The Impact of Participation in Intercollegiate Athletics on Income and Graduation

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directly affect price may create larger welfare losses than previous studies suggest.[10] More generally, this paper implies that researchers may need to control for differences in quality among the various models of a heterogeneous good (an inherently subjective task) if they wish to obtain accurate estimates of the demand for such a good.

[10] Such policies may also lead producers to change the physical characteristics (and, presumably, the quality) of their products; see Feenstra (1988).

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THE IMPACT OF PARTICIPATION IN INTERCOLLEGIATE ATHLETICS ON INCOME AND GRADUATION

James E. Long and Steven B. Caudill*

Abstract—Males who participated in intercollegiate athletics are estimated to receive 4% higher annual incomes than similar non-athletes. No such income premium associated with college athletics is revealed among females. Both male and female athletes who attended colleges and universities in the early 1970s had higher graduation rates than other students. Since the models used to estimate income and graduation differentials included many measurable determinants of labor market and academic outcomes, these findings suggest that athletic participation may enhance the development of discipline, confidence, motivation, a competitive spirit, or other subjective traits that encourage success.

I. Introduction

During recent years criticism of college athletics seems to have increased at a rate perhaps even greater than the growth in the annual number of televised intercollegiate football, basketball, and baseball games. The most recent stimulus to the "academics versus athletics" debate came in the form of an NCAA-funded \$1.75 million study of "the effects of participation in intercollegiate athletics" (Sullivan, 1989). The study conducted by the American Institutes for Research (1988) found that college athletes have lower grade point averages and more psychological, physical, and alcohol- and drug-related problems than other students involved in time-demanding extracurricular activities. Furthermore, the report suggested that athletes are less likely to accept leadership roles or to assume responsibility for other persons.

In this paper we offer a different insight into the consequences of participation in varsity athletics at the college level. Using a data base containing information on the athletic participation of individuals while in college and their labor market activity a decade after the freshman year, we empirically estimate the impact of college athletics on individual income. We also investigate an issue frequently raised in current discussions of college athletics, namely, the view that a disproportionately large number of athletes fail to graduate from college. These and related issues were not addressed in the NCAA study because it collected

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data for a single point in time (the academic year 1987–88). However, some longitudinal data (described below) presently exist to investigate these questions, although our data provide fewer details about athletic participation than may ultimately be available (in the mid-1990s or later) in follow-up surveys of students in the NCAA study.

A brief discussion of the potential effects of athletic participation on labor market success follows in the next section. Section III describes the data and econometric procedure used in the analysis, and estimates of the athletics–income relationship are reported in section IV. The impact of athletic participation on college graduation is examined in section V. Concluding comments follow in the final section.

II. Potential Impacts of Athletic Participation on Income

The Becker (1965) allocation-of-time model is one framework for analyzing the effects of athletic participation on income. Assume that college students can allocate the total amount of time available to three distinct activities: academics, athletics, and leisure. Current discussions of the athletics-versus-academics issue stress the inordinate amount of time athletes must devote to athletic activities such as training, practice, meetings, games, and travel. Because time is limited, college athletes may allocate less time to academic activities such as attending class, studying, and completing homework than other students. Based on evidence indicating that participation in college athletics adversely affects grades, the NCAA's Presidents Commission has recommended reductions in practice time and limits on the number and timing (not during exams, for instance) of games in certain sports (Sullivan, 1989). While the motivation for such recommendations is understandable, there is not necessarily a tradeoff between academic and athletic activity. Instead, college athletes may consume or participate in fewer leisure activities (sleeping, social interaction and recreation, non-athletic extracurricular pursuits) than non-athletes. However, if athletic participation does reduce academic activity and result in lower labor market productivity for athletes than other students, then the human capital view (Becker, 1975) suggests a negative relationship between athletic participation and individual income.

