which names may influence the choices that a girl makes, it is important to attempt to determine the degree to which names affect proficiency as well as preferences.

I begin by examining whether girls with feminine names perform differently from their sisters with less feminine names. I therefore look at mathematics and science national percentile rankings on a nationally norm-referenced examination such as the Iowa Test of Basic Skills or the Stanford Achievement Test.[2] Table 8 presents the results of regressions that control for family fixed effects, grade fixed effects and the log of name frequency, separated by school level – elementary grades (2-5), middle grades (6-8) and high school (9). One observes that there is no statistically significant relationship between name femininity within a family and student mathematics or reading test scores at any of the three grade levels. For reading, the point estimates are relatively stable throughout the three school levels, but for mathematics, while none are statistically distinct from zero, it appears as if sisters with more feminine names deteriorate (albeit only slightly) in mathematics performance as they age. In both reading and mathematics, sisters with more popular names apparently perform better on standardized examinations, but there is no clear pattern with age.[3] In sum, there appears to be little relationship between name femininity and mathematics (or reading) performance on standardized exams, at any given point in time.

Why might name femininity influences course selection but not test scores? One potential answer is that names could affect a student's preferences but not one's

[2] I cannot identify the precise test because it could identify the school district providing me with these data.
[3] The same basic pattern of results persists whether I estimate separate regressions for different grade levels or include all school levels in the same regression and estimate separate results using interaction terms.

motivation to succeed in a given subject. To investigate this possibility, I am currently surveying middle-school-aged children to determine their preferences for mathematics. Preliminary evidence suggests that boys with higher mathematics test scores are considerably more likely to say that "mathematics is my favorite subject" or that "I am good at math" than are boys with lower mathematics test scores. For girls, this relationship is considerably smaller and is currently not statistically significant. Among high-achieving girls (those in the top quartile of the national mathematics score distribution), girls with top-third names (in terms of femininity) are 30 percent less likely as are girls with bottom-third names to report that "mathematics is my favorite subject" and 40 percent less likely to report that "I am good at math." While these results are extremely preliminary, they indicate that names may influence preferences for mathematics, independent of actual skill at mathematics. These results are consistent with the observed male-female differential selection into mathematics and science on factors other than ability documented Weinberger (2005) and others. Future versions of this paper will include final results from the survey.

Conclusion

Fist names can influence individual self-concept and the ways in which a person is perceived by others. I posit this as a partial explanation for the male-female gap in mathematics and science. This paper is motivated by the fact that while girls outpace boys in all other advanced high school coursework, the highest-achieving girls do not take calculus and physics at higher levels than do their highest-achieving male counterparts.

Part of this phenomenon may be due to the first names of the girls themselves. I find that girls with highly feminine names have the same starting values as do their sisters with less feminine names, and over time they perform similarly on standardized mathematics exams. However, even though girls with more feminine names are just as likely as are their sisters with less feminine names to be academically successful in mathematics, they are less likely to select the most advanced mathematics and science courses in high school. This finding of name-based selection that is independent of ability in high school suggests that similar patterns may continue in post-secondary education and career selection.

While I present these results as evidence of causal effects of names per se, the mechanism through which names affect student outcomes in this context are still unknown. Sisters with different types of names may be treated differently by their parents or their teachers, they may independently develop a self-concept based on their name, or they may select different peers (or be treated differently by their friends) because of their names. Regardless of the specific nature of the pathway, this finding of substantial name-based differences in mathematics and science selection among girls lends credence to the notion that environmental factors play a large role in the explanation for why fewer women self-select into the mathematics and science professions.

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Table 1: Advanced class enrollment rates, by sex and ninth grade math test score

	Test score (national percentile)					
	<50	50-59	60-69	70-79	80-89	>=90
CALCULUS						
Girls	0%	1%	2%	3%	7%	26%
Boys	0	0	1	2	4	26
Difference	0	1	1	1	3**	0
PHYSICS						
Girls	3	8	12	17	26	40
Boys	3	7	12	14	23	40
Difference	0	1	0	3**	3**	0
AP ENGLISH						
Girls	2	5	8	12	20	38
Boys	1	2	4	4	8	20
Difference	1	3**	4**	8**	12**	18**
AP HISTORY						
Girls	1	4	5	7	12	28
Boys	0	2	3	5	8	23
Difference	1	2	2	2*	4**	5**
FOUR OR MORE YEARS OF FOREIGN LANGUAGE						
Girls	9	15	17	21	27	32
Boys	6	10	10	12	17	23
Difference	3**	5**	7**	9**	10**	9**

Note: Differences marked * are statistically significant at the ten percent level; those marked ** are statistically significant at the five percent level.

