The Impact of High School Leadership on Subsequent Educational Attainment

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Job Market Paper
October 2008

Abstract

Despite a growing emphasis on leadership skill in the labor market and higher education, few economists have studied the development of and return to leadership skill. This paper uses data from the National Education Longitudinal Study of 1988 to estimate the impact of leadership experience in high school on one of its most likely consequences - subsequent educational attainment. Using three estimation methods to address the non-random selection of students into leadership positions, I find a large, positive impact of high school leadership on subsequent educational attainment that is significant in both a statistical and an economic sense. The most conservative estimates suggest that students who are leaders in high school complete 0.35 more years of education than their non-leader peers. High school leadership is also predicted to increase the probability of attending a post-secondary institution by a minimum of 5 percent and to increase the probability of holding a college degree by at least 9.5 percent. Interestingly, similar to many empirical studies on the return to schooling, the instrumental variables estimates, which rely on variation in school leadership opportunities, birth order and twin indicators for identification, are two to three times the magnitude of the corresponding ordinary least squares and propensity score estimates. This result suggests that failure to control for unobserved heterogeneity leads to estimates that understate the true impact of leadership. An alternative interpretation put forth by Card (2001) is that the IV estimates reflect a relatively high return to leadership by the small group of students who are affected by the instruments. I also find evidence of a differential impact of leadership for students from low versus high income households. In terms of total years of education and post-secondary attendance, high school leadership appears to disproportionately benefit students from lower income households, while with respect to college graduation, leaders from high income households seem to derive at least as great or greater benefit from their leadership experience than their low-income peers.

* I would like to thank my advisor, Tom Mroz, as well as David Blau, Donna Gilleskie, David Guilkey, and Helen Tauchen for their helpful comments and assistance. I'd also like to thank the participants of the UNC Applied Microeconomics workshop. I can be contacted via email at Katy.Rouse@unc.edu. Copies of this paper can be downloaded at http://www.unc.edu/~felter/research.html.

1. Introduction

Many employers and academic institutions rank “soft-skills” such as communication, motivation and leadership higher on their list of desirable employee/student attributes than traditional academic skills as demonstrated through a high grade point average or class rank.[1] One skill on which these institutions have placed particular emphasis is that of leadership. Kuhn and Weinberger (2005), for instance, report that top MBA programs are sending their students to leadership boot camps and that Fortune 500 companies are paying for leadership training of their employees. An examination of elite university web pages also shows that leadership skill is listed among top admission criteria. In fact, according to eHow.com, leadership is now “the hottest buzzword in college admissions.” Oprah Winfrey has even emphasized the importance of leadership, recently opening a boarding school for girls in South Africa which she calls the *Oprah Winfrey Leadership Academy for Girls.*

Perhaps the easiest way for a student to increase his leadership ability and to demonstrate this skill to universities is to undertake a leadership position in a high school extracurricular activity. In fact, according to Christine Stoddard, author of “How to Demonstrate Leadership for College Admissions[2],” earning a leadership position in high school is the number one way to achieve this goal. Yet, in spite of this fact, school systems across the nation have looked to cutting extracurricular activities to solve their budget crises. While some have gone as far as eliminating these activities all together, many other districts have implemented “pay-to-play” programs in which students are charged fees, typically ranging from $75 to $100 per activity. Such actions have been met with considerable controversy. While proponents argue that extracurricular activities do not constitute part of a public student’s free education and are therefore logical areas to cut expenses, opponents argue that programs such as pay-to-play are discriminatory against students from low income households. Opponents of program cuts also argue that

[1] For instance, in a recent survey by the National Association of Colleges and Employers, employers rank communication, motivation, work ethic, and teamwork skills above academic credentials in their list of top skills they look for in job candidates.
[2] Stoddard, Christine. “How to Demonstrate Leadership for College Admissions.” www.ehow.com/how_2129742_demonstrate-leadership-college-admissions.html

reducing the availability of activities prohibits students from gaining valuable life skills that are best learned outside of the classroom.

Surprisingly, despite a growing emphasis on leadership skill in higher education and an increased debate over programs such as pay-to-play that may limit a student's ability to undertake a leadership position, few economists have studied the return to and the development of leadership skill. In fact, while a small number of studies have examined the role of participation in extracurricular activities or athletics on labor market outcomes, to my knowledge, only two papers have looked specifically at the potential impact of holding a leadership position.[3] Further research on the consequences of a student's high school leadership experience is therefore essential to education policymakers involved in these debates.

This paper uses data from the National Education Longitudinal Study of 1988 (NELS) to estimate the impact of high school leadership on one of its most probable direct consequences - subsequent educational attainment. In contrast to the limited literature on this subject, which relies on linear ordinary least squares and probit estimation, I use two additional estimation approaches to address the potential bias that arises from the non-random selection of students into high school leadership positions. As a baseline, I first control for selection on observable characteristics parametrically using ordinary least squares and probit estimation procedures. Then, I relax the linearity assumption and estimate the impact non-parametrically using a propensity score matching (PSM) approach. Finally, instrumental variables estimation methods, which rely on variation in school leadership opportunities, birth order and twin indicators for identification, are used to directly address the endogeneity of high school leadership that arises when there is selection on characteristics that are not observed (by the econometrician).

Every estimation method and model specification examined implies that high school leadership has a large, positive impact on post-secondary educational attainment. The most conservative estimates suggest that students who are leaders in high school complete 0.35 more years of education than their non-leader peers. In addition, high school leadership is predicted to increase the probability of attending a post-secondary institution by at least five percent and to increase the probability of holding a college

[3] These are Kuhn and Weinberger (2005) and Lozano (2008).

degree by 9.5 percent. These estimates are significant in both a statistical and an economic sense. Compared with the estimated impact of math ability on educational attainment, for instance, these effects are roughly equivalent to a 5.5 to 8 percentile point increase in a student's standardized math test score. The estimate of 0.35 years of education is also of similar magnitude to Altonji's (1995) largest point estimates of the effect of an additional year of science, foreign language and math class on total years of education (0.270, 0.416, 0.424, respectively). The results are robust to the inclusion of school fixed effects and are not highly sensitive to the definition of high school leadership.

Interestingly, similar to many empirical studies on the return to schooling[4], the instrumental variables estimates of the impact of high school leadership are two to three times the magnitude of the ordinary least squares and propensity score estimates. IV estimates of the impact of high school leadership on total years of education, for instance, suggest the impact of high school leadership is roughly 0.9 (versus 0.35) years of additional education. The IV estimates on the probability of attending a post-secondary institution and college graduation are approximately 21 and 35 percent, respectively. These estimates are equivalent to a more than 15 percentile point increase in a student's math test score. The instruments used in the analysis pass multiple validity tests and the results change little when alternative specifications are employed.

The most straightforward explanation for this result is that failure to control for unobserved heterogeneity arising from selection on unobserved characteristics biases the OLS and PSM estimates in the downward direction. However, in the context of the schooling literature, Card (2001) puts forth an alternative interpretation. Card suggests that, rather than recovering an average treatment effect, the IV estimation procedure recovers an estimate of a local average treatment effect (LATE); the high instrumental variables estimates may therefore be reflective of a relatively high marginal impact for a small sub-group of students who are affected by the instruments. Regardless of the interpretation of the

[4] Card (2001) summarizes eleven studies where instrumental variables estimates of the return to education are larger than their corresponding ordinary least squares point estimates.

results, however, the evidence in this paper indicates that the causal impact of high school leadership is, at a minimum, non-trivial and suggests that the effect may be much larger for some students.

Finally, I also find evidence that the impact of high school leadership varies by family income. High school leadership appears to disproportionately benefit students from low-income households in terms of total years of education and post-secondary attendance. With respect to college graduation, however, the benefit from leadership experience seems to be at least as great or greater for students from high income households.

2. Background

In this section, I first briefly discuss the conceptual frameworks in which this question can be placed. Then, I provide a short discussion of the related literature.

2.1 Related Conceptual Frameworks

Undertaking a leadership position in high school may help develop a student's leadership skill and increase his stock of non-cognitive human capital, and may therefore be placed within the conceptual framework of Gary Becker's (1964) theory of human capital. The model hypothesizes that the role of education is as an investment in an individual's human capital stock, or his productive skills. The costs to the student include his forgone wage as well as any tuition or other pecuniary costs associated with his education. The "return" on this investment comes in the form of higher wages once the individual enters the labor market. Likewise, the experiences provided by a high school leadership position may help to increase an individual's leadership skill. Since this skill is sought out by employers and academic institutions and is considered a productive asset, taking on a leadership position in high school may be viewed as investment in psychological or non-cognitive human capital, which will lead the student to not only attend college, but may also make it more likely that the student will graduate. The student's costs of high school leadership include the cost of time in terms of his forgone leisure, study time and/or high school employment, any pecuniary costs (such as participation fees), as well as the psychological costs (such as speaking in front of other students) associated with undertaking such a position.

Given the role that high school leadership activities play in the college admissions process, leadership may also be placed in the framework of Michael Spence's (1973) signaling model. In this model, education is thought to serve as a signal to employers of an individual's innate intelligence. Similarly, high school leadership serves as a signal of one's leadership ability to university admission committees. Individuals with innately higher leadership ability may take on leadership positions in order to separate themselves from their non-leader peers in the college admissions process. It is therefore more likely that high school leaders will attend college and will therefore attain a higher level of education than their non-leader peers.

