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THE BENEFITS OF SCHOLASTIC ATHLETICS

James J. Heckman
Colleen P. Loughlin
Haihan Tian

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Cambridge, MA 02138
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We gratefully acknowledge Greg Curtner who introduced us to this subject in 2012 and framed the importance of the question of whether student-athletes benefit from or are exploited by participation in college athletics. We examine this question more broadly and consider the educational, social and economic outcomes of participation in scholastic athletics at all levels of schooling. We thank Jenna Bujalski, Alejandra Campos, Ron Laschever, Josh Sherman, Aniello Bianco, Daniel Stone, Fredrick Flyer, Soloman Polachek and Jennifer Pachon for research support and commentary. Heckman and Loughlin used a portion of this work on the impacts of participation in major college sports conferences in litigation on behalf of the NCAA, which funded this limited scope of the work. That research was summarized in The Hill (Heckman et al., 2021). The NCAA did not provide financial support for this paper. This paper greatly extends the scope of our previous research. This study uses restricted-use data from the Education Longitudinal Survey and the National Educational Longitudinal Survey provided by the National Center for Education Statistics (NCES). Access was granted under a restricted-use data license, and all analyses comply with NCES confidentiality standards. The findings and opinions expressed in the article do not necessarily reflect the views of the NCES or the U.S. Department of Education. Opinions and errors are solely those of the authors, and not the NCAA or Compass Lexecon. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

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ABSTRACT

This paper uses longitudinal data to study the benefits of participation in scholastic athletics starting with high school participation and continuing with college athletics, including the benefits of intramural athletics. We study the impact of participation on a number of important life outcomes, including graduation from high school and college and wages after schooling is completed. Controlling for rich measures of cognitive and personality skills and social background, we find substantial benefits at all levels. Participation in athletics promotes social mobility for disadvantaged and minority students.

James J. Heckman
University of Chicago
and IZA
and also NBER
jjh@uchicago.edu

Haihan Tian
The University of Chicago
hhtian@uchicago.edu

Colleen P. Loughlin
Compass Lexecon
cloughlin@compasslexecon.com

A data appendix is available at http://www.nber.org/data-appendix/w34046

1 Introduction

This paper presents the first comprehensive *longitudinal* analysis of the benefits of participation in athletics at both the high school and college level.[1] Controlling for rich measures of cognitive and socioemotional skills and family background, substantial benefits are associated with participation in athletics at all levels, including intercollegiate athletics at NCAA schools known for elite athletic programs.[2]

Participation in high school varsity athletics improves student prospects of finishing high school and attending college. Attending college confers life-long benefits. We show that, on average, those who play varsity intercollegiate sports at four-year institutions, including major football and basketball institutions, graduate at higher rates and earn higher post-school starting wages than otherwise comparable non-athletes.[3] We also consider participation in intramural sports, which also yields benefits. Participation in sports promotes social mobility of athletes from disadvantaged environments.

These conclusions are based on an analysis of two large nationally representative longitudinal datasets: The National Educational Longitudinal Survey (NELS)[4] and the Education Longitudinal Survey (ELS).[5] Longitudinal data enables us to track the careers of student athletes as they progress through schooling and into the labor market.

We reach the following major findings controlling for a rich set of measures of cognitive and noncognitive skills:

[1]The longitudinal data cover 1988-2000 and 2002-2012.

[2]The NCAA is comprised of three divisions, Division I, Division II and Division III, representing 350, 310 and 438 schools, respectively, and with over 500,000 student-athletes across the divisions (`https://www.ncaa.org/sports/2016/1/7/about-resources-media-center-ncaa-101-our-three-divisions.aspx`, `https://ncaaorg.s3.amazonaws.com/research/sportpart/2023RES_SportsSponsorshipParticipationRatesReport.pdf`). Division I schools at the most elite competitive levels are often referred to as those in the Power 4 Conferences, which as of 2025 are the Atlantic Coast Conference ("ACC"), Big Ten Conference, Big 12 Conference and Southeastern Conference ("SEC"). For football, these and other schools are categorized in the Football Bowl Subdivision("FBS") within Division I, which compete for conference championships and eventually the Division I National Championship (`https://www.cfc1869.com/sub-division/FBS/learn-more/`).

[3]The survey data we use follows students through their mid-20's, thereby providing information on early life-cycle wages.

[4]U.S. Department of Education, National Center for Education Statistics (2000).

[5]U.S. Department of Education, National Center for Education Statistics (2012).

(1) Participation in athletics is associated with a higher probability of graduating from high school.[6] It is an important step in the path toward subsequent achievement and improved life outcomes for student athletes.

(2) Participation in high school athletics is significantly associated with higher probabilities of attending college.[7] This finding is plausible since high school students, in the hope of receiving a scholarship, invest more in their academic and athletic skills to meet eligibility requirements and gain admission to college. The possibility of obtaining an athletic scholarship, among other potential benefits from high level competition, likely motivates student learning in high school that brings future rewards.

(3) Intercollegiate varsity athletes are as likely or more likely to earn at least a bachelor's degree relative to otherwise comparable non-athletes.[8] "One and done," at times used to describe Division I basketball participation before heading to the NBA, is an anecdote, not a valid characterization of college athletics as a whole, even for the Power Conferences. College varsity athletes are more likely to receive college scholarships that facilitate college completion in addition to health benefits and coaching. Participation in college intramural sports also yields benefits.

(4) Participation in college athletics is associated with better starting wages for participants compared to observationally identical non-athletes.[9] This is true for both college varsity athletes and college intramural athletes. Our samples are too small to adequately analyze the impact of community college athletic participation.

(5) Participation in scholastic athletics opens the door to college education with benefits for minorities and disadvantaged students. Scholastic athletics is a vehicle for social mobility, facilitating educational, social and economic opportunities.

We document these claims in the rest of the paper. Section 2 briefly surveys the previous

[6]See Section 4 and parallel OLS results in Appendices C.1.1 and C.2.1.

[7]See Section 5 and parallel OLS results in Appendices C.1.2 and C.2.2.

[8]See Section 6 and parallel OLS results in Appendices C.1.5 and C.2.5. This is also supported by data from the NCAA (`https://ncaaorg.s3.amazonaws.com/research/gradrates/2024/2024D1RES_GSRTrends.pdf`).

[9]See Section 7 and parallel OLS results in Appendices C.1.6 and C.2.6.

literature. Section 3 describes our data and methodology. We present summary statistics of transition rates. Section 4 summarizes our evidence on the effect of participation in high school sports on high school graduation rates. Section 5 shows that high school varsity athletes are more likely to be admitted by colleges at all levels and receive scholarships that facilitate college attendance. Section 6 studies college performance and graduation rates associated with participation in college sports. Section 7 shows the impact of participation in athletics at all levels on post-schooling earnings at all levels. We also show earnings and occupational attainment of high school varsity athletes who do not finish high school or go on to college, and college varsity athletes who do not finish college. Section 8 shows that for elite sports schools (NCAA Division I and FBS schools), college student-athletes have as high or higher graduation rates and post-school earnings than otherwise comparable non-athletes. There is no evidence in our analysis of harm from participation in intercollegiate athletics. Section 9 summarizes.