Investment in human capital is not restricted to schooling and formal education, so an alternative prediction of the effect of athletic participation on individual income emerges from the human capital perspective. Although earnings and academic success (in terms of grades) are positively related (James et al., 1989; Jones and Jackson, 1990), athletes may acquire other traits which increase earning power. Participation in college athletics may enhance self-control, perseverance and discipline, and may prepare the future employee to follow orders and cooperate in "team" production which increases efficiency (Alchian and Demsetz, 1972). Athletes may develop exercise, eating, and drinking habits that lead to better health and earnings potential than non-athletes. Lastly, varsity athletes may have relatively more "competitive" drive that ultimately results in greater career accomplishments, other things the same.

The impact of athletic participation on income can also be considered in the context of screening or signaling in the labor market (Stiglitz, 1975; Spence, 1973). If, on average, varsity athletes are perceived to have acquired inferior academic skills in college, then when making personnel decisions employers may give preferential treatment to non-athletes. Conversely, this statistical discrimination might work in favor of athletes. For example, if participation in college athletics constitutes a signal of ambition, competitive drive, dedication to work, team loyalty, and so forth, then varsity athletes may have an edge over other persons in hiring and promotion choices. A related form of signaling is analogous to the advertising benefits of big-time athletics described by McCormick and Tinsley (1987). The reputation of athletes may enhance their earnings and careers in lines of work involving extensive contact with the public, such as automobile sales, insurance, and real estate.

III. Data and Econometric Technique

In 1971 over 10,000 freshmen entering 487 American colleges and universities were extensively interviewed as part of a continuing study of higher education by the American Council on Education. The same individuals were reinterviewed in 1980 in order to determine their perceptions about the college training they received, their experiences and activities during college, and other information including their annual incomes in 1980.[1] For the purposes of this study, an individual who participated in college athletics (*ATHLETE*) is identified by a dichotomous variable equal to 1 if a varsity letter was earned in a college sport, and 0 otherwise. The survey does not indicate the specific sport (such as football) in which the athlete lettered, nor does it reveal the number of years of participation in college athletics. To the extent that not all participants receive varsity letters, the variable *ATHLETE* measures athletic success or perseverance rather than mere participation in college athletics.

[1] Details of these surveys, known as the Cooperative Institutional Research Programs (CIRP) surveys, can be found in Astin (1982).

The sample used to estimate the relationship between athletic participation and income contained 9,787 individuals (4,394 males and 5,393 females).[2] Over 15% of the males (674) were varsity lettermen, and about 5% of the females (243) were college athletes. More than half (52%) of the males, and an even higher percentage (59%) of the male athletes, reported that they attended colleges and universities having total enrollment of 1,000 to 4,999 students. Only 13% of the males and 5% of the male athletes attended institutions having 10,000 or more students. These facts indicate that the majority of male varsity athletes contained in the sample did not come from schools participating in big-time college athletics. The distribution of females according to college enrollment size was comparable to that for males.

The income equation estimated with the data contained the variable *ATHLETE* and numerous independent variables measuring personal characteristics, educational and academic achievements, and college and employment characteristics. In the interest of brevity, descriptions and statistics for these variables are relegated to an appendix available from the authors. However, we wish to call attention to several explanatory variables that were included to control for sample deficiencies and possible sources of econometric bias. First, since the dependent variable is annual income but data on annual hours worked are not reported, *PARTTIME*, *MARRIED*, *CHILDREN*, and *FAMILY* were included as controls for the amount of work activity and labor force commitment. Second, the income equation included *ACT*, *CGRADES*, *DRIVE*, *SUCCEED*, and *WELLOFF* to minimize the possibility that the estimated relationship between athletic participation and labor market success is biased (or even spurious) due to differences between athletes and non-athletes in innate ability, drive, motivation, entrepreneurship, or related factors.

