PUBLIC VS. PRIVATE SCHOOLS: THE IMPACT ON WAGE RATES

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ABSTRACT

Educational reform has attracted a lot of attention both in political and academic circles in recent years, and it continues to do so. Newly elected office holders at the federal as well as the state level (e.g., U.S. President George W. Bush and New Jersey Governor James E. McGreevey) made education one of the centerpieces of their respective campaigns. One of the hotly debated topics is the issue of school vouchers which would permit parents to take their children out of the public school system and send them to a private school instead. They would receive a voucher in the amount that the public system would not have to spend for educating one fewer student. So far, the experience with voucher programs is limited, but in mid-February 2002, the U.S. Supreme Court indicated that at least some of the judges held the opinion that such vouchers could be used for schools with religious affiliation without violating the separation of church and state. This suggests a possible expansion of school voucher programs in the future. Before such larger-scale voucher programs are enacted, however, it would seem desirable to gain knowledge about the relative benefits of private versus public schools. Dating back to the work of James Coleman and his colleagues (Coleman, Hoffer, and Kilgore, 1982; Coleman and Hoffer, 1987), researchers have attempted to analyze and quantify such benefits.

This paper contributes to the relevant literature in the following ways: First, unlike much of the literature (e.g., Coleman, Hoffer, and Kilgore, 1982; Coleman and Hoffer, 1987; Evans and Schwab, 1995) which uses data from the "High School and Beyond Study" as primary data source, I use the National Longitudinal Survey of Youth (NLSY79). As described in more detail in Section 2, the NLSY79 is a panel data set which is rich in information both at the individuals' level as well as at the level of the educational institution the respondents attended.

INTRODUCTION

Educational reform has attracted a lot of attention both in political and academic circles in recent years, and it continues to do so. Newly elected office holders at the federal as well as the state level (e.g., U.S. President George W. Bush and New Jersey Governor James E. McGreevey) made education one of the centerpieces of their respective campaigns. One of the hotly debated topics is the issue of school vouchers which would permit parents to take their children out of the public school system and send them to a private school instead. They would receive a voucher in the amount that the public system would not have to spend for educating one fewer student. So far, the experience with voucher programs is limited, but in mid-February 2002, the U.S. Supreme Court indicated that at least some of the judges held the opinion that such vouchers could be used for schools with religious affiliation without violating the separation of church and state. This suggests a possible expansion of school voucher programs in the future. Before such larger-scale voucher programs are enacted, however, it would seem desirable to gain knowledge about the relative benefits of private versus public schools. Dating back to the work of James Coleman and his colleagues (Coleman, Hoffer, and Kilgore, 1982; Coleman and Hoffer, 1987), researchers have attempted to analyze and quantify such benefits.

This paper contributes to the relevant literature in the following ways: First, unlike much of the literature (e.g., Coleman, Hoffer, and Kilgore, 1982; Coleman and Hoffer, 1987; Evans and Schwab, 1995) which uses data from the "High School and Beyond Study" as primary data source, I use the National Longitudinal Survey of Youth (NLSY79). As described in more detail in Section 2, the NLSY79 is a panel data set which is rich in information both at the individuals' level as well as at the level of the educational institution the respondents attended.

A second difference between the existing literature and this paper is the exact research question: While much of the previous work focuses on educational outcomes such as high school graduation (e.g., Evans and Schwab, 1995), standardized test scores (e.g., Coleman, Hoffer, and Kilgore, 1982; Coleman and Hoffer, 1987), or graduation from college (Neal, 1997), I examine the impact of private schooling on wages.