2 Previous Studies on the Impact of Participation in Athletics on Life Outcomes

Leadership and teamwork skills are acquired or enhanced through participation in sports. They plausibly have value in the job market.[10] The benefits of improved knowledge about exercise, eating habits, and general physical care last well beyond school years and provide value later in life. Heckman et al. (2016, 2018) find that educational participation positively influences diverse outcomes later in life, including earnings, health, reduced participation in crime, and a variety of social outcomes such as personality skills that predict many life outcomes.[11]

[10]See, for example, Shulman and Bowen (2018). Specifically, in discussing the post-schooling careers of college student-athletes, the authors report that athletes tend to have better teamwork skills and they demonstrate positive labor market outcomes to these types of skills.

[11]See Almlund et al. (2011).

Many studies examine the social and non-monetary returns to education. For example, Milligan et al. (2004) find positive effects of schooling on civic participation and involvement at all levels. Oreopoulos and Salvanes (2011) show that more educated individuals tend, on average, to have higher levels of job satisfaction and jobs with higher levels of prestige. Controlling for income, those with more education have lower separation/divorce rates and improved parenting skills, which benefit the next generation (see García and Heckman 2023). There are also benefits in terms of learning about cooperation and teamwork and the satisfaction of completing a goal.

Research on the impact of athletic participation on educational and labor outcomes starting with Long and Caudill (1991) shows benefits on income and graduation using longitudinal data from the American Council on Education for individuals from 1971 to 1980.[12] Male athletes receive higher annual incomes than non-athlete peers. Both male and female athletes are more likely to graduate from college. Their results suggest that participating in sports promotes non-cognitive skills that lead to better outcomes.

Maloney and McCormick (1993) examine the effects of college athletic participation on academic outcomes using data of students enrolled at Clemson University from 1988 to 1989. They find that the performance of football and basketball athletes is worse than that of non-athletes in terms of grades received controlling for student academic history, but not for the athletes of other sports. However, most of this difference can be explained by background factors. Additionally, they find a seasonal effect with athletes in so-called "revenue sports" (i.e. football and men's basketball) having lower grades during the season.

Henderson et al. (2006) study collegiate athletic participation on earnings. Using the same data as Long and Caudill (1991), they find that college athletes earn higher wages, but the wage premium is not uniform. More than half of the athletes earned less than non-athletes. Former athletes in business, military, and manual labor earned more but some former athletes were more likely to become high school teachers with associated lower wages.

[12]We summarize the results that are statistically significant in these studies unless explicitly state otherwise.

Routon and Walker (2015) study the impact of participation in intercollegiate athletics on academic outcomes using longitudinal data for college students from over 400 institutions. Using propensity score matching, they find participation in college sports has a small negative effect on grades. The negative effect on grades is strongest for football and basketball players, and student-athletes who were more scholastically able in high school are less affected.

Insler and Karam (2019) study the impact of intercollegiate athletic participation on grades using data from the U.S. Naval Academy. They show that participation in sports has a minor negative effects on grades. The negative effects vanish with IV estimation using their peers being selected as athletes.

Amornsiripanitch et al. (2023) study the educational and labor outcomes of college athlete and non-athlete students in Ivy League universities. Ivy League athletes have better labor market outcomes than their non-athlete peers in terms of higher income and male athletes are more likely to achieve senior positions in their chosen industries.[13]

Barron et al. (2000) use an allocation-of-time model to study the effect of male high school athletic participation on educational and labor outcomes. They test their model using NLSY79 and NLS-72 data and find that male athletic participation is associated with higher earnings and better educational outcomes. These effects are largely explained by individual scholastic ability and preference for leisure. Students with higher scholastic ability and a lower preference for leisure have higher athletic participation rates. Ewing (2007) finds that high school athletes have higher post-schooling wages and fringe benefits than high school non-athletes.

Stevenson (2010) focuses on the effect of Title IX on the returns to female high school athletic participation. She finds that higher female athletic participation in high school increases female college attendance and female labor force participation.

Lumpkin and Favor (2013) compare the academic performance of high school athletes

[13]They mischaracterized the datasets we analyze in this paper. Both NELS:88 and ELS:2002 are panel survey data but not cross sectional survey data. Also, we report in this paper that attrition is not a serious issue in these analyses.

and non-athlete peers in Kansas in 2008–2009. They find that high school athletes have better academic performance in high school and were more likely to graduate from high school. Gorry (2016) analyzes the benefits of sports participation in secondary education. Athletes in team sports have higher high school graduation rates, employment rates, and earnings. Also, less academically successful students gain substantially from participating in sports in terms of educational outcomes.

Ransom and Ransom (2018) examine the effects of high school athletic participation on education, labor, and health outcomes. They report no statistically significant positive effects.

Kniffin et al. (2015) show that high school athletes show more leadership, self-confidence, and self-respect. High school athletic participation is associated with higher levels of leadership and more prosocial behavior.

In summary, the previous literature generally, but not universally, reports positive impacts of the effect of athletic participation on a variety of outcomes. Students who participate in either high school-or college level-sports are generally found to earn higher wages. The current literature has mixed findings on educational outcomes. The literature generally finds that student athletes are more likely to graduate from high school and college, and high school athletes are more likely to attend college. However, the literature also finds that student athletes have worse grades than non-athletes, especially during their athletic season.

We find that participation in athletics provides incentives and paths to educational and career opportunities for students with otherwise limited opportunities. Participation in athletics for these students is a vehicle for social mobility.

Our analysis is more general than that of previous studies. Many papers analyze single cross-section samples for a single institution or for a single year. We consider a range of schooling levels from eighth grade through college using two different, largely comparable, longitudinal datasets with rich measures of cognitive, socioemotional skills, and family background. No study has analyzed longitudinal data to examine the impact of participation in

athletics at all levels of schooling.

3 Data and Methodology

The National Education Longitudinal Study of 1988 (NELS:88) and the Education Longitudinal Survey of 2002 (ELS:2002) are public-use datasets downloaded from a public website. Restricted-use data are obtained under contract with the U.S. Department of Education, Institute of Education Sciences. The restricted-use data provide detailed information on individual respondents, including information on the post-secondary institutions they attend, which is needed to identify attendance at schools sometimes characterized as "sports factories."

The NELS data are a nationally representative sample of students initially surveyed in eighth grade in 1988. A sample of these initial respondents was surveyed again in 1990, 1992, 1994 and 2000.[14] Overall, 10,827 individuals respond in every survey wave. Our analysis of the NELS data is based on this set of respondents. Student questionnaires across these survey years cover school experiences, activities, school and labor market outcomes, cognitive and socioemotional traits, and family background characteristics.[15]

The base year survey of NELS (1988) captures the characteristics and activities of students as they are about to graduate middle or junior high school. The first follow-up (1990) examines these students, many of whom are sophomores in high school. The second follow-up occurs in 1992, when many of these individuals are seniors in high school. The third follow-up surveys these individuals in 1994, when many sample members were enrolled at a post-secondary institution. The final NELS survey wave occurs in 2000, at which point many of the respondents have completed their post-secondary education and started their careers.

The ELS data are a representative sample of students surveyed in 2002, 2004, 2006, and

[14] Additional students were added in the first two follow-up periods to maintain the representativeness of the sample.

[15] See `http://nces.ed.gov/surveys/nels88/index.asp`.