Because the survey reported the dependent variable in terms of income intervals, ordinary least squares estimation (using interval midpoints as income values) would produce biased and inconsistent estimates of the income equation.[3] Consequently, the income equation was estimated using an alternative method of maximum likelihood proposed by Nelson (1975).[4]

IV. Empirical Results

Maximum likelihood estimates of the income model, obtained separately for males and females, are presented in table 1. In the male equation the coefficient of *ATHLETE* is \$652 and is highly significant. This estimate implies that, early in his labor market career, the male college athlete enjoys about a 4% income advantage over comparable individuals who did not participate in varsity athletics during college. In the income equation for females, the *ATHLETE* variable has a much smaller positive coefficient (\$299) but it is not statistically different from zero. The non-athletic variables generally perform as expected on the basis of other analyses of the determinants of individual income or earnings. For instance, the positive and statistically significant coefficients of the college grades, enrollment size, and private school variables are consistent with results recently reported by James et al. (1989), which were also based on a sample of individuals who had been out of college for a fairly short time.

A number of alternative specifications of the income model were estimated but none yielded results that differed substantially from those reported in table 1.[5] For example, when *DRIVE* was omitted the *ATHLETE* coefficient for males increased to \$786 (t = 2.57), which is consistent with the view that male

[2] The entire sample contained 10,326 persons, but 539 did not report their income in 1980.

[3] The bias results because the error terms in the model no longer have zero expectation. Caudill (1991) has shown that the bias is not large when the intervals are exhaustive and of equal length, but our data contained an open-ended income interval.

[4] In this model, the unobserved dependent variable, y^*, is assumed to be normally distributed with mean XB and variance σ^2, thus

$$y_i^* = X_iB + \epsilon_i.$$

Let the entire real line be partitioned so that

$$\cdots < L_{i-1} < L_i < L_{i+1} < \cdots,$$

and assume that only the income interval in which y_i^* lies is known. Then if individual i's income falls between L_i and L_{i-1}, or $L_{i-1} \le y_i^* \le L_i$, it implies that

$$(L_{i-1} - X_iB)/\sigma \le (y_i^* - X_iB)/\sigma \le (L_i - X_iB)/\sigma.$$

The probability of this event can be written

$$P_i(L_{i-1} \le y_i^* \le L_i) = F((L_i - X_iB)/\sigma) - F((L_{i-1} - X_iB)/\sigma)$$

where $F(\cdot)$ is the cumulative distribution function of the standard normal. The likelihood function is the product of probabilities like those above, and is given by

$$L = \prod_{i=1}^{n} P_i.$$

The logarithm of this likelihood function can be maximized for choices of B and σ. The algorithm used in the estimation is that described in Berndt et al. (1974).

[5] Besides the different specifications described in the text, we also estimated income equations that (1) contained dummy variables for the absence of children, (2) included enrollment size category dummy variables, and (3) measured college grades with separate dummy variables for letter grade averages (A, B, C, etc.).

TABLE 1.—MAXIMUM LIKELIHOOD ANALYSIS OF ANNUAL INCOME OF COLLEGE GRADUATES

Explanatory Variable	Males (1)	Females (3)
ATHLETE	652	299
	(2.21)	(.79)
BLACK	−1,032	1,030
	(−3.16)	(4.13)
MARRIED	1,457	−507
	(6.28)	(−2.86)
CHILDREN	761	−1,596
	(4.73)	(−13.90)
VETERAN	1,310	3,923
	(1.97)	(1.30)
SELFEMP	−412	−470
	(−1.11)	(−1.12)
PARTTIME	−6,858	−4,168
	(−15.92)	(−14.88)
FAMILY	12	−1,235
	(.04)	(−6.95)
FIRMSIZE	901	1,054
	(14.35)	(23.88)
ACT	35	24
	(1.27)	(1.36)
CGRADES	302	308
	(2.80)	(3.87)
BACHELORS	288	1,248
	(1.00)	(6.00)
MASTERS	1,704	2,635
	(4.27)	(9.08)
PHDPROF	2,099	5,202
	(3.44)	(10.41)
PRIVATE	560	225
	(1.98)	(1.06)
COLLSIZE	217	154
	(3.26)	(3.17)
MIDWEST	325	255
	(1.23)	(1.33)
SOUTH	−668	47
	(−1.95)	(.20)
WEST	526	765
	(1.79)	(3.43)
DRIVE	1,814	1,092
	(8.06)	(5.98)
SUCCEED	1,312	119
	(4.93)	(.42)
WELLOFF	751	886
	(2.61)	(3.21)
CONSTANT	3,729	2,794
	(3.68)	(4.48)
CHI-SQUARE	1,630	2,581
n	4,394	5,393