2.2 Related Literature

While the theoretical relationships between schooling, cognitive skill development and resulting labor market outcomes have been empirically tested extensively in the labor economics literature, there have been far fewer empirical studies exploring the role of non-cognitive skills[5], such as leadership, in the labor market. However, the empirical evidence emerging from this growing body of literature suggests that non-cognitive skills are, indeed, important in the determination of later life labor market outcomes. A handful of studies, for instance, have shown that in addition to cognitive skills, non-cognitive skills also play an important role in wage determination [Heckman and Rubenstein, 2001; Heckman, Stixrud and Urzua, 2006; Flossman, Piatek and Wichert, 2006]. Differences in such skills have also been used to explain the growing gap between males and females in educational attainment [Jacob, 2002]. Similar to the more general studies on non-cognitive skills, the limited economic studies on leadership suggest that this skill is also an important determinant of future labor market success. For example, while students perceive high grade point averages and interview preparation to be of highest value to potential employers, evidence suggests that employers actually seek students with work and leadership experience [Siebert, et al., 2002]. Examining the returns to military leadership of Vietnam generation young men, Lee and Yip (2005) also find a positive wage return to leadership skill through military rank.

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[5] "Non-cognitive" skills are considered to be those skills that are unrelated to academic ability or IQ.

The focus of this paper is on the specific impact of high school leadership experience. To date, there has been even less research on this specific topic. Several studies have, however, examined the later labor market effects of high school extracurricular *participation*. Barron et al. (2000) argue that participation in high school may increase traits such as self-discipline, motivation and competition, which are subsequently rewarded in the labor market in the form of higher wages. Empirical estimates from a number of studies support this theory [Ewing, 1995; Barron et al., 2000; Eide and Ronan, 2001; Stevenson, 2006; Ewing, 2007]. Participation in either club or sports has also been shown to increase students' high school math and science test scores as well as their Bachelor's degree expectations [Lipscomb, 2006].

High school leadership is a more involved level of participation. Moreover, in contrast to participation that may increase and signal a wide range of non-cognitive skills, holding a leadership position specifically fosters and signals the skill of leadership - a skill that is widely valued and sought after by universities and employers. The connection between leadership and future outcomes may therefore be even stronger and more direct than simple participation. Evidence from the two papers that estimate the impact of high school leadership experience on future outcomes suggests that this is, indeed, the case. Using data from Project TALENT, the NLS-72 and the sophomore cohort of HS&B, Kuhn and Weinberger (2005) use high school leadership as a proxy for leadership skill to assess whether leadership skill is associated with higher future wages of white males. Their results indicate that high school leadership leads to a wage premium ranging from 4% to 33% depending on the sample and measure of leadership used. The leadership premium also appears to be greatest in managerial occupations. Finally, using data from the NELS, Lozano (2008) assesses whether differences in high school leadership activities can explain observed Hispanic educational gaps. Results suggest that, after controlling for demographic and school variables, there is no significant difference in leadership propensities between Hispanics and non-Hispanics. In addition, high school leadership is estimated to increase college attendance of all demographic groups (by roughly 7%) and to increase college graduation probabilities of non-Hispanic and English speaking Hispanic high school leaders by 28 to 32 percent.

This paper contributes to the existing literature in several ways. First, to my knowledge, it is only the second paper to examine the impact of high school leadership on educational attainment. Second, while the evidence coming from Lozano (2008) is suggestive of a positive relationship between high school leadership and future educational attainment, the focus of the paper is on only one ethnic group. Moreover, the reported estimates come from univariate probit models that assume linearity and do not account for self-selection into high school leadership positions.[6] It is therefore difficult to determine the extent to which the estimated relationship is causal. In this paper, I estimate the impact of high school leadership using three econometric approaches that control for possible selection bias that arises due to the non-random selection of students into leadership positions in high school. Use of the three methods provides further evidence as to whether the estimated relationship between high school leadership and later-life outcomes is, in fact, causal. Finally, I allow the impact of high school leadership to vary by family income. In doing so, I address one of the primary objections of pay-to-play programs- that they discriminate against students from low income households who are the students that derive the largest benefit from the availability of school activities.

3. Data

The data used in the empirical analysis come from the National Education Longitudinal Study of 1988-2000 (NELS). The NELS includes 12,144 individuals who were in eighth grade in 1988 and included in the fourth follow-up in 2000. The participants were re-interviewed in 1990, 1992, 1994 and 2000. In the survey, the students, their parents, their teachers and their school counselors were interviewed. The dataset contains a rich collection of both individual and school level characteristics. For the purposes of this research, this study is particularly well-suited as it asks a number of questions covering a wide range of extracurricular activities. Moreover, the responses include an indicator of whether the individual was a participant, a non-participant or if he was an officer or a captain in the particular activity. This allows me to construct a dummy indicator for high school leadership experience.

[6] In an earlier (unpublished) version of his paper, Lozano does use a two-stage least squares approach in his robustness checks; however, he is unable to test the validity of his instrument and his results are associated with large standard errors.

I consider an individual to be a high school leader if there is evidence that he held any leadership position in either the tenth or twelfth grade.[7]

Since the effect of high school leadership is estimated using three different econometric approaches, a common analysis dataset is constructed so that each method is applied to the same sample of students. This is done in order to allow for meaningful comparisons across the econometric methods. Creation of a common analysis set reduces the original sample of 12,144 students who were included in the fourth follow-up survey to a sample of 9,665 students.[8] In the analysis sample, 4,179, or 43.2%, of students are leaders, while 5,486 students (56.8%) are non-leaders. Admittedly, 43.2% seems like a high proportion of student leaders. However, Kuhn and Weinberger (2005) find similar proportions of student leaders in all three of their datasets. In their Project Talent sample, for instance, 57.7% of students are leaders; and, in the High School Beyond sample that only considers twelfth grade leadership, 48% of the students are leaders. These high percentages may reflect student reporting error. Alternatively, they may simply be a result of the comprehensive list of activities that are used to construct the leadership indicators (see Table A1 in Appendix A). In addition, within a given activity, there may be multiple leadership positions. The National Honor Society, for example, likely has a president, vice president, secretary and a treasurer. Unfortunately, the data does not allow me to differentiate between a club president and a club treasurer. In robustness checks, I test the sensitivity of the reported results to the leadership definition by restricting high school leadership to leadership in the senior year only.

Compared with the full dataset, the analysis sample has a slightly larger proportion of leaders (43.2% versus 41.5%). Importantly, however, outcome and control variable mean differences across

[7] Table A1 in Appendix A provides a list of the tenth and twelfth grade extracurricular activities and responses used to construct the leadership indicator.
[8] Table A2 in Appendix A describes the sample selection criteria.

leaders and non-leaders do not vary largely between the full and restricted samples.[9] Table 1 presents descriptive statistics of the full sample and disaggregated by leadership status.[10]

Three different measures are used to assess the impact of high school leadership on subsequent educational attainment: (1) years of education, (2) probability of attending any post-secondary institution, and (3) probability of holding a college degree. Each of these outcome variables is measured in the year 2000, approximately eight years after high school. Looking at the descriptive statistics, a simple comparison of the means of each measure of educational attainment supports the main hypotheses of the paper. Compared with non-leaders, for example, leaders have, on average, obtained roughly one more year of education. In addition, over 90% of leaders have acquired some post-secondary education by 2000, while only 76% of non-leaders have attended. Finally, 50% of high school leaders are college graduates, compared with just 26% of non-leaders.[11] Each of these differences in means is statistically significant at the one percent level.

Evidence provided by the descriptive statistics suggests that there is also substantial heterogeneity in many individual, family, and school characteristics across the two groups. Compared with non-leaders, for instance, sampled high school leaders come from families with significantly greater levels of socioeconomic status and higher family incomes than their non-leader counterparts. In addition, leaders are more likely to come from schools that have smaller enrollments, a lower percentage of students receiving free lunch, and a smaller proportion of both Black and Hispanic students. Summary statistics also suggest that, compared with non-leaders, a smaller proportion of the leaders attend public schools, while a higher proportion of leaders attend both Catholic and private non-Catholic schools. On average, the high school leaders also have a statistically significant higher math test score percentile than the non-leaders, suggesting that leadership is positively correlated with cognitive ability.

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[9] For instance, in the full sample, leaders have a 24.6 mean percentage point advantage over non-leaders in terms of the proportion who are college graduates. In the restricted sample, this difference is nearly the same, 25.3. For more details, see Table A3 in Appendix A.

[10] Table A4 in Appendix A defines outcome and explanatory variables.

[11] Descriptive statistics also suggest that, conditional on attendance, high school leaders are more likely to graduate than their non-leader peers.

In addition to more traditional controls, the NELS includes self-reported measures of athletic ability, popularity, and locus of control.[12] These variables may capture some traits such as self-esteem or other non-cognitive skills that are not captured by standard controls or by math ability. The descriptive statistics suggest that leaders and non-leaders do, in fact, differ along these dimensions. For instance, high school leaders are more likely to report that others see them as athletic and popular in eighth grade and high school. Additionally, they have a higher locus of control than their non-leader peers. This fact suggests that students who are high school leaders are more internal, meaning they perceive their actions to have an impact on their outcomes.