Third, while Neal (1997) also analyzes the effects of private schooling on wage rates, he focuses exclusively on Catholic schools. While examining Catholic schools has the advantage of obtaining a rich data set, it ignores the fact that many non-parochial schools are substantially more expensive than Catholic schools. To

name just one example, the leading non-parochial private school in our community (a medium-sized suburban community in the vicinity of New York City) charges annual tuition (dependent on the grade) in the range of approximately $11,500 to$18,000, hardly what is representative for Catholic private schools. Note that the inclusion of students at private schools other than Catholic schools adds a substantial number of students to the sample. While the NLSY79 does not include information about which type of private school a student attended, it is possible to obtain national frequency distributions for private school enrollment. The results of the Private School (Universe) Survey—which gets published biennially by the National Center for Education Statistics (NCES), a part of the U.S. Department of Education—can be assumed to be a good approximation for the individuals included in my data set since the NLSY79 is a nationally representative sample. I was able to obtain the results of the Private School (Universe) Surveys from 1989/90 to 1999/2000. During that period the percentage of students attending grades 9-12 at a private school which is not a Catholic school was rather steady at values between 40 and 50%. The NLSY79 respondents must have attended high school in the mid-1970s to the early 1980s since they were 14-22 years of age in 1979. Even though I was unable to obtain the respective percentage for that particular time period, it can be assumed that a substantial fraction of students at private high schools did attend a non-Catholic school. Thus, by using a data set which includes students which attend a private high school which is not affiliated with the Catholic church, new insights into the returns to private schooling can potentially be gained.

Finally, I start my analysis by running one (log) wage regression which includes a dummy variable as regressor if an individual attended a private school. This is the same approach as, e.g., in Neal (1997). Additionally, however, I estimate variations of this initial model which allow for greater flexibility.

METHODOLOGY

Data

As mentioned in the Introduction, I use NLSY79 data, survey years 1979-1993. The NLSY79 is a nationally representative panel data set that started in 1979 with 12,686 individuals who were ages 14-22 at the beginning of 1979. The participants in 1979 were 6,111 randomly sampled individuals; 2,172 oversampled blacks; 1,480 oversampled Hispanics; 1,643 oversampled economically

disadvantaged whites; and 1,280 individuals from a military sample. In 1993, 9,011 respondents continued to participate in the NLSY79.

In case of a non-response, the NLSY79 contains information on *why* the interviewee did not answer. Some answers are missing because—due to the panel nature of the NLSY79—values for some variables can be concluded from earlier waves and the interviewees do not get asked such questions again. In such cases, I change the non-responses accordingly. Non-responses for which no "appropriate" answer could be concluded were set to missing.

I use the NLSY79 data set because it includes a wealth of information well suited for the analysis of the impact of school type on earnings while controlling for a host of other possibly contributing factors. Specifically, at the individual level, the NLSY79 includes information on a person's work history including earnings and hours worked which allows the calculation of an hourly wage. Additional variables which can be used as explanatory variables in a wage regression include sex, race, and potential job market experience. Otherwise unobserved ability can be proxied by the results of the Armed Forces Qualification Test (AFQT) which 94% of NLSY79 participants completed. In terms of an individual's educational attainment, the highest grade completed is reported. Also, a dummy variable indicates whether an individual attended a private or a public high school. In addition to individual characteristics, the NLSY79 includes information on a person's family background in the form of the highest grade which his or her father and mother completed.

The 1980 wave of the NLSY79 includes a school survey which makes it particularly suited for my purposes. The high schools which the NLSY79 respondents attended were asked to submit information concerning enrollment, qualitative and quantitative aspects of their faculty, curriculum, etc. Specifically, the student-to-teacher ratio and the percentage of full-time teachers with a Master's or doctoral degree can be used in regressions as a measure of school quality.

In summary, the NLSY79 has a number of features that make it appealing for a wage regression which includes school quality measures as explanatory variables. First, the data set includes detailed information on school characteristics, not all of which is available in, e.g., the "High School and Beyond" data set, especially not in more recent years. Second, the use of data at the school level potentially eliminates measurement error and aggregation bias vis-à-vis studies that use school district or even state level data. Third, due to the panel nature of the data set, it is possible to follow individuals over time and thus examine what effect the school quality in 1979 has on the respondents' wages several years thereafter.