2012. We analyze the outcomes of the 10,895 individuals who respond across every survey wave. Unlike the NELS survey, the ELS survey begins surveying individuals when many of them are sophomores in high school (2002). The first follow-up occurs in 2004, when many of these respondents are in the 12th grade. The second follow-up (2006) occurs at a point in their lives when many of the individuals are enrolled at a post-secondary institution. The last survey occurs in 2012, when most students are in their mid-20's. The ELS survey covers many of the same or similar questions covered by NELS, including educational and income outcomes, measures of cognitive and non-cognitive ability, socio-economic status (including parents' education and income), personal aspirations and attitudes towards school, work, and home, educational resources and support, and extracurricular activities.[16]

We analyze the NELS and ELS data separately rather than combine them into one dataset. While the NELS and ELS surveys ask many similar questions, there are differences in some question formats. If the data are pooled, the creation of similar but not identical variables across the two surveys might introduce imprecision in the measurement of the various effects of interest. Each survey tracks different cohorts over time.

While specific questions are different, the corresponding measures capture similar characteristics and activities. Some of these differences are due to developments in the construction of sample questions. The variables used in our analyses are discussed in Appendix A. Appendix B presents the cognitive and non-cognitive measures in this study. While both the NELS and ELS surveys ask respondents about high school and college athletic participation, specific sports are only identified in the data at the high school level. For males, we define "college football players and college basketball players" as intercollegiate athletes who participated respectively in either varsity high school football or varsity high school basketball,

[16]See `https://nces.ed.gov/surveys/els2002/`.

or both.[17] For females, we define "college basketball players" as those intercollegiate athletes who participated in high school basketball.[18] This convention imparts imprecision in measuring which college varsity sport was played but does not affect our conclusions about participation in college varsity athletics.

3.1 Methodology

The longitudinal nature of the NELS and ELS data enable us to examine the impact of participation in athletics at each stage of schooling as well as to assess the cumulative effects of participation in athletics. For example, consider the effect of participation in high school varsity athletics. Below, we report that controlling for differences in background and measured personality and ability traits, participation in high school athletics increases the likelihood of high school graduation. High school graduation, in turn, increases the likelihood of college attendance, and graduation. It is well documented that college graduates earn, on average, higher wages than those who do not have a college degree. Participation in high school athletics is associated with higher wages in one's mid-20's via the channel of post-secondary education.

To reach these conclusions, we exploit the rich data at our disposal to conduct analyses based on propensity score matching, logit regression, and OLS regression analysis to examine educational and labor market outcomes while controlling for a host of individual characteristics, including cognitive abilities, socio-emotional skills, socio-economic background, and family histories. Omitting such controls likely produces spurious relationships between participation in athletics and the outcomes we study. The methods we use enable us to isolate the effect of athletic participation and to evaluate whether our estimates are statistically

[17] In the NELS and ELS data, a majority of male college athletes either a) only played football in high school, b) only played basketball in high school, c) played both football and basketball in high school, or d) did not play football or basketball in high school. For the above four groups of college athletes, there exists an unambiguous high school sports classification for the purposes of our analysis (college basketball/football athletes and non-basketball/football college athletes). Likewise, a majority of female college athletes either a) only played high school basketball or b) did not play high school basketball.

[18] We discuss the definitions used in NELS and ELS in detail in Appendix A.

significant. Our identification strategy crucially depends on access to an unusually rich set of data on family backgrounds, cognitive skills, and personality traits.

Studies like that of Harper et al. (2013) that do not control for student background characteristics, such as ability, motivation, and parental resources reach different conclusions than we do in college graduation rates between African American student-athletes and other college students. They do not compare comparable people. A full set of results, including a list of controls used for each outcome, is presented in Appendix C.

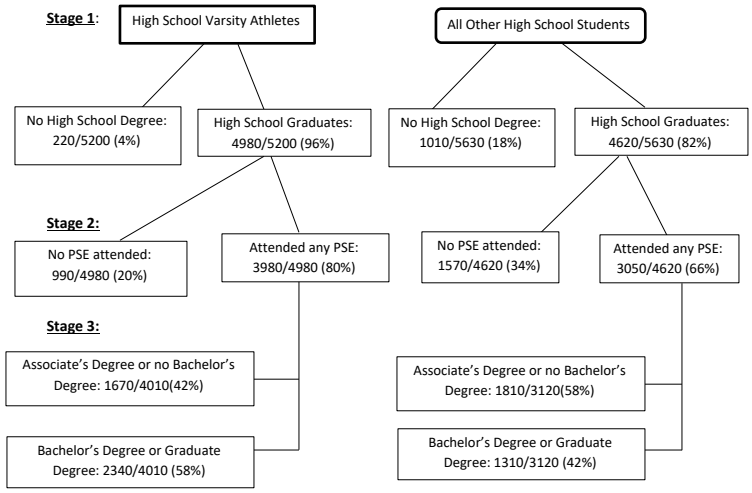
3.2 Patterns of Participation Over the Life Cycle of Schooling

Figures 3.1 and 3.2 give flow charts of sample dynamics. We divide samples from NELS:88 and ELS:2002 into two groups with different subgroups (e.g., high school varsity athletes versus all other high school students, college varsity athletes versus all other college students), and track each group's educational outcomes over three stages. First, we compare the percentage of high school graduates including those who receive high school equivalence certificates (GEDs) for two groups of high school students. Second, we compare the percentages of students attending post-secondary education among high school graduates. The third stage compares the percentage of students who obtained bachelor's degrees or above among the students attended some form of post-secondary education (PSE).[19]

In both datasets, high school varsity athletes have higher high school graduation rates, higher rates of attending PSE, and have higher rates of obtaining bachelor's or graduate degrees. High school varsity athletes are more likely to be admitted by colleges and they are more likely to obtain scholarships other than those based on need alone.

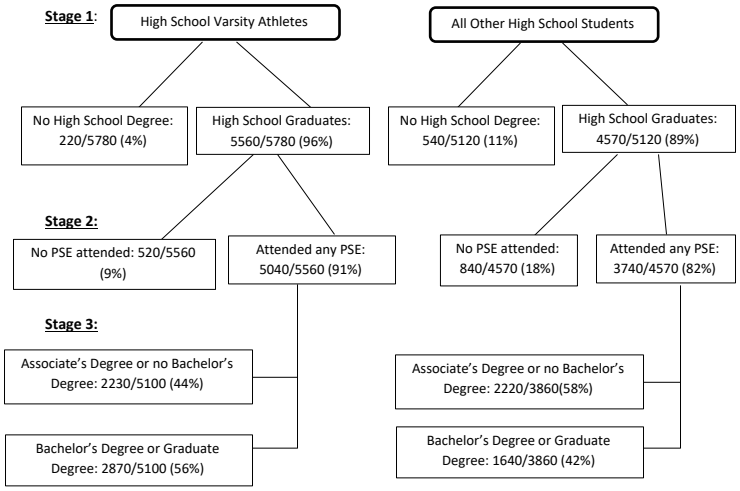
[19]The data we study do not have sufficient observations of student-athletes at the two-year college level to conduct parallel studies to those at the four-year college level.

Figure 3.1 Diagram of stages and the distribution of outcomes in NELS:88



NOTE: Number of observations is rounded to the nearest 10. Percentages are rounded to the nearest whole numbers.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000.

Figure 3.2 Diagram of stages and the distribution of outcomes in ELS:2002



NOTE: Number of observations is rounded to the nearest 10. Percentages are rounded to the nearest whole numbers.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

NELS:88 and ELS:2002 sample members of the same age, albeit in different years. Comparing these two datasets shows that patterns are similar for high school varsity athletes. Appendix figures D.1 and D.2 make similar comparisons among high school varsity athletes

by types of sports. Not controlling for family background and personal attributes, high school non-basketball and football varsity athletes have slightly higher percentages of attending colleges and obtaining bachelor's or graduate degrees. But the difference is not as sharp as the comparison between high school varsity athletes compared to all other high school students.