4. Empirical Approach

The primary econometric challenge I face in this study is the difficulty in distinguishing between the causal effect of high school leadership and observed correlation between high school leadership and subsequent educational attainment. If students were randomly placed into leadership positions, a simple difference in the mean educational outcomes of leader and non-leaders would give rise to the causal effect of leadership. However, selection into high school leadership positions is not random. Students either self-select into a high school leadership position or are elected into a leadership role based on their characteristics, which may or may not be directly observed in the data. Students from low-income households, for instance, may be less likely to hold a leadership position because they are not able to afford the fees required to participate (and subsequently lead) in an extracurricular activity. Similarly, students with lower academic ability may find leadership roles more costly than an otherwise identical high-ability student who can perform well academically with less study time. Since these characteristics are also likely to have a direct impact on post-secondary educational attainment, the empirical analysis must control for these and all other such leader/non-leader differences in order to recover an effect of high school leadership that is void of selection bias.

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[12] The term "locus of control" refers to a student's belief about the causes of the good or bad outcomes in his life. A student with a high locus of control is said to be *internal*. An internal student believes that he controls himself and his life, while an *external* student believes that his "environment, some higher power, or other people" control his decisions and his life. [http://en.wikipedia.org/wiki/Locus_of_control]

I address the selection problem by first exploiting the richness of the NELS data to control for selection on observable characteristics. This is done both parametrically using ordinary least squares and probit models and non-parametrically using propensity score matching. The assumption here is that the variables included in a vector of observed variables (X_i) are sufficient to eliminate any relationship between the leadership dummy variable (L_i) and unobserved characteristics or shocks impacting the educational outcome (ε_i). The second approach uses instrumental variables estimation to control for selection on unobserved characteristics under the assumption that there is a set of variables (Z_i) that are related to L_i but are uncorrelated with ε_i. I discuss these strategies below.

4.1 Selection on Observables

Provided selection into leadership is based on only the observed variables, X_i, the causal impact of high school leadership can be recovered by controlling for these variables in the estimation procedure. I therefore begin the empirical analysis by estimating the following linear equation:

$$Y_i = \beta_1 X_i + \beta_2 L_i + \varepsilon_i \qquad (1)$$

where Y_i is the educational outcome of interest, X_i is a vector of observed covariates that includes all measurable variables thought to either affect leadership or education, L_i is a dummy indicator for high school leadership, and ε_i is the error term. In the case of the continuous outcomes, the model is estimated by OLS, while univariate probit estimation is used when the outcome is discrete. With OLS estimation, the marginal effect of high school leadership is given by $\hat{\beta}_2$. It is interpreted as the effect of high school leadership for the average student (the average treatment effect, or ATE) and is assumed to be equivalent to the average effect of high school leadership on the leaders (the average treatment effect on the treated, or ATT). In the case of probit estimation, the marginal effect is calculated by averaging the differences between students' predicted outcomes when their leadership indicator is set to one and their predicted outcome when their leadership indicator is set equal to zero.

The crucial identification assumption underlying the validity of the OLS approach is that of *conditional independence,* which states that conditional on the observed covariates, X_i, the educational outcome is independent of the leadership choice. Formally, the conditional independence assumption (CIA) states $Y_i \perp L_i \mid X_i$. Provided the CIA holds, the inclusion of the vector X_i eliminates all possible correlation between L_i and ε_i, thus $E[\varepsilon_i \mid L_i, X_i] = 0$. The resulting OLS and probit estimates will therefore be free of selection bias and yield consistent estimators of the leadership effect.

When the regressor of interest is a dichotomous treatment indicator (such as high school leadership), propensity score matching (PSM) can also be used to control for selection on observable characteristics. This non-parametric econometric method has been has been widely applied by economists in the program evaluation literature [Heckman et. al. (1997, 1998), Dehijia and Wahba (1999, 2002), Smith and Todd (2005), Diaz and Handa (2006)].[13] The basic methodology consists of matching student leaders with a non-leader based on his and their estimated propensity scores, $pscore_i = p(L_i) = probability(L_i = 1 \mid X_i)$, and then comparing the education outcomes of students who have the same leadership propensity. PSM is arguably an improvement over simple OLS, because it is not constrained by the assumption that leadership or any of the covariates are linearly related to the outcome. Further, unlike OLS, propensity score matching ensures that for every set of characteristics, X_i, there exists both a treated and non-treated observation. Unlike OLS, PSM explicitly avoids extrapolation into areas of the causal effect distribution that are not on the common support.

Work by Heckman and other economists in the evaluation literature has shown that the PSM method works well when there are a rich set of variables on which to match and when outcomes of treated and control groups are measured from the same survey.[14] The regressor of interest in this study is a dichotomous indicator of leadership experience. I also have a rich set of control variables and the

[13] A recent example of the method is found in Morris (2007) and a detailed discussion of this method can be found in Becker and Inchino (2002) or in Cameron and Trivedi (2005).

[14] See, for instance, Heckman, Ichimura, and Todd (1997, 1998), Heckman et al. (1998) and Diaz and Handa (2006).

outcomes of leaders and non-leaders are taken from the same dataset. Since this study fits the conditions under which the method is likely to perform well, I also use PSM to control for observed characteristics.

I implement PSM by first calculating a leadership propensity score for each student from a probit regression of the leadership dummy variable on the vector X_i.[15] Next, I match the student leaders to the non-leader with the most similar propensity score (the 1-to-1 nearest neighbor estimator with replacement[16]). The ATT is then recovered by taking the mean of the leader/non-leader education differences across the entire set of N matched pairs:

$$ATT = \frac{1}{N_T} \sum_{i \in T} [Y_i - Y_{j(i)}] \qquad (2)$$

where N_T represents the number of student leaders, Y_i is the educational outcome for a student leader, and $Y_{j(i)}$ is the educational outcome of the matched non-leader j for student i. Since the estimates rely on estimated propensity scores, the standard errors are estimated using the bootstrap method with 50 replications.[17] The resulting estimate is interpreted as the causal effect of high school leadership on the outcome for high school leaders (ATT).[18]

Like OLS, the validity of the PSM methodology rests on the assumption of CIA. Importantly, Rosenbaum and Rubin (1983) show that if the CIA holds such that education is independent of the leadership choice conditional on observed covariates X_i ($Y_i \perp L_i \mid X_i$), then it is also independent of the leadership choice conditional on the propensity score ($Y_i \perp L_i \mid p(X_i)$). Rather than using exact

[15] In fact, any discrete choice model could be used to estimate the propensity score in the first stage. Since the purpose of the first stage is classification, the choice of model isn't likely to be a critical one. Use of the propensity score overcomes the so-called 'dimensionality problem' common in full matching procedures where, due to a large number of observable characteristics, it is difficult to find an exact match for each treated individual.

[16] There are a number of alternative matching procedures. These include stratification, kernel, and radius matching, among others. The models were also estimated using nearest neighbor matching without replacement, kernel matching with a Guassian kernel and radius matching with radius values of 0.1, 0.01 and 0.001. Results are not highly sensitive to the matching approach and are available upon request.

[17] While there is some discussion regarding the validity of use of this method with matching, it is widely applied in the matching literature. Therefore, since I am faced with a lack of better alternatives, I follow the majority of the literature in using the bootstrapping method to address the issue of the estimated propensity score.

[18] It is also possible to estimate the average treatment effect and the average treatment effect on the untreated. In this discussion, I focus on the ATT since it is the effect most commonly estimated by PSM.

matching, in which individuals are matched on their observed characteristics, matching can therefore be done on the propensity score without violating the CIA. Perfect matching on the propensity score eliminates any selection bias arising from the differences in observed covariates on average. If the CIA holds, the PSM approach will recover an unbiased estimate of the causal effect of leadership that does not depend on the functional form of the leadership/education relationship.

4.2 Selection on Unobservables

If, after conditioning all on measurable differences between leaders and non-leaders, there is still unobserved heterogeneity, $E[\varepsilon_i \mid L_i, X_i] \neq 0$, then the CIA will be violated. In this case, the OLS and PSM estimates will be biased. *A priori*, the direction of the selection bias is ambiguous. Following arguments drawn from the education literature, where the traditional unobserved variable is "ability," which causes the so-called "ability bias," one would think that a factor such as unobserved student ability or motivation would be positively correlated with both leadership and the educational outcomes, leading to upward biased OLS and PSM estimates. High school leadership, however, is different from education in the following way. High school leadership involves tasks such as managing other students and speaking in front of other people. Such experiences are likely to be more costly for students who are less social, bookworms or, for lack of better term, "nerdy." These students may therefore not undertake leadership positions, but may still acquire more education if their time is better spent at home, in the library, or at their computer. In this case, the estimated impact of leadership with OLS or PSM will be understated. Measurement error in the high school leadership variable will also bias the OLS and PSM estimates toward zero.

4.2.1 Identification

In the presence of unobserved heterogeneity, identification of the high school leadership effect requires an explicit leadership selection equation. In addition to the vector of observed variables thought to impact leadership and education (family income, school controls, etc.), the selection equation must include at least one instrumental variable that only impacts educational outcomes through its impact on leadership. Formally, selection into a leadership position can be described by the following equation:

$$L_i^* = \alpha_1 X_i + \alpha_2 Z_i + u_i \quad [L_i = 1 \mid L_i^* > 0] \qquad (3)$$

where L_i^* is a latent leadership indicator variable, X_i is the defined as in equation (1) , Z_i is the vector of instruments, and u_i is the error term.

