Revised Draft
April 11, 2001

Ivy League Athletic Performance:

Do Brains Win?

by

Dmitry Kotlyarenko and Ronald G. Ehrenberg*

1

*Kotlyarenko is a CorneIl University Sophomore Presidential Research Scholar. Ehrenberg is the Irving M. Ives Professor of Industrial and Labor Relations and Economics at Cornell University and Director of the Cornell Higher Education Research Institute (CHERI). We are grateful to Susan Murphy and Michael Matter for providing us with some confidential data and to the Andrew W. Mellon Foundation and other donors for providing financial support for CHERI. Without implicating them for what remains, we are also grateful to two anonymous referees and the editor for their comments on an earlier draft

I. Introduction

Intercollegiate athletics are big business at many major American universities.[1] Notre Dame's football team, for example, generated revenues that exceeded its expenses by over $12 million in 1996-97. Individual teams and their conferences compete for millions of dollars in television revenue from the broadcast of men's football and basketball and, in recent years, women's basketball. Additional millions are at stake from appearances in major post-season football bowl games and in the National Collegiate Athletic Association (NCAA) tournaments in basketball.

Home football and basketball games are major events at many universities. The University of Michigan, for example, regularly fills its 107,500-seat stadium each Saturday that there is a home football game. The spectators at these events include students, alumni, friends of the university and the general public. These varsity sports are big business and are used by universities as a way of building school spirit, linking alumni to the university, building support for pubic institutions in the state legislature, and generating revenue to help support other varsity sports at the universities. Varsity athletics are often a major part of the development efforts of a university, even if the athletics department itself loses money on its operations.

Having a varsity team in a major sport that wins a conference title, or still better a major bowl game or a NCAA championship, can have a substantial effect on the revenues that flow to a university. It can also influence the quality and quantity of high school students that apply for admission to the institution.[2] . It is no wonder then that the competition to enroll top college football and basketball players is extraordinary.

The vast majority of major universities award athletic scholarships to varsity athletes. Given the pressure to win, admission standards for athletes that play major sports at an institution are often lower than admission standards for the institution's freshman class as a whole. Not surprisingly then, the athletes' graduation rates are often much lower than the average graduation rate for the university as a whole.[3]

The Ivy League, which consists of Brown, Columbia, Cornell, Dartmouth, Harvard, Pennsylvania, Princeton, and Yale universities, is unique among the athletic conferences that compete at the Division I (major university) level in the NCAA. The Ivy League prohibits athletic scholarships and all undergraduate financial aid is awarded only on the basis of financial need. The league rigorously monitors the academic qualifications of the athletes that its coaches recruit and requires that the academic ability of its recruited athletes be close to that of the student body as a whole.[4] The league also sets tight limits on the number of days that teams can be away from campus during the academic year and participation in varsity sports is not permitted during exam periods. Finally, the number of varsity athletic teams fielded by each academic institution in the league is among the largest in the nation.[5] At our own institution, for example, there were 36 different varsity teams (18 male, 18 female) during the 1998-99 academic year.

In the absence of being able to compete for student-athletes with athletic scholarships, it is natural to ask what the factors are that determine the athletic success of the different teams in the league when they compete head-to-head with each other. We argue in this paper that in the main it is the same factors that determine the enrollment decisions of the majority of the students who attend these institutions, namely the perceived academic quality of each institution and the generosity of the financial aid packages that each institution provides to students with financial need.

We also show that the schools in the league differ in the extent to which their athletes' average academic qualifications differ from the average academic qualifications of the student body as a whole. While such differences help to explain the number of female league titles won by each institution in a year, they prove to have no impact on the number of male titles won or on the numbers of victories won by a school within the league in the three major male sports basketball, football and hockey.

After the next section provides some descriptive statistics and explains the admission standards to which Ivy League athletes are held, section III sketches our simple conceptual framework for the determinants of Ivy League athletic teams' success. Our empirical analysis appears in section IV and we end with some brief concluding remarks.

