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Anil Nathan
College of the Holy Cross, anathan@holycross.edu

Sovita Hean
College of the Holy Cross, shean11@holycross.edu

Ryan Elliot
College of the Holy Cross, rpelli16@holycross.edu

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Anil Nathan, Sovita Hean, and Ryan Elliot

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Department of Economics and Accounting
College of the Holy Cross
Box 45A
Worcester, Massachusetts 01610
(508) 793-3362 (phone)
(508) 793-3708 (fax)

http://holycross.edu/academics/programs/economics-and-accounting

The Value of a Private Education: Differential Returns and Selection on Observables

Anil Nathan* , Sovita Hean† , and Ryan Elliot‡

Abstract

The academic value of a private education versus a public education is explored. This study first attempts to see whether there are differential returns to a private education based on ability level. It also intends to non-parametrically control for the selection on observables of the decision to attend private school. Using 8th graders from the National Educational Longitudinal Study of 1988, we find that the there is a positive effect on standardized math test scores using OLS. Based on quantile regression results, average students benefit most from a private education. Low-achieving and high-achieving students do not benefit as much. The particularly low return to a private education for high achievers suggests most of them would succeed at any school. Average treatment effects on the treated (ATET) are twice as large and average treatment effects (ATE) are more than three times as large as ordinary least squares estimates. These results suggest that perhaps private schools are actually not selecting the best students, but rather selecting average students and adding value to them.

*Department of Economics and Accounting, College of the Holy Cross. Email: anathan@holycross.edu
†Class of 2011, College of the Holy Cross. Email: shean11@holycross.edu
‡Class of 2016, College of the Holy Cross. Email: rpelli16@holycross.edu

1 Introduction

The choices on how to educate children are quite numerous. There are tangible differences between public, private, religious, magnet, and charter schools The decision on the parental choice of education for their children is an important one. Many factors go into this decision, such as:

- School Type
- Location
- Student to Teacher Ratio
- Facilities
- Academic Quality
- Peers
- Cost

This study seeks to determine the academic returns to private school (religious and non-religious) versus public school. By splitting students into low achieving, average achieving, and high achieving subgroups, differential returns to private school versus public school based on the type of student can be calculated. Knowing the differences in rate of return is important, since it may affect the decisions of parents on where to send their children to school. For example, parents may not deem it beneficial to send a child of a certain type to an expensive private school versus a public school if the returns to going to private school for the child is relatively low. On the other hand, there may be some groups of students that would relatively benefit from attending a private school versus a public school. It also may affect how governments proceed in distributing vouchers, which give certain students a choice and a subsidy for attending school.

This study also seeks to determine if there are selection on observable effects that could potentially bias estimates on returns to private schools over public schools. Perhaps private schools attract a certain type of student (based on academic ability) that could enhance or dampen the effect of actually attending the school. If it is determined that private schools attract many bright students, then it is possible that any returns to private school versus

public school may be overstated. On the other hand, if it is determined that private schools attract many students that need extra motivation to succeed, then it is possible that any returns to private school may be understated.

This paper will be organized as follows. Relevant literature will briefly be outlined in section 2. Section 3 describes the National Educational Longitudinal Study of 1988 sample that is used. Section 4 outlines the econometric models used to determine if there are any differential returns based on student academic ability and if there is a selection on observables problem with the data. Section 5 presents the results if the study, and section 6 concludes with policy implications and future work.

2 Literature Review

There have been numerous studies on the importance of education on a variety of outcomes. Card and Krueger (1998) have an extensive literature review on education related papers, and many of them have mixed results on the factors in an educational production function. So there is some dispute on what factors are important. Becker and Chiswick (1966) in one of the first papers on the economics of education find a school earnings function. There are also many studies regarding differences in public and private education. Coleman, Hoffer, and Kilgore (1982) find strong evidence of stronger vocabulary and mathematics cognition in private schools. Glomm and Ravikumar (1992) find that economies with public education have less income inequality, while economies with private education have greater per-capita incomes. Evans and Schwab (1995) assert that attending Catholic high schools raises the probability of entering a 4 year college by 13%, which is one way to measure the return to a private (in this case Catholic) education. Fryer and Levitt (2004) suggest school quality as a cause of the black-white test score gap in early education. If there are quality differences in the type of education, there could be long term effects along many lines, one of which is race.