The NELS contains several students from many high schools. This allows me to construct a school-level measure of leadership opportunities to instrument the individual's leadership choice. Specifically, I use the percent of peer leaders in a student's school.[19] For additional identification, I also include dummy indicators of whether the student is the oldest child in his family and whether or not he is a twin as well as the interaction of these variables. I discuss these in turn.

The use of school leadership opportunities as an instrument for the individual choice follows from previous work in this area and is capturing two things. First, it can be viewed as a measure of peer effects, where a student who has a larger proportion of leader classmates is thought to be more inclined to take on similar positions.[20] Second, the variable is also capturing a measure of school-level leadership opportunities .[21] As long this measure is unrelated to school quality or student characteristics, it should be a valid instrument. The inclusion of observed school characteristics such as the school-level average math score, the percent of students who receive free lunch, school enrollment, and public/Catholic status should proxy for school and student quality[22] and therefore help mitigate these concerns, however, if the

[19] The variable is constructed by taking the number of leaders, excluding the student, divided by all of the individuals in a student's school. Importantly, while the NELS 1988-2000 sample includes only individuals who were included in the fourth follow-up survey, the peer leadership measure is constructed from the NELS 1988-1994 dataset which has a much larger sample of students. Specifically, the NELS 1988-1994 has 27,394 students. On average, there are 21 students per school (excluding the student) in the sample used to construct the peer measure.

[20] Anderson (2002) relies on a similar instrument.

[21] Altonji (1995) relies on a similar instrument. Looking at the impact of school curriculum on post-secondary educational attainment and wages, he uses average school curriculum to instrument the individual's curriculum choice. In unpublished versions of their papers, both Kuhn & Weinberger (2005) and Lozano (2008) also rely on similar instruments.

[22] Earlier model specifications included a much wider range of school and teacher characteristics such as student/teacher ratio, lowest salary of teacher, average education level of teachers, among others. These variables did little to the estimates and were not statistically significant at conventional levels. Moreover, many of these variables came from counselor or teacher surveys and were missing for many students. Therefore, due to their

instrument is related to some unobserved measure of school quality or student characteristics, the resulting IV estimates may be suspect. In particular, if the instrument is positively correlated with either unobserved school quality or student characteristics then the resulting IV estimates will be biased upward.

The use of the eldest child indicator follows from the observation that being a first born child may make it more likely that the student is a leader than an otherwise identical student who is a second or third born and who may be used to following the actions of his elder siblings and be more content serving in a "follower" role. The use of a twin indicator follows from research drawn from the sociology field that suggests students with siblings are more likely to participate in sports [Wold and Anderson, 1992]. Since being a twin is an exogenous factor that provides a student with a sibling and constant playmate of the same age, being a twin may be particularly strong predictor of participation and, subsequently, leadership. The oldest child and twin dummy indicators will be valid instruments provided they do not have a direct impact on the educational outcomes.

Admittedly, with respect to oldest child and twin indicators, there is reason to question the plausibility of the exclusion restrictions. A body of research, for instance, suggests that birth order and family size are related to a child's educational outcomes through the child quantity/quality tradeoff.[23] If parents do disproportionately invest in their oldest child in activities other than high school extracurricular activities that lead to more education, then the oldest child indicator should not be validly excluded from the outcome equation. If this investment is both positively related to high school leadership and to educational attainment, the resulting IV estimates will be biased upward. However, if the observed correlation between being the oldest child and educational outcomes is not due to differences in parental resources, but is instead related to an oldest child's propensity to be a leader, then being an oldest child would only have an indirect impact on educational attainment. The variable would therefore be validly excluded from the outcome equation.

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negligible effects and in order to maintain a large sample size, these variables were ultimately dropped from final model specifications.

[23] See, for instance, Black, Devereux and Salvanes (2005), Booth and Kee (2006) and Conley and Glauber (2005).

Similarly, if being a twin rather than a singleton reduces the resources devoted to a child and has a direct impact on his educational attainment, then the twin indicator is not a valid exclusion restriction. If twins are more likely to be leaders, but are less likely to attain further education, the estimates will be downward biased. Alternatively, if twin births result in fewer resources, both making a twin less likely to be a leader and less likely to go to college, then the IV estimates will be biased upward. While some researchers have found family size to be negatively related to a child's education, recent studies using twin births as a source of exogenous variation in family size suggest that when family size is made endogenous, the estimated impact of family size on educational attainment is actually negligible [Caceres-Delpiano (2006); Black, Devereux, and Salvanes (2005)]. This evidence suggests that the twin indicator may, in fact, be validly excluded from the outcome equation.

To help mitigate the concerns with the oldest child and twin indicators, controls for family income and family socioeconomic status are included in all of the model specifications. In addition, controls such as the Catholic and public school dummy variables should help pick up differential investments in first-born children and potential differences in resources induced by twin births if, for example, first-born children are more likely to attend private or Catholic schools. The plausibility of the exclusion restrictions is also tested statistically with a Sargan-Hansen over-identification test in section 5.3. Additional tests are provided in the robustness checks (section 5.4.1). In every case, the instruments pass the statistical tests and are shown to be validly excluded from the outcome equations.

Table 2 summarizes the variables used as instruments. Simple descriptive statistics (panel A) suggest that each of these variables does, in fact, differ by leadership status in the expected direction. For instance, whereas, on average, roughly 40 percent of the leaders' classmates are also leaders, just 35 percent of the non-leaders' classmates are leaders. Moreover, 33.8 percent of the student leaders are first born children compared with 30 percent of non-leaders and a larger proportion of leaders are twins (4.6 versus 3.7 percent). Each of these differences in means is statistically significant at the 5 percent level. In panel B, the leadership probabilities are given for each of the following four combinations: (1) twin only, (2) eldest child only, (3) neither twin nor eldest child, and (4) twin and eldest child. From the table it is apparent that, compared with the students who are neither twins nor eldest children, both the "twin only" and "eldest child only" groups have a larger proportion of leaders (roughly 45 versus 42%). Finally, nearly 60% of the students who are both a twin and an eldest child are leaders. This is substantially higher than the other groups. This evidence suggests that these variables are, in fact, correlated with high school leadership. As mentioned earlier, the instrument validity is discussed in further detail in section 5.3 and further evidence from robustness checks is provided in section 5.4.1.

4.2.2 Implementation of IV strategy

In the case of the continuous outcome variable (years of education), the IV strategy is implemented using two-stage least squares estimation where the leadership dummy indicator in equation (1) is replaced by its predicted value from ordinary least squares regression on equation (3). For the discrete outcome variables (probability of college attendance and college degree), I estimate a recursive bivariate probit model of the following form[24]:

$$L_i^* = \alpha_1 Z_i + \alpha_2 X_i + u_i \text{ such that } L_i = 1[L_i^* > 0]$$

$$Y_i^* = \delta_1 X_i + \delta_2 L_i + \omega_i \text{ such that } Y_i = 1[Y_i^* > 0] \qquad (4)$$

$$E[v_i] = E[\omega_i] = 0$$

$$Var[v_i] = Var[\omega_i] = 1$$

$$Cov[v_i, \omega_i] = \rho ,$$

where L_i and X_i, are defined as in equation (1), Z_i is the vector of instruments, Y_i is an indicator variable that equals one if the student attended (or graduated from) college and zero otherwise, v_i and ω_i are $\mathrm{N}(0,1)$ error terms, and ρ is the coefficient of correlation between the errors in the leadership selection equation and the education outcome equation. If $\rho \neq 0$ and is statistically significant, this can be interpreted as evidence of endogeneity bias present in the reduced-form univariate probit model. The marginal effects of high school leadership are calculated in the same way as they were in the univariate

[24] The models were also estimates via IV linear probability models. Estimates were largely unchanged.

probit model. The standard errors on the marginal effects are calculated using a bootstrapping procedure with 500 replications.

Under the restrictive assumption that the treatment effect is constant within the population, the ATE is assumed to be equivalent to the ATT and can be directly compared to the OLS and PSM estimates. Under the more realistic case in which the treatment effect is not constant and under additional assumptions[25], Angrist, Imbens and Rubins (1996) show that IV estimation provides an estimate of the local average treatment effect (LATE). The LATE is the average effect of the treatment for those students who, due to a change in the value of the instrument, are induced to select themselves into a high school leadership position.

5. Results

Results from each estimation approach are reported in Table 3. All of the model specifications include controls for standard demographic characteristics (gender, race, age); family background characteristics (family income and socioeconomic status); school characteristics (public, Catholic, enrollment, percent of students with free lunch, and the percent of Black and Hispanic students); and regional differences (northeast, midwest, and west). I also control for differences in endowed cognitive ability by including standardized math test scores in each specification.[26] Self-reported measures of popularity, athletic ability and locus of control may be endogenous with respect to high school leadership. However, the inclusion of these additional characteristics in the set of observed conditioning variables may, in fact, capture some characteristics that are often "unobserved" (motivation, confidence, etc.) and may therefore help to control for selection bias. All of the models are therefore estimated with and without these controls. Columns (a), (c) and (e) contain results from Model 1, which does not include controls for popularity, athletic ability and locus of control. Columns (b), (d) and (e) are from Model 2, in

[25] These assumptions are (1) stable unit treatment values, (2) random assignment to treatment, (3) valid exclusion restriction, (4) nonzero causal effect of the IV on treatment status and (5) monotonicity.
[26] Previous model specifications included controls for reading, history and science test scores. Once the math score was included, these other test scores did not affect the results. In order to maximize sample size, only math scores are included in the final specifications.

which these controls are included. Coefficients on math scores are also reported in Table 3 to provide a reference of relative magnitude of the leadership effects.