Estimation

Based on the pioneering work of Jacob Mincer (1957, 1958, 1974), Theodore W. Schultz (1960, 1961), and Gary S. Becker (1962, 1964), the research on the returns to education has been expanded to include additional explanatory variables which attempt to capture the influence of various school quality measures such as expenditures per student, student-to-teacher ratios, and percentage of teachers with at least a Master's degree (e.g., Card and Krueger 1992; Betts 1995; Grogger, 1996). Based on this body of knowledge, I examine what influence a student's attending a private school versus a public school has on the wage rate.

Table 1 presents the mean values and the standard deviations of the variables used in the estimations. Log hourly wages were obtained as follows: Reported hourly wages with values below $0.50 and above $100 were set to missing since they are likely to represent measurement error. The remaining hourly wages were deflated to 1990 levels using the price index for Personal Consumption Expenditures (see Economic Report of the President, 1992. Table B-3. p. 302). The natural logarithm of the resulting wage variable is the dependent variable in the wage regressions. "Highest grade completed" measures an individual's years of formal education, a variable whose influence on wages is well established in labor economics. "Sex" is a dummy variable that takes on the value zero if the individual is male and one if the individual is female. The dummy variable "Non-white" is equal to zero if the respondent is white and equal to one if the respondent classifies him- or herself as "black" or "other." The variable for potential job market experience ("Experience") is constructed as the minimum of age minus years of schooling minus 6 and age minus 17. In cases in which this construction led to negative values for the experience level (typically for individuals who were less than 17 years of age at the time of the interview or in the case of reporting error), experience is set equal to zero. "AFQT" is the individual's percentile score on the Armed Forces Qualification Test. This test was administered to the NLSY79 respondents between the 1979 and 1980 surveys; 94% of the respondents completed the test. While AFQT scores have been used in a special framework as a proxy for school quality (Maxwell 1994), I claim that AFQT does not capture school quality properly. Instead, I will use it as a proxy for otherwise unobserved ability. This approach seems to be the general consensus in the profession and is used, for instance, in Blackburn and Neumark (1995). "Father's highest grade completed" and "Mother's highest grade completed" are included since a student's background is thought to be quite important in the educational process (Neal, 1998). The student-

to-teacher ratio is calculated as the ratio of a school's enrollment to the number of full-time equivalent teachers, both taken from the school survey. Presumably, a lower student-to-teacher ratio offers higher-quality education because of the more personalized attention a teacher can provide to students. The percentage of full-time teachers with a Master's or doctoral degree is another frequently used measure of school quality. Finally, the dummy variable which measures private school attendance takes on the value one if the individual attended a private school, zero if the individual attended a public school.

Table 1: Means and Standard Deviations of Dependent and Independent Variables

Variable	Mean	Standard Deviation
Log hourly wage	6.57	0.54
Highest grade completed	12.15	2.40
Sex	0.51	0.50
Non-White	0.31	0.46
Experience	5.69	4.46
AFQT	40.67	28.86
Father's highest grade completed	11.00	3.93
Mother's highest grade completed	10.90	3.17
Student-to-teacher ratio	19.53	6.58
Percentage full-time teachers w/ Master's or doctoral degree	47.65	23.28
Students attended private school	0.06	0.23

In order to examine whether individuals who attended private schools earn higher wages than individuals who attended public schools, I start my analysis by running a pooled regression (i.e., private school plus public school students) of log hourly wages on a number of regressors that can be divided into two groups: The first group consists of variables which represent personal characteristics (education, gender, race, potential job market experience and its square, and parents' education). The variables in the second group are measures of school quality (student-to-teacher ratio, percentage of teachers with Master's or Ph.D. degrees, private or public school).

There is an ongoing debate in labor economics about potential biasedness of the Ordinary Least Squares (OLS) estimator in the context of estimating returns to schooling. In a recent article, McKinley L. Blackburn and David Neumark (1995) examine this issue and conclude: "Thus, in our NLSY79 data, OLS estimation of the standard log wage equation, including test scores, appears to provide an appropriate estimate of the returns to schooling." In order to take possible heteroskedasticity into account, all estimations in this paper are carried out using a Generalized Least Squares (GLS) procedure. While the resulting robust (Huber/White) standard errors are different from those resulting from an OLS regression, the coefficient estimates are unaffected by this procedure.