Figures D.3 and D.4 track black high school students' educational outcomes across the same three stages. A higher percentage of black high school varsity athletes graduate high school, attend colleges, and obtain bachelor's and graduate degrees than other black high school students.

4 High School Graduation

We first estimate the effect of participating in high school varsity sports on high school graduation rates. We use propensity score matching to determine[20] whether students graduate from high school or obtain a high school certificate (e.g., GED), matching on socioeconomic status, cognitive skills, and non-cognitive skills.[21] In both datasets, participating in high school varsity sports significantly positively affects the probability of obtaining a high school diploma or certificate. This is true when we separate high school sports by basketball and football versus non-basketball or football. The evidence holds when we split the athletes by

[20] We use Abadie and Imbens (2016) procedures.

[21] For our measures on non-cognitive ability, NELS:88 measures Locus of Control a composite of items. It is a continuous measure on an individual's belief in internal-external control and their ability to control their fate. Self-Concept is a composite of seven self-concept items. It is a measure on self-esteem. Externalizing behavior is the composite of six measure of aggressive and anti-social items. In ELS:2002, there are four non-cognitive measures. Action Control: General Effort and Persistence Scale is a scale of the respondent's self-rated effort and persistence in 8th grade. Higher values represent greater ratings of effort and persistence. Control Expectation Scale is a scale of the respondent's success expectations in 8th grade. Higher values represent greater expectations of success in academic learning. The Instrumental Motivation Scale is a scale of the base-year respondent's instrumental or extrinsic motivation, i.e., motivation to perform well academically in order to satisfy external goals like future job opportunities or financial security. Higher values represent greater instrumental motivation. Externalizing behavior is the composite of five measure of aggressive and anti social items. A full description of the construction of non-cognitive measures is shown in Appendix B. For our cognitive skill measures, in NELS:88 we use standardized mean of the cognitive variables (Z-score) of the mean of an individual's standardized test scores in reading, math, science, and history/citizenship/geography in 8th grade. In ELS:2002 we construct Z-score using the mean of an individual's standardized test scores in reading and math in 10th grade. See Appendix B for full description.

their gender and is true for both NELS and ELS data. The effects are smaller in the later years, but still statistically significant.

Table 1 Propensity Score Matching: Effects of participating high school sports on obtaining high school diploma or GED, by type of high school sports and sex: NELS:88 and ELS:2002

	NELS:88			ELS:2002		
Athlete Type	All	Male	Female	All	Male	Female
(1)	(2)	(3)	(4)	(5)	(6)	(7)
High school sophomore varsity athlete	0.054***	0.071***	0.048***	0.025***	0.048***	0.020*
	(0.007)	(0.010)	(0.009)	(0.006)	(0.011)	(0.008)
High school sophomore basketball/football varsity athlete	0.068***	0.082***	0.064***	0.048***	0.038***	0.044***
	(0.011)	(0.013)	(0.016)	(0.008)	(0.011)	(0.010)
High school sophomore non basketball/football varsity athlete	0.063***	0.082***	0.055***	0.027***	0.045***	0.008
	(0.008)	(0.012)	(0.009)	(0.006)	(0.013)	(0.009)

***$p < .01$, **$p < .05$, *$p < .10$.
NOTE: Coefficients are estimated by propensity score matching following Abadie and Imbens (2016). Variables used for matching: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

4.1 The Social Mobility of High School Athletes from Disadvantaged Backgrounds Graduating from High School

We study whether participation in athletics promotes social mobility for high school varsity athletes from disadvantaged backgrounds or from minority groups. The incremental effect of sports on high school graduation for the disadvantaged is measured by interacting athletic participation status by an indicator for being disadvantaged. A positive interaction indicates that students from disadvantaged backgrounds benefit from participating in varsity sports above and beyond the general positive effect of participation.

Table 2 compares the relative benefit of participation in high school varsity athletes for

those with disadvantaged backgrounds on high school graduation rates. High school varsity sports promote high school graduation rates for students from single-parent households. Male high school varsity athletes below the poverty line in both datasets are more likely to graduate high school compared to non-athletes below the poverty line. Black male high school varsity athletes in NELS:88 and black female high school varsity athletes in ELS:2002 are more likely to graduate from high school compared to their non-athlete peers. Participating in high school varsity sports is an avenue for promoting social mobility in disadvantaged groups. In no cases are the estimated interactions negative, that is, no evidence of worsening their outcomes by participating in high school athletics [22]

Table 2 Incremental effect analysis of participating high school sports on obtaining high school diploma or GED among disadvantaged groups, by dataset and sex: NELS:88 and ELS 2002

	Male		Female	
	NELS:88	ELS:2002	NELS:88	ELS:2002
	(1)	(2)	(3)	(4)
Incremental Effect of HS Athletics for Black Student	0.110*	0.037	0.062	0.067**
	(0.046)	(0.043)	(0.033)	(0.026)
Incremental Effect of HS Athletics for Income Below Poverty Line	0.116**	0.153**	0.046	0.035
	(0.039)	(0.049)	(0.033)	(0.030)
Incremental Effect of HS Athletics for Single-Parent Household	0.112***	0.074***	0.069***	0.027*
	(0.022)	(0.021)	(0.016)	(0.014)
Incremental Effect of HS BB/FB Athletics for Black Student	0.100*	0.040	0.050	0.070*
	(0.047)	(0.045)	(0.052)	(0.032)
Incremental Effect of HS BB/FB Athletics for Income Below Poverty Line	0.107*	0.135*	0.043	0.085*
	(0.043)	(0.056)	(0.044)	(0.039)
Incremental Effect of HS BB/FB Athletics for Single-Parent Household	0.123***	0.068**	0.085***	0.052**
	(0.024)	(0.023)	(0.023)	(0.019)

***$p < .001$, **$p < .01$, *$p < .05$.
NOTE: Coefficients are estimated using the incremental effect analysis from the OLS regressions with interaction terms and the full set of control variables consistent in this study. Each coefficient is the separate effect of sports plus the product of the effect of the interaction term and disadvantaged indicator. Variables used as controls: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

[22]See Appendix Tables C.2, C.4, C.50, and C.52 for full regressions of Table 2.

5 Effects of Participation in High School Athletics on Attending College

The next step of our analysis estimates the effect of participating in high school varsity sports on attending colleges for high school graduates. Using propensity score matching, we estimate whether high school graduates attend post-secondary schools controlling for the same set of variables (e.g., socioeconomic status, cognitive skills, non-cognitive skills). In both datasets, high school varsity athletes who graduate high school are more likely to attend four-year post-secondary education institutions. This is also true for both genders when we separate high school sports by basketball and football versus non-basketball and football.

Comparisons of the results across the two datasets show an interesting pattern: the estimated coefficients for males are smaller in the 2002 dataset while the estimated coefficients for females are larger. This might be due to greater attention paid to female athletes and more females are attending college in the later years.