5.1 Selection on observables

OLS and univariate probit results are reported in columns (a) and (b). Results from each model specification are precisely estimated and indicate that, ceteris paribus, students who are leaders in high school attain 0.39 to 0.44 years more education than their non-leader counterparts. These estimates are not small. Compared with the effect of cognitive ability, for instance, they are roughly equivalent to a 6.5 to 7 percentile point increase in math test score.[27] In fact, these effects are also of similar magnitude to Altonji's (1995) largest estimates of an additional year of science, foreign language or math class on total years of education (0.270, 0.416, 0.424, respectively). High school leadership is also predicted to have a positive impact on both the probability of college attendance and college graduation that is significant in both a statistical and an economic sense. The univariate probit estimates suggest that high school leadership increases the probability of attending a post-secondary institution by 6.3 to 6.8% and increases the probability of obtaining a bachelor's degree by 12.4 to 14.1%. These estimates are comparable to math score increases of approximately 5.5 to 8 percentile points. As shown in section 5.4.2, these results change little when school fixed effects are included in the specifications.

PSM estimates are reported in columns (c) and (d). Compared with the OLS and probit estimates, the corresponding PSM estimates are slightly smaller but are of similar order of magnitude. PSM estimates indicate that high school leadership leads to a 0.35 to 0.391 (versus 0.443 and 0.397) year increase in education, increases the probability of post-secondary attendance by 4.9 to 5.7% (versus 7.0 and 6.4%) and increases the probability of obtaining a college degree by 9.5 to 10.4% (versus 14.1 and 12.4%).[28] The similarity of the PSM and OLS estimates suggests that the OLS results are not highly

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[27] This is calculated by taking the coefficient on leadership divided by the coefficient on math score (which represents the effect of a 10 percentile increase in math score) multiplied by 10.

[28] In fact, if estimated via linear probability models, the OLS and PSM estimates of high school leadership on college attendance and graduation are even more similar. In model 2, for instance, the estimate on high school leadership in the college attendance equation from linear probability model is 6.3% (versus 5.7% with PSM). In the college graduation model, the OLS estimate is 10% (versus PSM estimate of 10.4%).

sensitive to the linearity assumption. In contrast to the OLS estimates, which fall once the additional controls are included in Model 2, the PSM estimates increase slightly in magnitude when controls for popularity, athletic ability and locus of control are included in the specification. If selection bias is reduced by controlling for this wider set of observed variables, this suggests that failure to include the additional controls leads to downward biased PSM estimates.[29]

5.2 Selection on unobservables

Before discussing the instrumental variables estimates, it is important to demonstrate the validity of the instruments. In each model specification, the p-value on the F-statistic (see Table 3) for the null hypothesis that the instruments can be omitted from the first stage equation is essentially zero, providing evidence that the instruments are strong predictors of high school leadership and are therefore sufficiently powerful. First stage results, presented in Table 4, also show that both school leadership opportunities and the interaction between twin and oldest child variables have an independent statistically significant impact on high school leadership. In addition, in Table 3, I report p-values from a Sargan-Hansen test of over-identifying restrictions for the education outcome equations in models 1 and 2. The joint null hypothesis for this test is that all but one of the instruments are uncorrelated with the error term and are therefore properly excluded from the outcome equation. The Sargan p-values are 0.852 and 0.836. Consequently, the null hypothesis cannot be rejected at conventional confidence levels.[30] Taken together, this evidence indicates that the instruments are, in fact, valid.

Interestingly, the IV estimates are all larger than their corresponding OLS/probit and PSM point estimates. Compared with the OLS and PSM estimates, both of which suggest a return to high school leadership of about a half-year increase in educational attainment, the corresponding IV estimates are

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[29] To test the sensitivity of the PSM estimates to potential selection bias arising from unobserved heterogeneity, I estimated Rosenbaum Bounds (2004) on the PSM estimates. This bounding approach essentially allows the researcher to test the extent to which unobserved heterogeneity would have to impact the leadership propensity within a matched pair to suggest that high school leadership has no causal impact on educational attainment. The results from this procedure suggest that an unobserved factor would have to have an impact equivalent to a difference of nearly two to three standard deviations in math test scores within a matched pair to suggest a non-positive causal effect. Despite the limitations of OLS and PSM, it is therefore highly unlikely that high school leadership has a non-positive causal effect on educational attainment.

[30] The plausibility of the exclusion restrictions is further tested in robustness checks (section 5.4.1).

over twice the size, or roughly 0.85 to 0.96 years. The corresponding math test score estimates suggest that high school leadership is equivalent to a 15 to 16 percentile increase in math test scores. There is also a large difference in magnitude between with respect to the probability of attending and graduating from a post-secondary institution. Whereas probit and PSM estimates suggest a 5 to 7% impact of leadership on college attendance, the IV estimate suggests this magnitude is over 20%. Finally, both IV estimates of the impact of leadership on college graduation are around 37%. This estimate is much larger than the corresponding OLS and PSM estimates, which range from roughly 9.5 to 14%.

5.3 Discussion

At first glance, the finding that IV estimates are much larger than their OLS and PSM counterparts may seem counter-intuitive. If the unobserved variable affecting assignment to leadership and educational attainment is something such as the traditional 'ability' bias associated with the education literature, for example, IV estimation which correctly controls for such bias should result in estimates that are of smaller magnitude than their corresponding OLS or PSM estimates. Yet, here I find the opposite. It is worth noting, however, that while the theoretical literature on the return on education frequently suggests that OLS results will be biased in the upward direction, empirical researchers who rely on supply side features of the education system often find IV estimates that are at least as large as or larger than their corresponding OLS estimates.[31] In this sense, the results reported in this paper are consistent with much of the empirical literature on education. Why would this be the case?

The most straight forward explanation is that, rather than being upward biased, the OLS and PSM estimates are actually biased downward. The relatively high proportion of student leaders in the sample, for instance, may be suggestive of student reporting error. In this case, the true leadership variable is measured with error, and consequently, the OLS and PSM estimates are biased towards zero. As mentioned earlier, this result could also be due to the fact that the source of selection bias is not the traditional ability bias, but rather is an unobserved characteristic, such as being a bookworm, that makes a

[31] Card (2001), for instance, summarizes results from eleven studies that find IV estimates that are larger than their corresponding OLS estimates.

student less likely to be a leader but more likely to attain further education. In this case, the instrumental variables estimation procedure is appropriately correcting for the negative bias. Results from the bivariate probit models suggest that this explanation is, in fact, likely. In both model specifications for both discrete outcomes, the correlation coefficient rho is quite large, negative and, with the exception of any post-secondary education model 2, is statistically significant at the one percent level.[32] This indicates that high school leadership is endogenous and that the direction of the endogeneity bias is downward.

Card (2001) puts forth an alternative interpretation for similar results found in the returns to schooling literature. If the impact of leadership is not constant across the student population (as is likely), then the LATE, the estimated effect with IV, may differ from the ATT or ATE. In the case of education and wages, Card (2001) suggests that instrumental variables estimates may be larger than OLS estimates because the IV method, which uses supply-side features of the educational system, is measuring a treatment effect for a small low-education group with a higher marginal return to education than their more highly educated counterparts. In this case, the LATE will be greater than ATE or ATT. Likewise, in the case of leadership, the IV estimates could be larger because the students who are induced into a leadership position due to a change in the instruments have a much greater marginal return to their leadership experience than the students who chose to be leaders. Consider school leadership activities, for instance. An increase in the instrumental variable indicates a greater availability of school activities. Following Card's argument, if the students with initially higher marginal costs of high school leadership (those who will be more affected by the cost reduction imposed by greater availability of activities) also have a greater marginal return to leadership experience, then the IV estimates will overstate the average impact of high school leadership.

Regardless of the interpretation of these results, every estimation method and model specification examined suggests the impact of high school leadership is large, positive, and significant in both an

[32] This also holds true for simple bivariate probit models that do not have exclusion restrictions. When the two equations are estimated jointly (without exclusion restrictions) allowing for correlation in the error terms, the coefficient of correlation is also large, negative, and statistically significant.

economic and statistical sense. The smallest estimates found are non-trivial and the evidence implies the impact may be much larger for some students.

5.4 Robustness

In this section, I perform a series of robustness checks. First, I examine the instrument validity in more detail and test the sensitivity of the reported estimates to alternative identification assumptions. Then, I evaluate whether the estimated leadership effects are capturing differences in school quality by including school fixed effects. Finally, I address whether the effects reported here are sensitive the definition of leadership by defining leaders by their twelfth grade leadership experience only.

5.4.1 Instrument validity and specifications

Another possible explanation for the wide discrepancy between the OLS and PSM results compared with the IV results is that the instruments are either (a) weak or are (b) correlated with the education outcome. While the analysis discussed above shows that the instruments pass the standard first-stage and over-identification tests, for robustness, I test the instrument validity in further detail.