Specifically, the initial regression takes the following form:

$$(1) \qquad \ln(w_{it}) = \alpha + X'_{it}\beta + Y'_{i}\gamma + PRIVATE_i * \delta + u_{it}$$

where $\ln(w_{it})$ is the natural logarithm of the hourly wage of individual *i* in period *t*, X'_{it} is a vector of personal traits that change over time, Y'_{i} is a vector of personal traits that are constant over time, $PRIVATE_i$ is the dummy variable which indicates whether an individual attended private school, α, β, and γ are coefficients to be estimated, and u_{it} is an error term.

The regression estimates are presented in Table 2. Most of the estimates for all explanatory variables have the "correct" sign (correct with respect to economic theory or previous empirical work) and are highly significant. Exceptions are a respondent's mother's education (which is estimated to have a negative impact on wages, but is statistically not different from zero) and the student-to-teacher ratio. One might expect that a higher student-to-teacher ratio on average lowers the wage. However, as Betts (1995) points out, the majority of studies finds such a relationship at best to be weak. In light of such findings, I do not find the positive coefficient estimate too troublesome. The regression's R-squared is reasonably high for this kind of log-linear wage regression, and the F-statistic (zero, rounded to 4 decimals) clearly shows the overall statistical significance of the model. The coefficient estimate on the variable of interest, the dummy variable for private schooling is positive and highly statistically significant. In terms of magnitude, the estimate is rather substantial: All else equal, attendants of private schools earn wages which are 4.9% higher than the wages of their public-school counterparts. The finding that individuals who attended a private school tend to earn higher hourly wages than individuals who attended a public school is consistent with previous research (e.g., Neal, 1997).

Table 2: Pooled Regression of Log Hourly Wages on Personal Characteristics, School Quality Measures, and an Intercept Dummy

Variable	Coefficient Estimate	Standard Error	t-ratio
Highest grade completed	0.0645	0.0011	56.62
Sex	-0.2148	0.0038	-56.33
Non-white	-0.0249	0.0050	-5.01
Experience	0.0816	0.0014	56.62
Experience squared	-0.0035	0.0001	-33.64
AFQT	0.0030	0.0001	31.81
Father's highest grade completed	0.0029	0.0007	4.13
Mother's highest grade completed	-0.0013	0.0009	-1.53
Student-to-teacher ratio	0.0027	0.0003	7.88
Percentage full-time teachers w/ Master's or doctoral degree	0.0014	0.0001	17.03
Student attended private school	0.0494	0.0085	5.81
Constant	5.2974	0.0158	335.47
R-Squared Root MSE Number of observations	0.26 0.46 59,861		

After having established such a relationship, however, it needs to be pointed out that in a regression as in equation (1), the estimates for all the control variables are forced to be the same. Differences between the outcomes for students of public and private school can enter the model only via the intercept. That is, I can establish that there indeed is a systematic difference between the wages of students of the two types of schools, but it is not clear what causes such a difference. It might be suspected, for example, that the rates of return of the two types of schools differ systematically. In order to investigate this possibility, I estimate a variation of the model above. The new regression equation is

$$(2) \qquad \ln(w_{it}) = \alpha + X'_{it}\beta + Y'_{i}\gamma + (\text{PRIVATE}*\text{HIGRCO})_i*\zeta + u_{it}$$

where $(PRIVATE*HIGRCO)_i$ is an interaction term between the dummy for private schooling and the highest grade completed by an individual. The other variables are as defined for equation (1). Estimation results from this regression are presented in Table 3.