This paper is modeled after Jepsen (2002). His paper showed that private school competition does not necessarily have any positive significant effect on student achievement. However, his use of the National Educational Longitudinal Study of 1988 and some of his variables are in the analysis of this paper.

3 Data

The National Educational Longitudinal Study of 1988 (NELS 88) consists of a panel of nationally represented 8th graders. They were then followed through 1990, 1992, and 1994. Students, teachers, and administrators were surveyed by the National Center of Educational Statistics. Some of the questions of NELS 88 include the following.

- Resources
- Peers
- Neighborhood characteristics
- Tests

The dependent variable of interest in this study is an 8th grade standardized math test score, which is taken by all students. The independent variable if interest is the type of school that a student attends. This study has school type as a binary variable which consists of public schools and private schools. Private schools consist of both non-religious and religious institutions. Other independent variables consist of the following items.

- Race
- Gender
- Family Income
- Siblings
- Mother's education
- Religious commitment
- Future education prospects
- School size
- Percentage white students in school
- Percentage of teachers with a masters degree

Table 1 lists some of the the means and percentages in this dataset, with a sample size of 5171 students. Some key numbers to note are that about 21% of the students attended some form of private school. Also, the students' families were clustered in the \$25000 to \$75000

income range. Most of the mothers achieved a high school degree, which can approximate the implicit value of an education in a household. Schools ranged from very small (1-399 students) to very large (1200-1599 students). The percentage of teachers with a masters degree is an approximate (but imperfect) measure of teacher quality.

4 Model

4.1 Differential Returns

The following model is used to to estimate the returns to attending a private school on test scores.

$$Y_i = \beta_0 + P_i\beta_1 + \beta_2\overline{X_i} + \epsilon_i \tag{1}$$

- Y_i=Score
- P_i=School type
- $\overline{X_i}$= Vector of all other controls
- ϵ_i=Error

This model is then split into 25th, 50th, and 75th percentile of achievers in order to see if there are differential effects of attending a private school if you are a high achiever, an average achiever, or a low achiever. Simultaneous quantile regressions are performed along these percentiles.

4.2 Selection on Observables

Since the decision to attend a school is a choice, it is possible that there is non-random selection into public and private schools. This study looks into a possible selection on observables problem. In this case, high achievers may select themselves into private schools, thereby overestimating the return to a private education. Private schools may not be adding as much value as it seems since the population of students at these schools may just be higher achieving. It may also be possible that low achievers may select into private schools, thereby

using similar logic as above, underestimating the return to private schools. Imbens (2006) outlines ways to control for selection on observables by using matching methods to estimate average treatment effects.

One method used is nearest neighbor matching, which is a process of matching individuals with similar characteristics except their school choices. Essentially, the goal is to find individuals that are "close" to each other in every aspect except school choice. Closeness can be estimated by calculating the vector distance between all of the other independent variables except school choice between individuals. Once individuals are matched, then the difference in their dependent variables (test scores) is calculated. All matches are then averaged to calculate the average treatment effect of attending a private school.

Another method is propensity score matching, which is a process of matching individuals with similar probabilities of choosing a school, but who in actuality choose different schools. You can find the probability of attending a private school by running the following logit or probit regression.

$$P_i = \alpha_0 + \alpha_1 \overline{X_i} + \delta_i \tag{2}$$

- P_i=School type
- $\overline{X_i}$=Vector of all other controls
- δ_i=Error

Then, take the $\widehat{P_i}$'s for each individual and match them to another individual with the closest probability, but that attended a different type of school. After matching, the average treatment effects can be calculated using a similar method as done above.

5 Results

5.1 Differential Returns

Table 2 lists the results of the quantile regressions on equation 1. Low achievers score 91.6 points higher on average if they attend private schools, which is a 2.2% rise in score. This

estimate is significant at the 10% level. Middle achievers on average score 123.4 points higher at private schools than public schools, which is about 3.0% higher on average. This estimate is significant at the 5% level. High achievers, on the other hand, only score 51.4 points higher on average at private schools than public schools, or 1.2%. This estimate is insignificant. This means that the middle achieving students gain the most out of attending private schools over public schools. Low achieving students gain a little less, while high achieving students have insignificant gains in test scores while attending private schools over public schools.

Other control variables have unsurprising effects on test scores. Females on average score higher than males, school size has an adverse effect on scores, masters degrees for teachers has a positive effect on scores, and having a mother that graduates college also has a positive effect on scores.