Note. *t*-values are in parentheses. The equations also include dummy variables for college major and current occupation.

athletes have more drive and motivation than other individuals. Dropping the advanced degree variables (*MASTERS*, *PHDPROF*) resulted in *ATHLETE* coefficients of \$701 ($t = 2.30$) for males and \$311 ($t = 0.91$) for females. In no case did the estimates reveal a statistically significant relationship between athletic participation and female income. The idea that athletics generates "business contacts" may explain why the results are different for females.

The distribution of individuals by college enrollment size makes it unlikely that the positive coefficient of *ATHLETE* results from the inclusion of several unusually high-paid professional athletes in the male sample, since most (but not all) college athletes that star in the professional leagues attended larger colleges and universities. But even if professional athletes were included in the sample, their impact on the estimated parameters of the income equation would be mitigated by the interval nature of the dependent variable.[6] It is possible that the positive athletics-income relationship uncovered by equation (1) results because athletic participation is not truly exogenous. We tested for endogeneity using high school athletic participation as an instrument for college athletic participation in a variant of the Hausman test proposed by Dubin and McFadden (1980). The null hypothesis could not be rejected at the 0.05 level. Absent strong evidence that collegiate athletic participation is endogenous, we did not estimate a participation equation.

In summary, the evidence of a positive income effect of collegiate athletic participation is consistent with the views that athletics produces personal traits or behavior patterns which enhance labor market productivity, or that athletes acquire reputations that increase employer demand for their services off the playing field. Since few (if any) of the athletes in the sample were college superstars in high-profile sports (like football or basketball) at major schools, the "productivity" explanation is probably more plausible than the "reputation" rationale for higher incomes among athletes than other individuals.

V. Athletic Participation and College Graduation

Some of the calls for reforming intercollegiate athletics stem from the notion that athletic participation

[6] In the 1980 follow-up survey individuals were asked to indicate in which of 42 occupations they were currently employed, with "other" and "undecided" listed as two additional choices. "Professional athlete" did not appear among the 42 categories, so any such individuals interviewed in the survey must be assumed to be classified in the "other" category. The coefficient of the dummy variable for this category in equation (1) indicated only a \$2,349 ($t = 3.92$) income advantage relative to the base group, elementary and secondary school teachers. Consequently, it is unlikely that any highly paid professional athletes appeared in the sample.

TABLE 2.—LOGIT ANALYSIS OF COLLEGE GRADUATION

Explanatory Variable	Males (1)	Females (2)
ATHLETE	0.3610	0.8835
	(2.73)	(3.56)
BLACK	−0.1029	0.3260
	(−0.83)	(2.86)
HSGRADES	0.2505	0.2542
	(8.72)	(9.32)
ACT	0.0516	0.0361
	(5.53)	(4.35)
EXPDEGREE	−0.7602	−1.3214
	(−4.63)	(−10.14)
PARINC	0.0119	0.0219
($1,000s)	(2.32)	(4.49)
PAREDUC	−0.2005	−0.3083
	(−2.13)	(−3.64)
YRSCOMP	0.6312	0.6688
	(24.85)	(27.35)
DRIVE	0.4898	0.1352
	(4.64)	(1.30)
SUCCEED	−0.3697	−0.0846
	(−3.10)	(−0.56)
WELLOFF	−0.0157	−0.0337
	(−0.14)	(−0.24)
Constant	−3.7241	−3.6503
	(−14.61)	(−14.79)
Chi-square	1,489	1,920
n	4,606	5,720

Note. t-values are in parentheses.

hinders graduation. We investigated this possibility by estimating a logistic probability model of college graduation. The dependent variable assumed a value of one if the individual had obtained a bachelor's degree by the time of the 1980 follow-up survey, and zero otherwise. The independent variables included athletic participation, race, high school grades, college admission test score, years of college attendance, parental income and education, drive, and career and degree aspirations.