Table 3: Pooled Regression of Log Hourly Wages on Personal Characteristics, School Quality Measures, and an Interaction Term

Variable	Coefficient Estimate	Standard Error	t-ratio
Highest grade completed	0.0642	0.0011	56.27
Sex	-0.2148	0.0038	-56.33
Non-white	-0.0249	0.0050	-5.01
Experience	0.0815	0.0014	56.61
Experience squared	-0.0035	0.0001	-33.63
AFQT	0.0030	0.0001	31.84
Father's highest grade completed	0.0029	0.0007	4.13
Mother's highest grade completed	-0.0014	0.0009	-1.56
Student-to-teacher ratio	0.0027	0.0003	7.95
Percentage full-time teachers w/ Master's or doctoral degree	0.0014	0.0001	17.04
Schooling/private school interaction term	0.0038	0.0006	6.21
Constant	5.3010	0.0158	335.06
R-Squared	0.26		
Root MSE	0.46		
Number of observations	59,861		

The estimates for all the control variables as well as R-squared and F-statistic are very comparable to the first regression. With respect to a possible difference in the rates of return to schooling between private and public schools, I find that the coefficient estimate on the interaction term is highly statistically significant. That is, the rate of return for private school students indeed exceeds the respective rate for public school students by approximately 0.4 percentage points (6.43% + 0.38% = 6.81% versus 6.43%). In addition to being statistically

significant, a difference of that magnitude can be considered "economically significant" (cp. McCloskey and Ziliak, 1996) as well. While it is not directly clear *why* private school students enjoy a higher rate of return on their years of schooling, this result helps explain the wage premium that private school students enjoy as established in the first regression.

However, it could be further argued that an estimation including an intercept dummy *and* an interaction term is the appropriate specification. The resulting equation is

$$(3) \qquad \ln(w_{it}) = \alpha + X'_{it}\beta + Y'_{i}\gamma + PRIVATE_i*\delta + (PRIVATE*HIGRCO)_i*\zeta + u_{it}$$

Results from this estimation are in Table 4. Again, R-squared, F-statistic, and coefficient estimates for the control variables do not change substantially relative to the previous two regressions. Interestingly enough, when an intercept dummy as well as an interaction term are included in the model, the coefficient estimate on the former becomes negative while the estimate on the latter remains positive. (Both coefficient estimates are highly statistically significant.) That is, if one allows for the possibility that an individual's private schooling affects the overall level of wages as well as the rate of return to schooling, then private-school students are at a relative disadvantage at low levels of education. For somewhat more than 11 years of schooling (0.1563 / 0.0146 = 11.2) and above, the private-school students' higher rate of return more than compensates for the reduction in the constant term, and attendants of private schools have a wage advantage at these higher levels of schooling.

While I have addressed the various ways in which the dummy variable for private schooling attendance enters a (log) wage regression, I have so far constrained all other estimates to be the same for both types of schooling. This ignores the possibility that the impact of a factor such as, say, race may be different for public and private school students. In order to allow for such possible differences, I run regressions of the model in equation (1) separately for individuals who attended a private school and individuals who attended a public school. The results of these separate regressions are presented in Table 5. By and large, the results are quite similar to the pooled regression in Table 2. However, there are noteworthy differences as well. In the regression for private school students, the coefficient estimate for "Sex" indicates that the earnings disadvantage which women experience is only approximately half as large for private-school attendants than for their counterparts who attended public schools. The estimate on "Non-white"

indicates that non-white individuals from private schools are actually at an earnings advantage relative to their white private-school peers. This result is not the same as, but similar to Neal's (1997) finding that urban minorities benefit the most from Catholic schooling. Finally, the estimate on "Father's highest grade completed" becomes negative and is no longer statistically significant at conventional confidence levels.