Table 3 Propensity Score Matching: Effects of participating high school sports on attending 4-year post-secondary education institution among high school graduates, by types of high school sports and sex: NELS:88 and ELS:2002

	NELS:88			ELS:2002		
Athlete Type	All	Male	Female	All	Male	Female
(1)	(2)	(3)	(4)	(5)	(6)	(7)
High school sophomore varsity athlete	0.119***	0.124***	0.098***	0.087***	0.092***	0.104***
	(0.013)	(0.019)	(0.018)	(0.013)	(0.020)	(0.017)
High school sophomore basketball/football varsity athlete	0.100***	0.140***	0.087**	0.114***	0.101***	0.141***
	(0.020)	(0.022)	(0.029)	(0.018)	(0.024)	(0.028)
High school sophomore non basketball/football varsity athlete	0.089***	0.118***	0.073***	0.095***	0.063*	0.101***
	(0.015)	(0.023)	(0.019)	(0.014)	(0.025)	(0.018)

$^{***}p < .01$, $^{**}p < .05$, $^{*}p < .10$.
NOTE: Coefficients are estimated by propensity score matching following Abadie and Imbens (2016). Variables used for matching: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

5.1 Social Mobility of High School Athletes from Disadvantaged Backgrounds Attending College

We estimate social mobility for disadvantaged groups, adding an interaction term for athletic participation to our baseline specification. A positive estimated effect indicates that students with disadvantaged backgrounds benefit from participation in varsity sports. Participation promotes social mobility.

Table 4 compares the estimated effect of participation in high school varsity sports for disadvantaged students on attending a 4-year post-secondary college compared to non-athletes from similar disadvantaged backgrounds. First, high school varsity athletes of either sex from single-parent households are more likely to attend 4-year colleges compared to other high school non-athletes who also from single-parent households. Second, both male and female

high school varsity athletes below the poverty line in NELS:88 dataset are more likely to attend 4-year college. Finally we see that black male high school varsity athletes in ELS:2002 are more likely to attend 4-year college compared to their non-athlete peers. The results suggest participating in high school varsity sports is an important way to promote social mobility for disadvantaged groups.[23]

Table 4 Incremental effect analysis of participating in high school sports on attending 4-year post-secondary education among high school graduates from disadvantaged groups, by dataset and sex: NELS:88 and ELS:2002

	Male		Female	
	NELS:88	ELS:2002	NELS:88	ELS:2002
	(1)	(2)	(3)	(4)
Incremental Effect of HS Athletics for Black Student	0.092	0.136*	0.006	-0.009
	(0.067)	(0.065)	(0.051)	(0.048)
Incremental Effect of HS Athletics for Income Below Poverty Line	0.097*	0.090	0.183***	0.043
	(0.048)	(0.063)	(0.047)	(0.048)
Incremental Effect of HS Athletics for Single-Parent Household	0.115***	0.089**	0.141***	0.098***
	(0.032)	(0.031)	(0.029)	(0.025)
Incremental Effect of HS BB/FB Athletics for Black Student	0.112	0.170*	0.143	-0.013
	(0.069)	(0.068)	(0.073)	(0.071)
Incremental Effect of HS BB/FB Athletics for Income Below Poverty Line	0.130*	0.163*	0.040	-0.025
	(0.053)	(0.073)	(0.060)	(0.086)
Incremental Effect of HS BB/FB Athletics for Single-Parent Household	0.116**	0.090*	0.135**	0.152***
	(0.036)	(0.036)	(0.044)	(0.042)

$^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.
NOTE: Coefficients are estimated using the incremental effect analysis from the OLS regressions with interaction terms and the full set of control variables consistent in this study. Each coefficient is the separate effect of sports plus the product of the effect of the interaction term and disadvantaged indicator. Variables used as controls: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

5.2 Factors Promoting College Attendance: Admission and Scholarships

High school varsity level sports are important activities in college admission considerations. The most elite high school varsity athletes are often recruited into college-level varsity sport

[23]See Appendix Tables C.11, C.13, C.58, and C.60 for full regressions of Table 4.

teams which provide resources for coaching, training, mentoring and exposure to public and alumni networks.

For the NELS:88 dataset, we fit a logit regression on whether students are admitted to their most desired four-year college that they reported in the survey. The NELS:88 dataset shows that for the high school athletes defined in Table 5, there are significantly higher rates of admission by their most desired four-year college compared to their non-athlete peers. There are other key factors of college admissions revealed by the same analysis. Family income, parents' education, and cognitive and non-cognitive skills are all significant determinants of college admission.[24] We lack similar data on admission to first choice schools in the ELS data.

Table 5 Logit Regression: Effects of participating in high school varsity sports on admission by student's most desired four-year college, conditional on having graduated from high school by 1992, by types of sport and college attended: NELS:88

Athlete Type	Admitted by First Choice Four-Year Colleges
High school sophomore basketball/football varsity athlete	0.437***
	(0.068)
High school sophomore non basketball/football varsity athlete	0.395***
	(0.062)

***$p < .01$, **$p < .05$, *$p < .10$.
NOTE: Coefficients are estimated by logit regression. Variables used as controls: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL), Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Robust standard errors in parentheses. Number of observations is rounded to the nearest 10. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000). "Base Year through Fourth Follow-up, Restricted-Use File," 2000.

We next consider the impact of high school participation on receipt of scholarships and attendance in college. We separate our analysis of the marginal effect of an athletic scholarship into two stages. The first stage uses both NELS:88 and ELS:2002 to estimate the probability

[24]See Appendix Table C.95 for the full regression result.

of receiving first-year college scholarships for high school varsity athletes admitted to college. Table 6 shows that it is substantial. We note that both cognitive and non-cognitive skills are important for obtaining these merit-based scholarships.[25]

Table 6 Logit Regression: Effects of participating in high school varsity sports on receiving college scholarships or grants, conditional on being admitted by college, by types of sport and sex: NELS:88 and ELS:2002

	NELS:88			ELS:2002		
Athlete Type	All	Male	Female	All	Male	Female
(1)	(2)	(3)	(4)	(5)	(6)	(7)
High school sophomore basketball/football varsity athlete	0.330***	0.221	0.554***	0.332***	0.221**	0.500***
	(0.103)	(0.138)	(0.170)	(0.084)	(0.110)	(0.137)
High school sophomore non basketball/football varsity athlete	0.064	0.098	0.044	0.091	0.083	0.110
	(0.089)	(0.147)	(0.113)	(0.069)	(0.114)	(0.087)

***$p < .01$, **$p < .05$, *$p < .10$.
NOTE: Coefficients are estimated by logit regression. Variables used as controls: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Scholarships/Grants variable in NELS:88 is defined by parental survey on whether the partial of their children's college expenses will be covered by scholarships or grants. Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

We next show that college-admitted students are more likely to attend college if they receive scholarships or grants. We fit a logit regression on the choice of attending colleges using the same set of control variables conditional on being admitted by at least one college. The estimated marginal effects of scholarship and grants in addition of being admitted to college. Table 7 reports marginal effects on the probability of college attendance for those who receive scholarships or grants. Scholarships reduce the price of attendance for high school graduates. Other key factors affecting the probability of attending college including family income, parents' education, living in an urban area (or not), and cognitive and noncognitive

[25]We do not analyze need-based financial aids like Pell Grants in this study.

skills.