II. Background Information

Table I presents information on the endowment per student at each Ivy league institution during the 1996-97 academic year and numbers of Ivy League titles that each academic institution in the league has won between academic years 1981-1982 and 1996-1997. Information on Ivy League titles is presented in total, for all male sports, for all female sports and for the three major male sports (football, basketball and hockey). Harvard and Princeton have dominated the league, both in terms of total male titles and total female titles won. Interestingly, as the last column indicates, these are the two schools that have the highest endowment per student in the league, suggesting that there is a connection between the financial well being of the institutions and their athletic teams' records. In spite of a well-publicized Title IX suit against it, that was settled by a consent decree, Brown was third in the league in terms of total female team titles won.

Turning to the three major male sports, the sports that historically have drawn most attention at many of these institutions, Dartmouth and Pennsylvania have won the lion's share of the football titles during the period. Basketball championships have been "owned" by Pennsylvania and Princeton. Harvard has dominated in hockey, with Cornell winning most of the titles that Harvard did not.

The Ivy League has strict rules about the admission standards that its schools' athletes as a group must meet. Although admission to these schools is not based on any mechanical formula, either for athletes or students in general, the league watches closely an indicator of the academic qualifications of each school's athletic teams. The academic index (henceforth AI) for each student is a composite score based on the average of the student's mathematics and verbal Scholastic Assessment Test scores (SAT), class rank and the highest of the average of the student's SAT scores or achievement test (now called the SAT II) scores. Each of the three measures is converted to a 20 to 80 score so that the highest score that any individual can achieve is 240. A student who scored 650 on each SAT aptitude test and each SAT II test, and finished in the top 20% of his class would have an academic index of 194 (65+64+65).

In a recent year, after the re-centering that took place in the SAT exams, the average AI for freshman at the eight Ivy League institutions varied across institutions from about 203 to 216. In the same year, the average AI for recruited freshman athletes who enrolled at the eight institutions varied from over 194 to 212. Although on average recruited athletes had AIs somewhat less than the class as a whole at each institution, their average AI scores all exceeded that of the hypothetical student that we described above. Athletes at Ivy League institutions truly are scholar athletes.

What is of interest to us, is that the difference between the average AI of recruited athletes and the average AI of the class as a whole varied across the eight institutions. While the data are confidential and we can not identify individual schools, we are permitted to present information on how the average difference between the AI scores of the freshman class as a whole and freshman recruited athletes differed across institutions during the 1981-82 to 1996-97 period. The mean and range (across the eight institutions) of these differences for all male athletes, all female athletes, male basketball players, male football players and male hockey players all appear in Table 2.

Focusing first on all male athletes, while the average absolute difference between the AIs of athletes and the class as a whole was 13.7 points, across institutions this figure ranged from 11.5 to 16.9 points. Ranges of similar magnitudes existed for all female athletes, male basketball players and male football players.[6] While in absolute terms hockey players' AIs differed from the AIs for the class as a whole by the most, the range in this measure across institutions was smallest for hockey.

The two right-hand columns of Table 2 provide similar information, but in relative terms. On average, male and female athletes' average AIs were about 93.2 and 94.5 percent, respectively, of the AI of their classes as a whole. The relative differentials were greater for male basketball, football and hockey. In each case, the range in these measures across schools was 2 to 3 percentage points.

Although one cannot infer it from the Table 2, it turns out that the pattern of differentials across schools is positively correlated across periods for male athletes as a group, female athletes as a group, and football players. For these three groups some Ivy League institutions' athletes persistently have average AIs that are further from those of the class as a whole than do other

institutions' athletes. Put another way, some Ivy League schools "dig deeper" into their academic quality distribution of applicants than do other schools to enroll athletes. It is natural to ask whether this extra "discounting" gives these schools a competitive advantage on the athletic fields. In contrast, for men's hockey and basketball, the patterns of the differentials vary widely across years. It is natural to also ask if these changing patterns of differentials influence the number of Ivy League games won by each school in these sports.