The empirical estimates of the graduation equation are reported in table 2. In equation (1) the *ATHLETE* coefficient is positive and highly significant, which reveals that male varsity athletes have a higher probability of graduating from college than non-athletes. Holding constant other determinants of graduation, athletic participation is estimated to raise the graduation probability of males by approximately 4%.[7] For females as well, athletic participation is associated with an increase in the probability of obtaining a college degree. Because the graduation model included controls or proxies for years of college attendance, innate ability, motivation and drive, the likelihood that the positive coefficient of *ATHLETE* is simply a statistical artifact should be minimized (although not eliminated). Most of the non-athletic explanatory variables are statistically significant and perform as expected in each equation. Some interesting sex differences in the determinants of college graduation are revealed by the insignificance of *BLACK* in the male equation and *DRIVE* and *SUCCEED* in the female equation.

The positive coefficient of *ATHLETE* in the graduation equation contrasts with the common perception that a high proportion of college athletes never graduate. It may be that this perception exists because of excessive publicity received by a few well-known, big-time college football and basketball programs. Nonetheless, even if raw (unadjusted) statistics indicated a lower graduation rate among athletes than other students, this fact would not necessarily be inconsistent with our findings, since table 2 reveals that athletic participation is just one of many variables that affect college graduation. Furthermore, it is not illogical to expect that, whatever the income-enhancing individual characteristics or qualities resulting from athletic participation are, such factors also increase the probability of graduation.

VI. Conclusions

Early in their labor market careers, at around the ages of 28 to 30, males who participated in intercollegiate athletics were estimated to receive 4% higher incomes in 1980 than similar non-athletes. No such income premium associated with college athletics was observed among females. Both male and female athletes who attended colleges and universities in the early 1970s had higher graduation rates than other students. Since the models used to estimate income and graduation differentials included many measurable determinants of labor market and academic outcomes, these findings suggest that athletic participation may enhance the development of discipline, confidence, motivation, a competitive spirit, or other subjective traits that encourage success.

To our knowledge data are not currently available to determine whether today's athletes, especially those attending major universities, enjoy the same labor market and graduation success as athletes who played for smaller colleges and universities in the early 1970s. Hopefully, data will be collected in the future to update this analysis and to investigate whether the impact of college athletes on labor market success varies by sport (e.g., football versus swimming) and by size of institution.

[7] The 4% differential is computed by comparing the two predicted probabilities of college graduation that result from first evaluating equation (1) at sample means but ignoring the *ATHLETE* coefficient in the calculation, and then adding 0.3610 to the value obtained in the first step above.

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APPENDIX

TABLE A1.—VARIABLE DEFINITIONS

ATHLETE	1 if won varsity letter in college; 0 otherwise.
BLACK	1 if Black, Negro, or Afro-American; 0 otherwise.
HSGRADES	Average high school grades: 1 = D, 2 = C, 3 = C +, 4 = B −, 5 = B, 6 = B +, 7 = A −, 8 = A or A +.
ACT	Score on the American College Test.
EXPDEGREE	1 if does not aspire to receive a Bachelor's degree or higher, at the time of entering college; 0 otherwise.
PARINC	Parent's annual income before taxes in 1970.
PAREDUC	1 if parents are not college graduates; 0 otherwise.
YRSCOMP	Number of academic years of college completed.
PRIVATE	1 if attended private college or university; 0 otherwise.
MAJORs	Eleven dichotomous variables indicating major field of study during college.
MARRIED	1 if married; 0 otherwise.
CHILDREN	Number of children
VETERAN	1 if veteran; 0 otherwise.
SELFEMP	1 if self-employed; 0 otherwise.
PARTTIME	1 if employed part-time on current job; 0 otherwise.
FIRMSIZE	Number of employees in organization employed by: 1 = work alone; 2 = 2 to 9; 3 = 10 to 99; 4 = 100 to 999, 5 = 1,000 to 9,999; 6 = 10,000 to 24,999; 7 = 25,000 or more.
CGRADES	Average undergraduate college grades: 1 = D or less, 2 = D + or C −, 3 = C, 4 = C + or B −, 5 = B or B +, 6 = A − or more.
BACHELORS	1 if holds bachelors degree; 0 otherwise.
MASTERS	1 if holds masters degree; 0 otherwise.
PHDPROF	1 if holds doctorate or advanced professional degree; 0 otherwise.
COLLSIZE	Total enrollment of college or university entered in 1971: 1 = less than 250; 2 = 250 to 499; 3 = 500 to 999; 4 = 1,000 to 1,499; 5 = 1,500 to 1,999; 6 = 2,000 to 4,999; 7 = 5,000 to 9,999; 8 = 10,000 to 19,999; 9 = 20,000 or more.
MIDWEST	1 if college located in midwest region; 0 otherwise.
SOUTH	1 if college located in south region; 0 otherwise.
WEST	1 if college located in west region; 0 otherwise.
OCCUPATIONs	Sixteen dichotomous variables indicating current occupation.