Table 7 Logit Regression: Marginal effects of receiving scholarships or grants on attending four-year colleges, conditional on being admitted by college: NELS:88 and ELS:2002

	NELS:88			ELS:2002		
	All	Male	Female	All	Male	Female
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Scholarships/Grants	0.588***	0.591***	0.604***	1.075***	1.179**	1.003***
	(0.095)	(0.142)	(0.128)	(0.078)	(0.120)	(0.103)

***$p < .01$, **$p < .05$, *$p < .10$.
NOTE: Coefficients are estimated by logit regression. Variables used as controls: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Scholarships/Grants variable in NELS:88 is defined by parental survey on whether the partial of their children's college expenses will be covered by scholarships or grants. Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

6 College Graduation

We next estimate the effect of athletic participation on graduation using the same matching methodology. Among students attending four-year colleges, college varsity athletes have, on average, a statistically higher chance of graduating from college in both the NELS:88 and ELS:2002 data. In NELS, overall positive effects are seen mainly in female college basketball varsity athletes. Male and female athletes in other sports have higher chances of graduating from colleges or obtaining graduate degrees, although the estimated effects are not statistically significant. Other athletes are statistically as well off as their non-athlete peers.

Table 8 Propensity Score Matching: Effects of participating in college sports on obtaining bachelor's degree or higher from 4-year post-secondary education institutions, by types of college sports and sex: NELS:88 and ELS:2002

	NELS:88			ELS:2002		
Athlete Type	All	Male	Female	All	Male	Female
(1)	(2)	(3)	(4)	(5)	(6)	(7)
College varsity athlete	0.093***	0.088***	0.147***	0.042	0.053*	0.011
	(0.030)	(0.030)	(0.039)	(0.027)	(0.032)	(0.029)
College basketball/football varsity athlete	0.122**	0.065	0.207***	-0.041	0.112***	-0.124
	(0.048)	(0.047)	(0.023)	(0.036)	(0.038)	(0.108)
College non-basketball/football	0.047	0.080	0.049	0.046	0.049	0.018
	(0.040)	(0.053)	(0.035)	(0.033)	(0.047)	(0.034)

***$p < .01$, **$p < .05$, *$p < .10$.
NOTE: Coefficients are estimated by propensity score matching following Abadie and Imbens (2016). Variables used for matching: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

6.1 Social Mobility of College Athletes from Disadvantaged Backgrounds Graduating from College

We next study social mobility for college varsity athletes from disadvantaged backgrounds or for minority groups of graduating from four-year colleges. We add an interaction term for college athletic participation and disadvantage status to our OLS regressions. A positive estimated incremental impact indicates that students with disadvantaged backgrounds benefit from participating in varsity sports.

Table 9 compares the estimated effect of college varsity participation on those from disadvantaged backgrounds on graduation from college. Benefits are positive or neutral for all groups, save for ELS female basketball players. There are substantial benefits for children from single-parent households who participate in the NELS survey, but not for the

ELS survey. There is little evidence of adverse outcomes.[26]

Table 9 Incremental effect analysis of participating in college sports on obtaining bachelor's degree or higher from 4-year post-secondary education institutions among 4-year college students from disadvantaged groups, by dataset and sex: NELS:88 and ELS:2002

	Male		Female	
	NELS:88	ELS:2002	NELS:88	ELS:2002
	(1)	(2)	(3)	(4)
Incremental Effect of College Athletics for Black Student	0.039	0.069	0.223	0.041
	(0.108)	(0.097)	(0.138)	(0.103)
Incremental Effect of College Athletics for Income Below Poverty Line	0.034	0.028	0.281	-0.097
	(0.169)	(0.126)	(0.167)	(0.153)
Incremental Effect of College Athletics for Single-Parent Household	0.080	0.002	0.179*	0.032
	(0.068)	(0.058)	(0.079)	(0.058)
Incremental Effect of College BB/FB Athletics for Black Student	0.026	0.078	0.233	0.257*
	(0.112)	(0.109)	(0.219)	(0.119)
Incremental Effect of College BB/FB Athletics for Income Below Poverty Line	0.066	-0.254	0.562***	-0.468***
	(0.222)	(0.251)	(0.052)	(0.062)
Incremental Effect of College BB/FB Athletics for Single-Parent Household	0.158*	-0.022	0.315***	-0.094
	(0.077)	(0.073)	(0.092)	(0.098)

***$p < .001$, **$p < .01$, *$p < .05$.
NOTE: Coefficients are estimated using the incremental effect analysis from the OLS regressions with interaction terms and the full set of control variables consistent in this study. Each coefficient is the separate effect of sports plus the product of the effect of the interaction term and disadvantaged indicator. Variables used as controls: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

6.2 College Intramural Athletes

This section estimates the effect of participating in college intramural sports on four-year college graduation rates. We use propensity score matching with the same set of control variables as used in previous analyses. To avoid double-counting, we exclude college students who were both varsity and intramural athletes and just compare intramural athletes with their non-athlete peers.

Table 10 shows the estimated effects of participating in college intramural sports on college graduation rate by types of sport and by gender. We perform the same analysis for

[26]See Appendix Tables C.36, C.40, C.82, and C.86 for full regressions of Table 9.

both NELS:88 and ELS:2002 respectively. In summary, we find that both male and female non-basketball and football intramural athletes are more likely to graduate from colleges in both datasets, while we find basketball and football intramural athletes more likely to graduate from colleges in NELS:88 only.

Table 10 Propensity Score Matching: Effects of participating in college intramural sports on obtaining bachelor's degree or higher from 4-year post-secondary education institutions, by types of college intramural sports and sex: NELS:88 and ELS:2002

	NELS:88			ELS:2002		
Athlete Type	All	Male	Female	All	Male	Female
(1)	(2)	(3)	(4)	(5)	(6)	(7)
College intramural athlete	0.106***	0.188***	0.097***	0.057***	0.105***	0.051*
	(0.023)	(0.029)	(0.032)	(0.020)	(0.028)	(0.026)
College basketball/football intramural athlete	0.252***	0.223***	0.216*	-0.030	0.052	-0.001
	(0.074)	(0.056)	(0.123)	(0.050)	(0.051)	(0.063)
College non basketball/football intramural athlete	0.116***	0.168***	0.074**	0.096***	0.141***	0.065**
	(0.020)	(0.030)	(0.033)	(0.022)	(0.035)	(0.030)

$^{***}p < .01$, $^{**}p < .05$, $^{*}p < .10$.
NOTE: Coefficients are estimated by propensity score matching following Abadie and Imbens (2016). College intramural athlete categories exclude college students who were both varsity and intramural athletes. Variables used for matching: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

7 Earnings After Departing School

The final stage of our analyses considers post-schooling earnings of student-athletes compared to non-athlete students using the same matching methodology (Table 11). We consider four-year college graduates, high school graduates who do not go on to college and high school dropouts. For NELS:88, both male and female college varsity athletes earn statistically

higher wages than their peers. For ELS:2002, the benefits are concentrated on female college varsity athletes while male college basketball and football varsity athletes are better off than their non-athlete peers. We do not find that any subgroup is worse off than their peers.

Table 11 Propensity Score Matching: Effects of participating in college sports on logarithmic annual income conditional on full-time working status and attended 4-year post-secondary education institutions, by types of sports and sex: NELS:88 and ELS:2002

	NELS:88			ELS:2002		
Athlete Type	All	Male	Female	All	Male	Female
(1)	(2)	(3)	(4)	(5)	(6)	(7)
College varsity athlete	0.062*	0.092**	0.104**	0.082**	0.042	0.183***
	(0.037)	(0.045)	(0.042)	(0.042)	(0.056)	(0.053)
College basketball/football varsity athlete	0.124*	0.079	0.011	0.119*	0.130*	0.276***
	(0.068)	(0.066)	(0.046)	(0.067)	(0.076)	(0.065)
College non basketball/football	0.082*	0.002	0.072	0.127**	-0.023	0.153**
	(0.049)	(0.073)	(0.068)	(0.061)	(0.066)	(0.061)

***$p < .01$, **$p < .05$, *$p < .10$.
NOTE: Coefficients are estimated by propensity score matching following Abadie and Imbens (2016). Variables used for matching: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

7.1 Post-Schooling Income of Athletes from Disadvantaged Backgrounds

We next study impacts of athletic participation on college varsity athletes from disadvantaged or minority backgrounds using the same interaction strategy as previously used. The incremental effect of sports on earnings for these students is estimated by interacting with an athletic participation variable and a measure of disadvantage.