III. Conceptual Framework

Does the difference between the average AI for an Ivy League school's varsity athletes and its class as a whole influence its athletic teams' records? We conduct multivariate regression analyses in the next section to provide an answer to this question. Here we sketch the simple conceptual framework upon which our analyses are based.

Figure 1 illustrates what we hypothesize to be the relationship between the athletic ability of athletes who enroll at Ivy League institutions and their AIs. At any level of the AI, athletes of different levels of athletic ability will be present. So, for example, at the level AI1 athletes range in athletic ability from a low of C to a high of B.

We have drawn the average relationship between athletes' athletic ability and their AIs, the line AA, as having a negative slope. That is, we have assumed that on average athletes with higher AIs have lower athletic ability.

This does not mean that we believe that bright individuals are born with less athletic ability than individuals who are somewhat less bright. Rather, the negative slope captures the idea that athletic ability at the time that an athlete is ready to enroll in college is a function of both the individual's inherent athletic ability and the extent to which the student has developed athletic

skills up until that point of time. To become a top flight athlete requires a substantial investment in practice time, just as to become a top flight student requires a considerable time investment. To the extent that a student's time in high school is limited, time devoted to studies may be competitive with time devoted to athletics. Thus, on balance, as the slope of the line AA indicates, there is likely to be a negative relationship between a student's AI score and athletic ability. Hence, our first prediction, other factors held constant, we expect to observe that the lower the average AI of the athletes at an Ivy League institution, the better will be the performance of the institution's varsity athletic teams.

What are the other factors that should be held constant? Put another way, what are the factors that we believe will make it more likely that an Ivy League school will draw athletes from above the line AA rather than below the line. One obvious factor is the generosity of the school's financial aid program. To the extent that athletes come from families with financial need, the more generous a school's financial aid policies the more likely that applicants will want to enroll at the school. Thus, at any given level of applicants' AI, schools with relatively generous financial aid policies will have the luxury of being able to admit and enroll the applicants with the highest athletic ability. Conversely, schools with relatively scanty financial aid packages will have to settle for the lesser athletes.

Financial aid packages at Ivy League schools are based solely on need. The packages consist of grant aid, loans, and jobs during the academic year. The latter two components of the packages are called the self-help component of the package. In 1996-97, the average self-help level for freshman varied across the eight Ivy League schools from $5,300 to $7,600, with the larger self-help levels not surprisingly occurring at the schools that had smaller endowments per student. Viewed from the prospective of future students, larger self-help levels mean less

generous financial aid packages. Hence, our second prediction is that, other factors held constant, the higher the self-help level at a school, the poorer the athletic performance of the school's varsity teams is likely to be.

Another important factor is the average AI for all freshman students at the institution. Other things equal, students applying to Ivy League institutions prefer to attend the most selective of these institutions, the schools whose entering freshman have the highest average AIs. While Ivy League schools that are somewhat less selective can and do attempt to compete with the schools in the league that have higher average freshman AIs by vigorously "marketing" their unique programs, on average student-athletes do prefer to go to the higher AI schools. Thus, our third prediction is that other things held constant, the higher the average AI of freshman at each institution, the more likely that the institution can "cream off" the better athletes at each level of the athletes' AI. Hence, the higher the average admission index for the freshman class as a whole, the better we expect the institution's athletic team records to be.

The final factor that we hypothesize will influence athletic performance is the size of the freshman class at an institution. Each Ivy League institution is restricted to recruiting approximately the same number of varsity athletes for a given sport (e.g., men's basketball). Varsity athletes thus tend to make up a smaller fraction of the freshman class at the larger institutions than they do at the smaller ones.