The problems associated with weak instruments have been well-documented. Research has shown that weak instruments will tend to bias the instrumental variables results toward the OLS results. Weak instruments would therefore lead the instrumental variables estimates reported here to be understated. To test the sensitivity of the results to the instrumental variables, I employ alternative model specifications. Table 5 presents results from alternative specifications. In column (b), the first stage F-statistic increases from just above 8 to 13.72, which is above 10, the commonly cited threshold for weak instruments. In this model specification, the coefficients on high school leadership increase compared with the original specification. Columns (b) and (c) of Table 5 show that a similar pattern is found when the model is exactly identified using either of these two variables.

An alternative explanation for the results is that the IV estimates are upward biased. If, for instance, school leadership opportunities are positively correlated with unobserved school quality or student characteristics, then the IV estimates may be biased upward. However, when the model estimated using only the oldest child and twin dummy variable interaction for identification (Table 5, column (d)), the IV estimate is still considerably larger than the OLS and PSM estimates. However, as mentioned earlier, both oldest child and twin dummy variables may be directly correlated with educational attainment. To further test the robustness of the exclusion restrictions, I therefore also run separate regressions where each instrument is directly entered into the outcome equation. Table 6 shows the leadership coefficients and instrumental variable coefficients as well as their standard errors and z-values from these regressions. In each case, and in both model specifications, none of the coefficients on the instrumental variable is statistically different from zero. Moreover, the coefficient on the leadership variable is always larger than any of the OLS or PSM coefficients. This provides further evidence that the instruments are correctly excluded from the outcome equation.

While there are reasons to question the plausibility of the instruments, the variables pass multiple tests for validity. Moreover, the results are not sensitive to the model specification. In each case, the estimates are at least two to three times the size of the OLS and PSM estimates.

5.4.2 School Fixed Effects

While I have included observable school characteristics in the model specifications, if there are differences in school quality that are not being adequately captured by the included variables, the estimates reported in the paper may be attributing a portion of the impact of school quality to high school leadership. To test this, I include school fixed effects in the OLS estimation.[33] The resulting estimates can be interpreted as the impact of high school leadership relative to non-leaders in the same school. Results are presented in Table 7. From the table, it is apparent that fixed effects do little to the OLS estimates. This suggests that the impact of high school leadership is not being confounded by the effect of school quality.

5.4.3 Alternative measure of high school leadership

In this paper, I have broadly defined high school leadership as leadership experience in either the tenth or twelfth grade. In this section, I test the sensitivity of the results to this definition by limiting the

[33] Since the OLS estimates are not largely different from the PSM estimates, for simplicity, I focus on the OLS estimates with fixed effects.

definition of leadership experience to leadership in the twelfth grade. This decreases the proportion of leaders in the sample to 37.4 (versus 43.2) percent.[34] Table 8 illustrates the sensitivity of the OLS[35] and IV results to the more restricted definition of high school leadership. Columns (a) and (c) display the original OLS and IV results, respectively. Columns (b) and (d) display the results where high school leadership is measured as twelfth grade leadership only.

A comparison of the estimates shows that the results are not highly sensitive to the measurement of leadership. While the OLS and probit estimates fall slightly in the total years of education and post-secondary college attendance models, the marginal effect from the probit model on college graduation increases. The IV estimates are also of similar magnitude.[36]

5.5 High School Leadership and Family Income

As discussed in the introduction, one policy question surrounding this topic concerns the potential impact of the so-called pay-to-play programs in which students are required to pay fees to participate in school activities. Opponents argue that these programs are discriminatory against students from low income households. In addition, many people argue that these students are the very same students who may benefit most from the availability of school activities. Joan Ryan of the SFgate.com, for instance, argues that many low income students have parents who work long hours or live in a single-parent home and that, consequently, these students may benefit more from participation in school activities than their higher income peers.[37] While I do not have enough information to directly test the first claim (pay-to-play programs discriminate against low-income students), by estimating high school leadership separately for low and high family income students, I am able to provide some evidence as to whether leadership experience does, in fact, benefit students from lower income households to a larger extent than their higher income peers.

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[34] The sample also falls by 566 students when this definition is used.
[35] Since the OLS estimates are not largely different the PSM estimates, I only report OLS and IV results here.
[36] This result is not all that surprising given that many students who are leaders in the tenth grade are also likely to be a leader in the twelfth grade. In fact, the correlation between the two measures of leadership is 0.8458.
[37] "Pay to play is a shutout we can't afford." SFGate.com, May 2003. http://sfgate.com/cgi-bin/article.cgi?f=/c/a/2003/05/09/ED214390.DTL.

I separate the students into two groups based on median family income. Students below the median income category are considered "low income," while students at or above the median are considered part of the "high income" group. Results (Table 9) suggest that high school leadership has a differential impact on students from low income households than it does on their high income peers. In terms of post-secondary attendance and total years of education, high school leadership appears to benefit students from low-income households to a larger extent. The OLS estimates, for example, suggest that high school leadership increases the probability of post-secondary attendance by 11.2%, while for high income students the experience increases their probability by just 3.6%. A similar trend is seen with total years of education. In terms of college graduation, however, the benefit of leadership for students from high income households is at least as great as or greater than it is for low income students.

One explanation for this difference may lie within the importance of leadership skill in the college admissions and financial aid decision process. If high school leadership activities increase the probability of financial aid or scholarships, for instance, then they may play a larger role in the post-secondary attendance of students from lower income households. Students from higher income families, on the other hand, may not have the same need for scholarships and may therefore not benefit from their leadership experience to the same extent as students from low income households whose college attendance rests on their ability to obtain a scholarship or a more lucrative financial aid package.

6. Conclusion

In this paper, I estimate the impact of high school leadership on subsequent educational attainment using three estimation methods to address the non-random selection of students into leadership positions. The contribution of the paper is to provide the first evidence that high school leadership does, in fact, have a large positive causal impact on the future educational attainment of the average student. Rather than providing specific estimates that can be relied upon for policy recommendations, this paper illustrates that even the smallest estimated effects are non-trivial and provides evidence that suggests the true causal impact for some students may be much larger.

I find students who are leaders in high school share at least a 0.35 year advantage over their non-leader peers in terms of total years of education. This estimate is of similar magnitude to Altonji's (1995) largest estimates of an additional year of science, foreign language and math class on total years of education; it is roughly equivalent to a 5.5 percentile point increase in standardized math test score. High school leadership is also predicted to increase the probability of attending a post-secondary institution by a minimum of 5 percent and to increase the probability of holding a college degree by 9.5 percent. These estimates are equivalent to a 5.5 to 8 percentile point increase in standardized math test score. Similar to many empirical studies on the return to schooling, the instrumental variables estimates are two to three times larger than these magnitudes. Finally, I also find evidence of a differential impact of leadership for students from low versus high income households. In terms of total years of education and post-secondary attendance, high school leadership appears to disproportionately benefit students from lower income households, while with respect to college graduation, leaders from high income households seem to derive at least as great or greater benefit from their leadership experience than their low-income peers. Since the availability of leadership positions depends upon the existence of school activities that provide such leadership opportunities, the results presented in this paper suggest that decisions regarding financial cutbacks for extracurricular activities should not be taken lightly.

Table 1. Descriptive Statistics

	Full Sample		Leaders		Non-Leaders		Difference[a]		
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev.	Mean	Std. Error	
Outcomes:									
Years of education	14.415	1.700	14.968	1.540	13.994	1.687	0.974	(0.033)	***
Any post-secondary education	0.827	0.378	0.911	0.285	0.763	0.425	0.148	(0.008)	***
College graduate	0.371	0.483	0.514	0.500	0.262	0.440	0.253	(0.010)	***
College graduate, conditional on attendance[b]	0.449	0.497	0.565	0.500	0.343	0.475	0.222	(0.011)	***
Controls:									
Male	0.474	0.500	0.468	0.499	0.478	0.500	-0.011	(0.010)	
Black	0.089	0.285	0.088	0.284	0.089	0.285	-0.001	(0.006)	
Hispanic	0.118	0.003	0.094	0.292	0.137	0.344	-0.043	(0.007)	***
Age (years)	25.842	0.541	25.800	0.505	25.877	0.564	-0.077	(0.011)	***
8th grade socioeconomic status indice	-0.040	0.008	0.147	0.754	-0.182	0.759	0.329	(0.016)	***
High school socioeconomic status indice	0.017	0.793	0.209	0.773	-0.129	0.776	0.338	(0.016)	***
8th grade family income indice	9.882	2.530	10.378	2.364	9.504	2.579	0.874	(0.051)	***
High school family income indice	10.223	2.537	10.674	2.413	9.880	2.575	0.794	(0.051)	***
High school enrollment	267.592	181.001	234.769	173.726	292.595	182.456	-57.826	(3.670)	***
% free lunch in high school	20.280	20.823	19.067	20.300	21.205	21.168	-2.138	(0.427)	***
% Black in high school	10.355	20.355	9.084	19.122	11.323	21.196	-2.239	(0.417)	***
% Hispanic in High School	10.424	18.883	9.955	18.684	10.782	19.028	-0.827	(0.388)	**
Public high school	0.830	0.375	0.792	0.406	0.859	0.348	-0.067	(0.008)	***
Catholic high school	0.065	0.246	0.073	0.259	0.059	0.236	0.013	(0.005)	***
Private (non-Catholic) high school	0.105	0.306	0.135	0.342	0.081	0.273	0.054	(0.006)	***
High school math score percentile	5.172	0.996	5.443	0.965	4.966	0.969	0.477	(0.020)	***
8th grade math score percentile	5.213	1.020	5.480	1.029	5.009	0.964	0.472	(0.020)	***
8th grade: athletic	0.258	0.438	0.340	0.474	0.195	0.397	0.145	(0.009)	***
High school: athletic	0.151	0.358	0.226	0.418	0.094	0.292	0.131	(0.007)	***
8th grade: locus of control	0.066	0.695	0.173	0.674	-0.015	0.699	0.188	(0.014)	***
High school: locus of control	0.065	0.751	0.184	0.750	-0.026	0.740	0.210	(0.015)	***
8th grade: popular	0.159	0.366	0.201	0.401	0.127	0.333	0.074	(0.007)	***
High school: popular	0.128	0.334	0.185	0.388	0.085	0.279	0.099	(0.007)	***
Northeast	0.191	0.383	0.191	0.393	0.190	0.393	0.001	(0.008)	
Midwest	0.281	0.449	0.287	0.452	0.276	0.447	0.010	(0.009)	
West	0.195	0.396	0.180	0.384	0.207	0.405	-0.026	(0.008)	***
South	0.332	0.471	0.341	0.474	0.325	0.469	0.015	(0.010)	
	N= 9,665		N= 4,179		N= 5,486				