Table 4: Pooled Regression of Log Hourly Wages on Personal Characteristics, School Quality Measures, an Intercept Dummy, and an Interaction Term

Variable	Coefficient Estimate	Standard Error	t-ratio
Highest grade completed	0.0636	0.0012	54.67
Sex	-0.2146	0.0038	-56.24
Non-white	-0.2491	0.0050	-5.01
Experience	0.0815	0.0014	56.54
Experience squared	-0.0035	0.0001	-33.59
AFQT	0.0030	0.0001	31.94
Father's highest grade completed	0.0029	0.0007	4.20
Mother's highest grade completed	-0.0014	0.0009	-1.57
Student-to-teacher ratio	0.0028	0.0003	8.16
Percentage full-time teachers w/ Master's or doctoral degree	0.0014	0.0001	17.05
Student attended private school	-0.1563	0.0555	-2.82
Schooling/private school interaction term	0.0146	0.0040	3.69
Constant	5.3072	0.0160	331.80
R-Squared Root MSE Number of observations	0.26 0.46 59,861		

Testing whether the slope coefficients on the schooling variable differ between the two groups shows that the difference is not statistically significant at the 95% level, but it is at the 90% level. Furthermore, even though the coefficients

are not estimated with high precision, the difference between them is worth considering: The estimated rate of return to schooling for public-school students is 6.4%; the respective rate for private-school students is 7.3%, i.e., it is 0.9 percentage points or approximately 14% higher.

Table 5: Separate Regressions of Log Hourly Wages on Personal Characteristics and School Quality Measures

Variable	For Public Schools			For Private Schools		
	Coefficient Estimate	Standard Error	t-ratio	Coefficient Estimate	Standard Error	t-ratio
Highest grade completed	0.0640	0.0012	54.49	0.0727	0.0048	15.23
Sex	-0.2197	0.0039	-56.04	-0.1211	0.0163	-7.45
Non-white	-0.0290	0.0051	-5.69	0.0608	0.0231	2.63
Experience	0.0801	0.0015	53.94	0.0981	0.0058	16.84
Experience squared	-0.0034	0.0001	-32.20	-0.0038	0.0004	-8.69
AFQT	0.0029	0.0001	30.32	0.0045	0.0004	10.38
Father's highest grade completed	0.0031	0.0007	4.46	-0.0031	0.0030	-1.04
Mother's highest grade completed	-0.0011	0.0009	-1.26	-0.0041	0.0039	-1.03
Student-to-teacher ratio	0.0035	0.0004	7.68	0.0012	0.0004	2.87
Percentage full-time teachers w/ Master's or doctoral degree	0.0014	0.0001	16.22	0.0018	0.0004	4.81
Constant	5.2974	0.0172	307.53	5.1250	0.0650	78.89
R-Squared	0.2538			0.3225		
Root MSE	0.4617			0.4687		
Number of Observations	56,459			3,402		

SUMMARY AND POLICY IMPLICATIONS

The estimation of wage equations has a long tradition in economics, going back almost half a century. Using NLSY79 data, I confirm previously obtained results in the literature that, on average, individuals who attended a private high school earn higher hourly wages than those who attended a public school. I then go on to show that the rates of return to schooling differ between public and private schools. This result holds whether an intercept dummy is included in the model or not. Finally, separate regressions for the two groups–which allow all the coefficient estimates to vary across the two groups of individuals–suggest that indeed the rates of return ro education differ between public and private schools. While this difference is not estimated with high precision, it is rather sizable. Overall, a summary of the results presented here is that, on average, individuals reap a financial reward from attending a private school.

Beyond being of interest to labor economists, this result has some policy implications. One of them is the possibility of expanding voucher programs, an issue which both continues to be of interest in political circles and deserves more attention from researchers. In principle, if a student attends a private school rather than a public one, individuals would receive the amount of money that the public system saves by not educating an additional student, i.e., the marginal cost. This paper raises an additional issue, however. In the design of a voucher program, it should be considered that a private school education has the benefit of ultimately raising the average private school attendant's wage. If further research confirms this finding, this result might be used to justify a reduction in the dollar amount of vouchers since it can be argued that individuals opting out of the public system will typically receive the future benefit of increased compensation.

The issue of what kind of expanded voucher program–if any at all–will be introduced in the future is a political one, but it is clear that economic research needs to provide the relevant information to policymakers for them to make sound political decisions.

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