Table 12 presents and compares the estimated effect of college varsity athletes from disadvantaged backgrounds on post-graduate earnings in the two datasets. Female varsity athletes

from low income families earn wage premiums in both datasets. Black male college varsity athletes and male college varsity athletes from low-income families in the NELS:88 data have higher post-graduate earnings compared to their non-athlete peers. The results suggest that participating in college varsity sports promotes social mobility among the disadvantaged groups, conferring higher earnings. There is no evidence of adverse outcomes.[27]

Table 12 Incremental effect analysis of participating college sports on logarithmic annual income among disadvantaged groups, by dataset and sex: NELS:88 and ELS:2002

	Male		Female	
	NELS:88	ELS:2002	NELS:88	ELS:2002
	(1)	(2)	(3)	(4)
Incremental Effect of College Athletics for Black Student	0.208*	0.246	0.214	0.137
	(0.096)	(0.178)	(0.113)	(0.261)
Incremental Effect of College Athletics for Income Below Poverty Line	0.569**	0.174	0.401***	0.638*
	(0.208)	(0.270)	(0.116)	(0.260)
Incremental Effect of College Athletics for Single-Parent Household	0.118	0.103	0.103	0.168
	(0.096)	(0.115)	(0.109)	(0.142)
Incremental Effect of College BB/FB Athletics for Black Student	0.233*	0.083	0.227	0.315
	(0.095)	(0.201)	(0.164)	(0.328)
Incremental Effect of College BB/FB Athletics for Income Below Poverty Line	0.570**	0.178	0.453***	0.609***
	(0.205)	(0.408)	(0.050)	(0.078)
Incremental Effect of College BB/FB Athletics for Single-Parent Household	0.133	0.034	-0.122	0.450**
	(0.127)	(0.165)	(0.174)	(0.143)

$^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.
NOTE: Coefficients are estimated using the incremental effect analysis from the OLS regressions with interaction terms and the full set of control variables consistent in this study. Each coefficient is the separate effect of sports plus the product of the effect of the interaction term and disadvantaged indicator. Variables used as controls: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

7.2 Post-Graduate Earnings for College Intramural Athletes

We further analyze the effect of participating in college intramural sports on post-graduate earnings. We use the same propensity score matching method with the same set of control variables as previously used. To avoid double-counting, in these analyses we exclude college

[27]See Appendix Tables C.44, C.48, C.90, and C.94 for full regressions of Table 12.

students who were both varsity and intramural athletes and using intramural level only athletes versus their non-athlete peers.

Table 13 shows the estimated effects of participating in college intramural sports on post-graduate earnings by types of sport and by sex. We perform the same analysis with both NELS:88 and ELS:2002 respectively. In summary, we find female non-basketball and football intramural athletes earn wage premiums in both datasets. We also find that female and male basketball and football intramural athletes earn wage premiums in both NELS:88 and ELS:2002.

Table 13 Propensity Score Matching: Effects of participating in college intramural sports on logarithmic annual income conditional on full-time working status and attended 4-year post-secondary education institutions, by types of college intramural sports and sex: NELS:88 and ELS:2002

	NELS:88			ELS:2002		
Athlete Type	All	Male	Female	All	Male	Female
(1)	(2)	(3)	(4)	(5)	(6)	(7)
College intramural athlete	0.081**	0.046	0.122***	0.106***	0.028	0.103**
	(0.032)	(0.040)	(0.038)	(0.036)	(0.055)	(0.042)
College basketball/football intramural athlete	0.119***	-0.097	0.289*	0.066	0.210**	0.037
	(0.032)	(0.122)	(0.170)	(0.089)	(0.096)	(0.076)
College non basketball/football intramural athlete	0.089***	0.046	0.142***	0.093***	0.019	0.134***
	(0.030)	(0.040)	(0.034)	(0.036)	(0.059)	(0.051)

***$p < .01$, **$p < .05$, *$p < .10$.
NOTE: Coefficients are estimated by propensity score matching following Abadie and Imbens (2016). College intramural athlete categories exclude college students who were both varsity and intramural athletes. Variables used for matching: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

7.3 Earnings for School Dropout Athletes

We also study the earnings of athletes who drop out of school or choose not to attend post-secondary education. We estimate the effect of participating in scholastic athletics on earnings for three groups: high school varsity athletes who drop out of high school, high school varsity athletes who graduate from high school but do not attend post-secondary education, and college varsity athletes who do not finish college.[28] We use the same matching methodology comparing these school dropout athletes with their non-athlete dropout peers at the same educational level. In general, participation in scholastic athletics benefited or made participants no worse off than their peers in terms of later estimated earnings.

Table 14 presents our results. In NELS:88, male high school varsity athletes who graduated from high school earn more than non-athlete high school graduates who did not attend post-secondary education. In ELS:2002 female college varsity athletes who didn't finish college earn more than their non-athlete peers who also did not finish college. Only female high school varsity athlete who drop out of high school in NELS:88 earn less than their peers, but we find no other group is worse off than their peers. This analysis focuses on a small subgroup of our sample, and does not change our conclusion that scholastic athletics as a whole promotes lifelong benefits and is a vehicle for social mobility.

[28]The time frame of the survey limits our ability to track if participants ever finished college, though they are tracked until their mid-20s.

Table 14 Propensity Score Matching: Effects of participating in scholastic athletics on logarithmic annual income conditional on full-time working status and levels of education, by types of athletes and sex: NELS:88 and ELS:2002

	NELS:88			ELS:2002		
Athlete Type	All	Male	Female	All	Male	Female
(1)	(2)	(3)	(4)	(5)	(6)	(7)
High school varsity athlete:	-0.185	-0.106	-0.549*	-0.039	0.012	-0.149
No high school degree	(0.114)	(0.098)	(0.313)	(0.180)	(0.215)	(0.709)
High school varsity athlete:	0.157***	0.132**	0.061	-0.191	-0.095	-0.315
High school degree, no PSE	(0.057)	(0.054)	(0.129)	(0.136)	(0.133)	(0.346)
College varsity athlete:	0.004	0.043	-0.046	0.230**	0.096	0.276***
No college degree	(0.103)	(0.049)	(0.305)	(0.106)	(0.074)	(0.084)

***$p < .01$, **$p < .05$, *$p < .10$.
NOTE: Coefficients are estimated by propensity score matching following Abadie and Imbens (2016). Variables used for matching: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

8 Outcomes for College Athletes in Major NCAA Division I Conferences

In past popular literature claimed that student-athletes got little benefit in return for competing Division I sports.[29] The fact that many students were able to enroll at top universities, with scholarships covering most if not all of expenses over time, and emerging debt-free is ignored, as are tutoring and mentoring, which assists student-athletes in maintaining good GPAs and progression to their degrees (in line with eligibility requirements) to maintain scholarships and stay in school.[30]

[29] See Nocera and Strauss (2018).

[30] Discussions about "pay-for-play," revenue sharing or NIL earnings are not part of the scope of this paper, which focuses on the broader educational-related outcomes for student-athletes derived from participation in scholastic athletics.