FAMILY	1 if sample respondent reports that "raise a family" is an essential goal and value; 0 otherwise.
DRIVE	1 if rates self in the highest 10% in terms of "drive to achieve"; 0 otherwise.
SUCCEED	1 if "be successful in own business" is an essential goal and value; 0 otherwise.
WELLOFF	1 if "be well off financially' is an essential goal and value; 0 otherwise.
INCOME	Current (1980) annual income before taxes: 1 = no income; 2 = $1 to $6,999; 3 = $7,000 to $9,999; 4 = $10,000 to $14,999; 5 = $15,000 to $19,999; 6 = $20,000 to $24,999; 7 = $25,000 to $29,999; 8 = $30,000 to $34,999; 9 = $35,000 to $39,999; 10 = $40,000 or more.

Note: Descriptive statistics are available from the authors.

PRICE FIXING: THE PROBABILITY OF GETTING CAUGHT

Peter G. Bryant and E. Woodrow Eckard*

Abstract—We estimate the probability that a price fixing conspiracy will be indicted by federal authorities to be at most between 0.13 and 0.17 in a given year. Our estimate is based on conspiracy durations calculated from data reported for a large sample of DOJ cases, and a statistical birth and death process model describing the onset and duration of conspiracies.

I. Introduction

The economic theory of collusion (e.g., see Stigler (1964)) suggests that a firm's decision to participate in a price fixing conspiracy is based substantially on a rational calculation of associated benefits and costs. One cost is the possible penalties arising from getting caught. The greater the probability of getting caught, the greater these penalties loom in the prospective conspirators' calculations, and, ceteris paribus, the less likely they are to collude. The probability of getting caught therefore is a measure of the deterrent effect of antitrust enforcement, and should be inversely related to the number of price fixing conspiracies attempted.

Our paper is the first to estimate this probability. We also estimate the number of conspiracies (eventually caught) active at one time. The results are based on approximate conspiracy durations calculated from data reported for a large sample of U.S. Department of Justice price fixing indictments. The intuition behind our approach is simple. If the distribution of conspiracy durations is (e.g.) characterized by many short-lived conspiracies and few long-lived ones, then the probability of getting caught must be high, and, given the catch-rate, the total number of active conspiracies (eventually caught) must be low. We propose a statistical model to describe the onset and duration of such conspiracies, a simple birth-and-death process model, and use maximum likelihood methods to estimate model parameters. These parameter estimates in turn are the basis for our estimates of the number of active conspiracies (eventually caught) and the probability of getting caught.

The total population of active conspiracies can be partitioned into two subpopulations, one containing conspiracies which are eventually caught and another containing those which are not. Our sample is from the first subpopulation, and therefore our statistical inferences relate directly to that population only. No data exist regarding the second population. Nevertheless, one can extrapolate to the second some information inferred regarding the first.

II. The Model

Suppose at time $t = 0$ there exist no price conspiracies. At any time $t > 0$, let there be $N(t)$ active ("alive") conspiracies. The changes in $N(t)$ can be described by a birth-and-death process, a continuous time Markov chain, as follows. In a short interval of time from t to

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