Table 2: Predicted "femininity" of the Top 20 Girls' Names, 2000-2004

First name	Popularity (per 1000 girls)	Femininity index
Kayla	5.74	1.23
Isabella	5.61	1.21
Anna	5.06	1.04
Elizabeth	7.22	1.02
Alyssa	6.48	1.01
Emma	8.70	0.97
Brianna	5.67	0.95
Jessica	6.17	0.93
Samantha	7.58	0.83
Sarah	7.50	0.78
Olivia	7.39	0.74
Hannah	9.61	0.70
Emily	12.67	0.68
Lauren	6.07	0.66
Ashley	7.91	0.63
Grace	6.09	0.50
Abigail	7.48	0.48
Taylor	6.02	0.31
Madison	10.52	0.28
Alexis	7.83	0.28

Note: The femininity index is generated from the empirical predictions, as calculated by the author.

Table 3: Within-family variations in name femininity across successive sisters

		Fraction of second sisters' names with given femininity index			
		<0.67	0.67-0.83	0.83-0.98	>0.98
First observed sister's name femininity index	<0.67	0.30	0.27	0.22	0.20
	0.67-0.83	0.26	0.25	0.26	0.23
	0.83-0.98	0.24	0.24	0.26	0.25
	>0.98	0.19	0.23	0.28	0.29

Table 4: Differences in birth conditions for Florida sisters with different name attributes

	All families with 2+ sisters		Families with 2+ sisters with name femininity index differences greater than 0.50	
	Sister with the least feminine name	Sister with the most feminine name	Sister with the least feminine name	Sister with the most feminine name
Birth weight (grams)	3173	3167	3172	3170
Complications of labor/delivery	0.311	0.314	0.312	0.312
Number of prenatal care visits	11.46	11.47	11.18	11.25
Parents married at birth	0.565	0.562	0.551	0.538
Birth is Medicaid-funded	0.589	0.588	0.624	0.621

Table 5: Relationship between femininity of mother's name and femininity of her daughters' names

Quartile of mother's name femininity	Average femininity of first observed daughter's name	Average femininity of last observed daughter's name
Least feminine	0.78	0.76
Second	0.78	0.77
Third	0.80	0.78
Most feminine	0.81	0.79

Table 6: Within-family comparisons: Estimated effects of name femininity and name popularity on the probability that a girl takes calculus or physics

	Calculus		Physics	
	Ninth grade math score at 25th percentile of calculus takers	Ninth grade math score at 75th percentile of calculus takers	Ninth grade math score at 25th percentile of physics takers	Ninth grade math score at 75th percentile of physics takers
Estimated effect of one standard deviation increase in "femininity"	-0.021* (0.012)	-0.026* (0.015)	-0.013 (0.015)	-0.036** (0.018)
Estimated effect of doubling name popularity	0.019** (0.007)	0.022** (0.008)	0.004 (0.009)	0.008 (0.012)

Note: Coefficient estimated marked * are statistically significant at the ten percent level; those marked ** are statistically significant at the five percent level. Regressions also include family fixed effects and controls for ninth grade math score. Sample: 1,401 girls from 687 families.

Table 7: Estimated Probability that a Girl with a Given Name (and 90th Percentile Ninth Grade Math Test Scores) Will Take Calculus

NAME FEMININITY

Lowest | Highest

Highest

Emily 0.18

Makayla 0.12

Melanie 0.12

NAME POPULARITY

Sophie 0.15

Aubrey 0.14

Katelynn 0.09

Josie 0.14

Harley 0.11

Kiley 0.12

Meagan 0.15

Sarai 0.08

Haylie 0.07

Lorena 0.08

Lowest

Note: The predicted probabilities are calculated using the regression results described in Table 6.

Table 8: Estimated effects of name femininity on girls' mathematics and reading test performance (sibling fixed effect model)

	Mathematics test scores		Reading test scores	
	Estimated effect of one standard deviation increase in "femininity"	Estimated effect of doubling name popularity	Estimated effect of one standard deviation increase in "femininity"	Estimated effect of doubling name popularity
Elementary grades (2-5)	0.174 (0.141)	0.424** (0.064)	-0.012 (0.126)	0.459** (0.057)
Middle grades (6-8)	-0.008 (0.142)	0.554** (0.064)	0.043 (0.129)	0.318** (0.057)
High school (9)	-0.041 (0.210)	0.527** (0.086)	0.125 (0.190)	0.285** (0.078)

Note: The dependent variable is the national percentile ranking on a standardized nationally-administered examination. Coefficient estimated marked * are statistically significant at the ten percent level; those marked ** are statistically significant at the five percent level. Regressions also include family fixed effects and grade fixed effects.