In this section of the paper, we present evidence on the educational and labor outcomes of intercollegiate athletes at NCAA Division I and FBS colleges. These groups include member schools of the current Power 4 conferences. We estimate social mobility in terms of college graduation and post-graduate earnings of varsity student athletes.

The incremental effect of varsity sports in these categories on college graduation is measured by interacting athletic participation status by an indicator of attending NCAA Division I and FBS college. A positive interaction indicates that varsity athletes at major sports schools benefit from participating in varsity sports above and beyond the general positive effect of participation in college sports.

Table 15 presents estimates of participation in varsity athletics at NCAA Division I and FBS college on college graduation rates for two datasets by sex. First, we show that in the NELS:88, both male and female basketball and football varsity athletes at NCAA Division I college have higher college graduation rates than their non-athlete peers at sports schools. Second, in the ELS:2002, male varsity athletes at NCAA Division I college are more likely to graduate compared to non-athlete peers. The results suggest that participating in varsity sports at NCAA Division I overall and at FBS schools, in particular, promotes social mobility. *In no case is there evidence of harm from athletic participation.*[31]

[31]See Appendix Tables C.35, C.39, C.81, and C.85 for full regressions of Table 15.

Table 15 Incremental effect analysis of participating in college sports on obtaining bachelor's degree or higher from NCAA Division I and FBS college, by dataset and sex: NELS:88 and ELS:2002

	Male		Female	
	NELS:88	ELS:2002	NELS:88	ELS:2002
	(1)	(2)	(3)	(4)
Incremental Effect of College Athletics for Division I Students	0.061	0.085*	0.055	0.006
	(0.038)	(0.036)	(0.041)	(0.038)
Incremental Effect of College Athletics for FBS Students	0.041	0.021	0.048	0.012
	(0.057)	(0.052)	(0.058)	(0.049)
Incremental Effect of College BB/FB Athletics for Division I Students	0.096*	0.085	0.144**	-0.037
	(0.047)	(0.053)	(0.048)	(0.107)
Incremental Effect of College BB/FB Athletics for FBS Students	0.063	-0.025	0.148	-0.038
	(0.069)	(0.081)	(0.083)	(0.154)

***$p < .001$, **$p < .01$, *$p < .05$.
NOTE: Coefficients are estimated using the incremental effect analysis from the OLS regressions with interaction terms and the full set of control variables consistent in this study. Each coefficient is the separate effect of sports plus the product of the effect of the interaction term and NCAA Division I and FBS college indicator. NCAA Division I college category includes NCAA FBS colleges. Variables used as controls: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

Table 16 estimates the benefits of participation in varsity athletics at NCAA Division I and FBS college on post-graduate earnings compared to the outcomes of non-athletes. We show that in NELS:88, male basketball and football varsity athletes at both NCAA Division I and FBS colleges have higher earnings after graduation than non-athlete peers at these schools. The results suggest participating in varsity sports at these elite sports schools promotes social mobility. There is no statistically significant evidence of harm.[32]

[32]See Appendix Tables C.43, C.47, C.89, and C.93 for full regressions of Table 16.

Table 16 Incremental effect analysis of participating in college sports on logarithmic annual income among NCAA Division I and FBS college students, by dataset and sex: NELS:88 and ELS:2002

	Male		Female	
	NELS:88	ELS:2002	NELS:88	ELS:2002
	(1)	(2)	(3)	(4)
Incremental Effect of College Athletics for Division I Students	0.199**	0.125	0.026	0.108
	(0.065)	(0.066)	(0.067)	(0.093)
Incremental Effect of College Athletics for FBS Students	0.129	0.076	0.082	0.044
	(0.090)	(0.099)	(0.104)	(0.143)
Incremental Effect of College BB/FB Athletics for Division I Students	0.243***	0.176	-0.078	0.204
	(0.069)	(0.091)	(0.095)	(0.194)
Incremental Effect of College BB/FB Athletics for FBS Students	0.215**	0.123	-0.130	-0.073
	(0.079)	(0.130)	(0.134)	(0.304)

***$p < .001$, **$p < .01$, *$p < .05$.
NOTE: Coefficients are estimated using the incremental effect analysis from the OLS regressions with interaction terms and the full set of control variables consistent in this study. Each coefficient is the separate effect of sports plus the product of the effect of the interaction term and NCAA Division I and FBS college indicator. NCAA Division I college category includes NCAA FBS colleges. Variables used as controls: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

9 Summary

Table 17 summarizes our findings for high school graduation, college attendance, college graduation and post-college wages.

Table 17 Outcomes of High School Varsity Athletics and Intercollegiate Varsity Athletics Compared to Non-Athlete Students, by dataset and sex: NELS:88 and ELS:2002

	Effects of High School Varsity Athletics		**Effects of Intercollegiate Varsity Athletics**	
Source	**HS Graduation**	**Attending a Four-Year Post-Secondary Institution**	**Earning a Bachelor's Degree or Higher**	**Wages**
NELS				
Male	0.071***	0.124***	0.088***	0.092**
	(0.010)	(0.019)	(0.030)	(0.045)
Female	0.048***	0.098***	0.147***	0.104**
	(0.009)	(0.018)	(0.039)	(0.042)
ELS				
Male	0.048***	0.092***	0.053*	0.042
	(0.011)	(0.020)	(0.032)	(0.056)
Female	0.020*	0.104***	0.011	0.183***
	(0.008)	(0.017)	(0.029)	(0.053)

***$p < .01$, **$p < .05$, *$p < .10$.
NOTE: Coefficients obtained from Tables 1, 3, 8, and 11. Coefficients are estimated by propensity score matching following Abadie and Imbens (2016). Variables used for matching: Single-Parent Household, Family Income, Number of Siblings, Father Education, Mother Education, Urban Location, Black - not Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino. Cognitive and non-cognitive measures for NELS:88: Cognitive Ability (Z-Score), Locus of Control, Self Concept, Non-Cognitive Ability (EXTERNAL). For ELS:2002: Cognitive Ability (Z-Score), Action Control: General Effort and Persistence Scale, Control Expectation Scale, Instrumental Motivation: Utility Interest Scale, Non-Cognitive Ability (EXTERNAL). Standard errors in parentheses. Race categories exclude Hispanic origin unless specified.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Base Year through Fourth Follow-up, Restricted-Use File," 2000. U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), "Base Year through Third Follow-up, Restricted-Use File," 2012.

Controlling for a rich variety of traits and background variables, Table 17 shows that, on average, participation in scholastic athletics benefits participants, especially those from disadvantaged backgrounds. On average, it never harms them. There are no adverse academic or labor market outcomes for students participating in intercollegiate basketball and football in NCAA Division I or FBS schools. To the extent that intercollegiate athletic scholarships provide incentives and paths to educational and athletic opportunities otherwise limited or unavailable for such students, participation in athletics offers a vehicle for social mobility.

The far richer data we have on family backgrounds, individual abilities and personality traits allow us to effectively estimate counterfactual outcomes for student-athletes. We go far beyond the low levels of analysis reported in articles or popular press that rely on simplistic statistics or anecdotes.

More generally, participation in athletics is beneficial (or not harmful) to high school or

college athletes and at all levels of participation: varsity or intramural. Going forward, data, not anecdotes, should drive the discussion of the benefits of athletic participation and its role in promoting social mobility for hundreds of thousands of student-athletes each year.

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