Notes:

a. Difference is calculated as mean(leaders) - mean(non-leaders). *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

b. N= 3,807 leaders and 4,188 non-leaders.

Table 2. Descriptive Statistics for Instruments

A. Means by leadership status	Leader	Non-Leader	Difference
% HS peers in leadership positions	0.400	0.356	0.043 ***
Twin	0.046	0.037	0.009 **
Oldest child	0.338	0.304	0.034 ***
Twin * Oldest child	0.014	0.007	0.007 ***

B. Proportion leader	High School Leader
Neither twin nor oldest child	0.419
Twin only	0.453
Oldest child only	0.454
Twin & oldest child	0.590

Notes:

a. Difference is calculated as mean(leaders) - mean(non-leaders). *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

b. N= 3,807 leaders and 4,188 non-leaders.

Table 3. Impact of high school leadership on educational attainment

	OLS & Probit		Propensity Score Matching		Instrumental Variables[c]	
	(a)	(b)	(c)	(d)	(e)	(f)
A. Education						
High School Leadership	0.443 ***	0.397 ***	0.346 ***	0.391 ***	0.963 *	0.835 *
	(0.028)	(0.028)	(0.038)	(0.046)	(0.512)	(0.502)
High School Math Score	0.639 ***	0.605 ***			0.586 ***	0.559 ***
	(0.026)	(0.027)			(0.047)	(0.045)
R-squared	0.411	0.419				
F-statistic (p-value)					0.0000	0.0000
Sargan Statistic (p-value)					0.852	0.836
B. Any Post-Secondary Education[b]						
High School Leadership	0.070 ***	0.064 ***	0.050 ***	0.059 ***	0.243 ***	0.213 ***
	(0.006)	(0.007)	(0.011)	(0.009)	(0.074)	(0.044)
High School Math Score	0.085 ***	0.080 ***				
	(0.006)	(0.006)				
R-squared	0.261	0.267				
Rho					-0.503	-0.396
					(0.157)	(0.184)
College Graduate[b]						
High School Leadership	0.141 ***	0.124 ***	0.095 ***	0.104 ***	0.341 ***	0.357 ***
	(0.011)	(0.011)	(0.015)	(0.015)	(0.116)	(0.115)
High School Math Score	0.229 ***	0.219 ***				
	(0.011)	(0.011)				
R-squared	0.320	0.328				
Rho					-0.490	-0.568
					(0.128)	(0.089)
Popular, Athletic, Locus of Control	No	Yes	No	Yes	No	Yes
N=9,665 individuals						

Notes:

a. Robust standard errors are reported in parenthesis. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively. All specifications include controls for demographic, family, region, school, and cognitive ability (math scores).

b. Reported coefficients in columns (a) and (b) on Any Post-Secondary and College Graduate are marginal effects from probit models.

c. Instruments include twin, oldest child, twin*oldest child and school leadership opportunities.

Table 4. First Stage Instrumental Variables Results

	Model 1 (a)	Model 2 (b)
School Leadership Opportunities	0.134 ***	0.122 ***
	(0.034)	(0.034)
Oldest Child*Twin	0.119 **	0.113 **
	(0.055)	(0.054)
Twin	0.040	0.048 *
	(0.027)	(0.027)
Oldest Child	0.009	0.016
	(0.010)	(0.010)
Popular, Athletic, Locus of Control	**No**	**Yes**
First Stage f-statistic	**7.62**	**8.07**
P-value	**0.0000**	**0.0000**

Notes:

a. *,**,*** denotes statistical significance at the 10, 5, and 1% level, respectively.

b. All specifications include controls for demographic, family, region, school, and cognitive ability (math scores).

Table 5. Alternative Instrumental Variables Specifications

	(a)	(b)	(c)	(d)
Education				
High School Leadership	0.835 *	1.024 *	1.160	0.895
	(0.502)	(0.551)	(0.786)	(0.762)
F-statistic	8.07	13.72	13.77	14.11
F-stastic p-value	0.0000	0.0000	0.0000	*0.000*
Sargan p-value	0.8362	0.8098	n/a	n/a
Any Post-Secondary Education				
High School Leadership	0.213 ***	0.219 ***	0.216 ***	0.198 ***
	(0.044)	(0.067)	(0.040)	(0.063)
Rho	-0.396	-0.417	-0.480	-0.426
	(0.184)	(0.175)	(0.137)	(0.170)
College Graduate				
High School Leadership	0.357 ***	0.365 ***	0.375 ***	0.373 ***
	(0.115)	(0.079)	(0.073)	(0.075)
Rho	-0.568	-0.583	-0.603	-0.599
	(0.089)	(0.084)	(0.078)	(0.080)
Instruments:				
School Leadership Opportunities	X	X	X	
Twin	X			
Eldest Child	X			
Twin*Eldest Child	X	X		X

N=9,665 individuals

Note:

a. Robust standard errors are reported in parenthesis. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively. All specifications include controls for demographic, family, region, school, and cognitive ability (math scores).

b. Reported coefficients on Any Post-Secondary and College Graduate are marginal effects from probit models.

Table 6. Instrumental Variables Estimates Exclusion Restrictions: Years of Education

	Model 1 (a)	Model 2 (b)
A.		
Twin	-0.050	-0.048
	(0.082)	(0.083)
	[z=0.61]	[z=-.057]
High School Leadership	1.080 *	1.040 *
	(0.591)	(0.624)
B.		
Oldest Child	-0.014	-0.051
	(0.030)	(0.031)
	[z=-0.46]	[z=-.051]
High School Leadership	0.940 *	0.923 *
	(0.512)	(0.533)
C.		
Twin*Oldest Child	0.012	0.018
	(0.173)	(0.175)
	[z=0.07]	[z=-.10]
High School Leadership	0.886	0.789
	(0.634)	(0.668)
D.		
School Leadership Opportunities	0.059	0.070
	(0.138)	(0.125)
	[z=0.43]	[z=0.56]
High School Leadership	0.745	0.597
	(0.741)	(0.657)
Popular, Athletic, Locus of Control	No	Yes
N= 9,665		

a. Both model specifications include controls for demographic, family, region, school, and cognitive ability (math scores).

Specification two also includes controls for popularity, athleticness and locus of control. N= 9,665. Robust standard errors are reported in parenthesis.

b. Coefficients represent estimates of the given variable on total years of education from separate regressions where leadership is instrumented with the other three instruments.

Table 7. OLS estimates with and without school fixed effects

	Model 1 (a)	Model 2 (b)	Model 1 (c)	Model 2 (d)
Education				
Marginal Effect	0.443 ***	0.397 ***	0.431 ***	0.383 ***
Standard Error	(0.028)	(0.028)	(0.030)	(0.030)
R-squared	0.4106	0.4192	0.3155	0.3273
Any Post-Secondary Education				
Marginal Effect	0.072 ***	0.063 ***	0.066 ***	0.057 ***
Standard Error	(0.007)	(0.007)	(0.008)	(0.008)
R-squared	0.3403	0.2166	0.1624	0.1709
College Graduate				
Marginal Effect	0.111 ***	0.100 ***	0.114 ***	0.103 ***
Standard Error	(0.009)	(0.009)	(0.009)	(0.009)
R-squared	0.3544	0.3602	0.2464	0.254
Popular, Athletic, Locus of Control	No	Yes	No	Yes
School Fixed Effects	No	No	Yes	Yes
N=9,665 individuals				
Number of schools= 1,119				

a. Robust standard errors are reported in parenthesis. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively. All specifications include controls for demographic, family, region, school, cognitive ability (math scores), popularity, athletic ability and locus of control.