5.2 Selection on Observables

Just running a straight ordinary least squares regression on equation 1 results in a 1.5% increase in test scores as a result of attending a private school. When controlling for selection using nearest neighbor matching, there is a 3.5% increases in test scores for attending private school. This rise over the OLS estimate does suggest that perhaps there is evidence towards low achieving students selecting into private schools. Perhaps parents send low achieving students to private schools for extra motivation and a more rigorous curriculum. Since they are lower achieving on average, not accounting for this selection could underestimate the impact of a private education. However, controlling for selection using propensity score matching results in a 0.07% decrease (insignificant) in test scores for attending private schools. There were some problems with this procedure, in that the support for the "treated" and "untreated" groups are not exactly the same. However, this result could mean that high achieving students are selecting into private schools, which means that not accounting for selection would overestimate the impact of private schools. Based on these results, selection effects are ambiguous, and more work needs to be done in investigating these methods.

6 Conclusion

The results in estimating the differential returns of a private education suggest that average students tend to get a better return on test scores than either low or high achieving students. The very low, insignificant rate of return for high achievers suggests that they can really succeed anywhere.

These results suggest that parents of students that are around the middle of the ability distribution can get the high returns to test scores by sending the students to private schools. Also, there could be potential impacts on voucher and aid policy to students. If average students have the greatest return, then perhaps vouchers and aid can be targeted towards them, if politically feasible.

This preliminary analysis will undergo plenty of future work. In addition to solving the selection on observables ambiguity, it is very important to utilize the panel nature of the NELS 88 data to create a true baseline and an accurate value added for each students across time. This baseline should allow more accurate calculation of a rate of return than a simple cross-sectional analysis. Also, since the NELS 88 data does extend beyond high school, it is possible to use other metrics besides 8th grade standardized math test scores. For example, college attendance and even initial wages can be used as metrics for judging the value of private schools. Nevertheless, this cross sectional analysis does show differential returns to a private education across ability level.

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Table 1: Sample Statistics of NELS 88

Variable	Mean	Variable	Mean
Private	21.3%	School Size 1-399	17.4%
White	81.3%	School Size 400-599	16.8%
Latino	6.2%	School Size 600-799	13.6%
Black	6.9%	School Size 800-999	15.7%
Asian	4.8%	School Size 1000-1199	17.3%
Income 10-15	6.5%	School Size 1200-1599	19.11%
Income 15-20	7.0%	Masters 0-5%	7.7%
Income 20-15	10.1%	Masters 6-10%	10.1%
Income 25-35	20.6%	Masters 11-15%	12.7%
Income 35-50	22.6%	Masters 16-20%	11.6%
Income 50-75	14.9%	Masters 21-30%	18.7%
Income 75-100	4.2%	Masters 31-45%	20.6%
Income 100-200	6.6%	Masters 46-60%	11.7%
Income 200+	2.0%	Masters 61-90%	5.0%
Mother No H.S.	10.5%	Masters 91+%	1.9%
Mother H.S.	35.3%	N	5171
Mother College	14.9%		
Mother PhD MD	9.1%		

Table 2: Returns to Private School Conditional on Ability

	Low Achievers	Middle Achievers	High Achievers
Private	91.6 (55.4) 2.2%	123.4 (50.4) 3.0%	51.4 (54.2) 1.2%
Male	-80.7 (-39.7) -1.9%	-112.4 (-33.8) -2.7%	-124.8 (-41.9) -2.9%
School Size 1200-1599	-106.0 (-65.52) -2.5%	-120.8 (-54.3) -2.9%	-112.0 (-90.9) -2.6%
Over 90% Masters	354.2 (84.9) 8.4%	311.9 126.1 7.4%	356.1 (131.8) -8.4%
Mother Graduated College	451.3 (53.2) 10.7%	447.5 (74.5) 10.6%	591.5 (75.7) 14.0%
Latino	-475.1 (-89.7) -11.2%	-634.5 (-123.6) -15.0%	-731.9 (-135.7) -17.3%
Black	-613.7 (-90.0) -14.5%	-858.8 (-128.5) -20.3%	-995.8 (-113.2) -23.5%
White	-221.5 (-76.8) -5.2%	-349.0 (-101.6) -8.2%	-341.5 (-79.8) -8.1%