Table 8. Sensitivity of Leadership Estimates to the Definition of Leadership

	OLS & Probit		Instrumental Variables[c]	
	(a)	(b)	(c)	(d)
A. Education				
High School Leadership	0.397 ***	0.384 ***	0.835 *	0.918 *
	(0.028)	(0.029)	(0.502)	-0.559
High School Math Score	0.605 ***	0.525 ***	0.559 ***	0.480 ***
	(0.027)	(0.027)	(0.045)	(0.054)
R-squared	*0.419*	0.395	n/a	n/a
F-statistic (p-value)	n/a	n/a	*0.0000*	*0.0000*
Sargan Statistic (p-value)	n/a	n/a	*0.836*	0.8905
B. Any Post-Secondary Education[b]				
High School Leadership	0.064 ***	0.053 ***	0.213 ***	0.224 ***
	(0.007)	(0.006)	(0.044)	(0.065)
High School Math Score	0.080 ***	0.059 ***	n/a	n/a
	(0.006)	(0.005)		
R-squared	0.267	0.2482	n/a	n/a
Rho	n/a	n/a	-0.396	-0.605
			(0.184)	(0.106)
College Graduate[b]				
High School Leadership	0.124 ***	0.145	0.357 ***	0.309 ***
	(0.011)	(0.013)	(0.115)	(0.138)
High School Math Score	0.219 ***	0.213	n/a	n/a
	(0.011)	(0.012)		
R-squared	0.328	0.3147	n/a	n/a
Rho	n/a	n/a	-0.568	-0.424
			(0.089)	(0.149)
Measure of Leadership	10th or 12th	12th	10th or 12th	12th
Number of Observations	9,665	9,099	9,665	9,099

Notes:

a. Robust standard errors are reported in parenthesis. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively. All specifications include controls for demographic, family, region, school, cognitive ability (math scores), popularity, athletic ability and locus of control.

b. Reported coefficients in columns (a) and (b) on Any Post-Secondary and College Graduate are marginal effects from probit models.

c. Instruments include twin, oldest child, twin*oldest child and school leadership opportunities. IV specification also includes conrtol for school average math percentile.

Table 9. The Imact of High School Leadership by Family Income Level

	(a)	(b)
A. Years of Education	OLS	IV
Low Income	0.504 ***	1.545
	(0.043)	(1.042)
High Income	0.392 ***	1.417 *
	(0.036)	(0.755)
Difference	0.112	0.128
B. Any Post-Secondary Education	Probit	IV
Low Income	0.112 ***	0.400
	(0.013)	(0.308)
High Income	0.036 ***	0.125
	(0.005)	(0.155)
Difference	0.076	0.275
C. College Graduate	Probit	IV
Low Income	0.104 ***	0.203
	(0.013)	(0.260)
High Income	0.150 ***	0.442 *
	(0.016)	(0.248)
Difference	-0.046	-0.239

Notes:

a. Students in the low income group are those students below the 50 percentile in the family income indicator (N= 4,493). Students included in the high income group include those students at or above the 50% in family income (N=5,172).

b. Robust standard errors are reported in parenthesis. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively. All specifications include controls for demographic, family, region, school, cognitive ability (math scores), popularity, athletic ability and locus of control.

c. Reported coefficients on Any Post-Secondary and College Graduate are marginal effects.

c. Instruments include twin, oldest child, twin*oldest child and school leadership opportunities.

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Appendix A. Data Detail

Table A1. School activities used to construct leadership variable[a]

A. 10th Grade Leadership

Sports:
Baseball/Softball
Basketball
Football
Soccer
Swim Team
Other team sport
Other individual sport
Cheerleading
Pom-pom, drill team

Potential Responses:	
1	School does not have
2	Did not participate
3	Intramural sports
4	JV
5	Varsity
6	**Captain/Co-captain**

Other Activities:
School play or musical
Student government
NHS or other academic honor society
School yearbook, newspaper, or literary magazine
Service clubs (AFS, Key Club)
Academic club
Hobby club
FTA, FHA, or FFA or other vocation education or professional club

Potential Responses:	
1	Does not offer
2	Does not participate
3	Participated
4	**Participated Officer**

B. 12th Grade Leadership

Interscholastic sports:
Team sport at school
Individual sport at school
Cheer/Pompom

Potential Responses	
1	School does not have
2	Did not participate
3	Intramural sports
4	JV
5	Varsity
6	**Captain/Co-captain**

Other activities:
Band, orchestra, chorus or other music group
Drama, school play, or musical
Student government
NHS, other academic society
School yearbook, newspaper, or literary magazine
Service clubs
Academic clubs
Hobby clubs
FTA, FHA, FFA or other vocational education or professional club
Intramural team sport
Intramural individual sport

Potential Responses	
1	Does not offer
2	Does not participate
3	Participated
4	**Participated Officer**

Elected officer of school class

Potential Responses	
1	**Yes**
2	No

Notes:
a. An individual is considered to be a high school leader if he gave a bolded response to a question regarding his participation in any of the above listed activities.

Table A2. Construction of Analysis Dataset

	Number of Observations[a]	Number of Observations Lost[b]	Percent of Sample Retained
Total Sample	12,144		100.00%
Variables			
Leadership	11,665	479	96.06%
Years of Education	11,552	113	95.13%
College Graduate	11,552	0	95.13%
Any Post-Secondary Education	11,552	0	95.13%
Male	11,552	0	95.13%
Black	11,552	0	95.13%
Hispanic	11,552	0	95.13%
Age	11,449	103	94.28%
High School math score	11,036	413	90.88%
8th grade math score	11,036	0	90.88%
High School socioeconomic status	10,936	100	90.05%
8th grade socioeconomic status	10,936	0	90.05%
High school family income	10,576	360	87.09%
8th grade family income	10,576	0	87.09%
High school enrollment	10,540	36	86.79%
Public high school	10,378	162	85.46%
Catholic high school	10,362	16	85.33%
% free lunch in high school	10,261	101	84.49%
% Black in high school	10,207	54	84.05%
% Hispanic in High School	10,204	3	84.03%
Northeast	10,204	0	84.03%
Midwest	10,204	0	84.03%
West	10,204	0	84.03%
High school: popular	10,066	138	82.89%
8th grade: popular	10,066	0	82.89%
High school: athletic	10,059	7	82.83%
8th grade: athletic	10,059	0	82.83%
High school: locus of control	10,006	53	82.39%
8th grade: locus of control	10,006	0	82.39%
Twin	10,006	0	82.39%
Eldest child	10,006	0	82.39%
% Peer leaders	9,665	341	79.59%

Notes:

a. Denotes the number of students left in sample after dropping students with missing values for any previous variable.

b. Denotes the number of students dropped due to missing value of variable.

Table A3. Outcome Summary Statistics by Leadership Status: Full Sample Versus Analysis Dataset

	Years of Education	College Graduate	Any Post-Secondary
Full Dataset (N= 11,552):			
Leader	14.899	0.495	0.901
Non-Leader	13.903	0.249	0.749
Difference	0.996 ***	0.246 ***	0.151 ***
Analysis Dataset (N=9,665):			
Leader	14.968	0.514	0.911
Non-Leader	13.994	0.262	0.763
Difference	0.974 ***	0.253 ***	0.148 ***
Difference-in-Difference	0.022	-0.006	0.004

Table A4. Variable Definitions

Variable	Definition
Outcomes:	
Years of Education	Total years of education
Any Post-Secondary Education	Equal to 1 if r attended any post-secondary institution
College Graduate	Equal to 1 if r graduated from college
Controls:	
Male	Equal to 1 if r is male
Black	Equal to 1 if r is black
Hispanic	Equal to 1 if r is Hispanic
Age (years)	Age in years
8th grade socioeconomic status	Indice for r's family socioeconomic status in 8th grade
High school socioeconomic status[a]	Indice for r's family socioeconomic status in high school
8th grade family income	Indice for r's family income in 8th grade
High school family income	Indice for r's family income in high school
High school enrollment	Equal to r's high school class enrollment size
Public high school	Equal to 1 if r's high school is public.
Catholic high school	Equal to 1 if r's high school is Catholic
Private (non-Catholic) high school	Equal to 1 if r's high school is private non-Catholic
% free lunch in high school	Percentage of students in r's high school who receive free lunch
% Black in high school	Percentage of students in r's high school who are black
% Hispanic in high school	Percentage of students in r's high school who are Hispanic
High school math score[b]	R's standardized math test score percentile
8th grade math score	R's 8th grade standardized test score percentile
8th grade: athletic	Equal to 1 if r reports himself as "very athletic" in 8th grade
High school: athletic	Equal to 1 if r reports himself as "very athletic" in high school
8th grade: popular	Equal to 1 if r reports himself as "very popular" in 8th grade
High school: popular	Equal to 1 if r reports himself as "very popular" in high school
8th grade: locus of control	Indice for r's locus of control in 8th grade
High school: locus of control	Indice for r's locus of control in high school
Northeast	Equal to 1 if r lives in northeast
Midwest	Equal to 1 if r lives midwest
West	Equal to 1 if r lives in the west
South	Equal to 1 if r lives in the south
Instruments:	
School Leadership Opportunities	Equal to the proportion of r's classmates (other sampled students) who are leaders.
Twin	Equal to 1 if r is a twin
Oldest Child	Equal to 1 if r is oldest child
Twin*Oldest Child	Equal to 1 if r is twin and oldest child

Notes:

a. All high school variables taken from 12th grade survey. If missing, variable is replaced with 11th grade variable.

b. Math scores percentiles are from exams administered by the survey. Percentiles are divided by ten so that the deviation is approximately equal to one.

c. Locus of control is a composite measure created by the NELS. The indice reflects whether a student is more internal , meaning he believes his actions impact his outcomes. A student with an low locus of control is said to be external, meaning he believes someone or something else controls his outcomes.