Each Ivy institution seeks to achieve many other things besides having winning athletic teams when it recruits its class. Other goals of the admission process include the academic ability of the class, geographic diversity, ethnic and racial diversity, gender balance, finding editors for the newspaper and finding trumpet players for the orchestra. In the larger Ivy League schools, admissions officers can turn to non-athletes to meet all of the other goals of the admissions

process. However, in the smaller schools, it may prove necessary for the athletes to also help meet some of the institution's other goals. Hence, the smaller schools may have less degrees of freedom than the larger ones when they recruit athletes and we expect, other factors held constant, that the larger schools will have better athletic teams.

IV. Empirical Analyses

Using data for the eight Ivy League Institutions for academic years 1984-85 to 1996-97, we estimated equations of the form

$$(1) \qquad PER_{it} = a_0 + a_1 SHELP_{it} + a_2 AI_{it} + a_3 ENR_{it} + a_4 ALL_{it} + \in_{it}$$

In equation (1), PER is a measure of the performance of institution i's athletic teams during year t. SHELP is the self-help level at the school. AI is the average academic index for all undergraduates at the school. ENR is a measure of the number of enrolled students at the school. ALL is a measure of the ratio of the admission index for recruited athletes to the admission index for all enrolled freshmen at the school. Finally $\in_{it}$ is a random error term, and the a's are parameters to be estimated.

The model that we described in section III implies that the estimated coefficients of AI and ENR (a_2 and a_3) should be positive and those for SHELP and ALL (a_1 and a_4) should be negative. Inasmuch as the performance of a team depends upon the quality of all of the athletes on the team, all of the explanatory variables are averages of the values for the current year's freshman class and the three previous years' freshman classes.[7]

The performance variables that we analyze are the number of Ivy titles won by each institution in the year in male sports, the number won in female sports, and the number of Ivy

League games won in each of the three major male sports (hockey, basketball, and football). Our analyses were limited to these three individual sports because these were the only individual sports for which the Ivy League provided us with data on the average AI for specific teams. The enrollment variable used in the female titles won equation is the number of female undergraduates, while all other equations use the number of male undergraduates. The athletes' average AI used in the computation of All in the different models are respectively the average AI for male athletes, the average AI for female athletes, the average AI for male hockey players, the average AI for male basketball players and the average AI for male football players.

Table 3 summarizes our empirical findings. Higher self-help levels are associated with poorer team performance, but the relationship is statistically significantly different from zero at the .05 level of significance only for the number of female titles and the number of male hockey wins. Other factors held constant, a decrease in the average self-help level of $2,000 is associated with winning almost one more female title a year and winning more than one more male hockey Ivy League game a year. Although it is not statistically significantly different from zero at the .05 level of significance, the coefficient for the number of male titles implies that the number of male titles won would be about .5 higher with a self-help decrease of the same magnitude.

A higher AI for the class as a whole is significantly positively associated with winning both more male and female titles and also more male hockey games. Schools with the better students thus do appear to attract the better athletes. As expected, larger schools, as measured by undergraduate enrollment levels, do win more female titles, male hockey games, and male football games. However, size per se does not appear to influence the number of male titles or the number of men's basketball games won. Finally, an institution with accepted athletes whose average AIs are relatively low as compared to the average AI for the institution's class as a whole,

as measured by ALL, appears to win more female titles but perversely win fewer male titles and fewer male basketball games.

To test for the sensitivity of our findings, we experimented with several different model specifications. First, we replaced the ratio of the AI for athletes to the AI for the class as a whole with the absolute difference between the AI for athletes and the AI for the class as a whole. Similar findings were obtained.

Second, each of our outcome variables has an upper and lower limit each year. For example, the number of Ivy League basketball games that a school wins in a year can not exceed 14 (each team plays each other team twice) or be less than zero. For some schools, the number of male titles, the number of female titles or the number of male hockey wins were zero in some years. In several years, one men's basketball teams won all 14 of its league games. Finally, in a number of cases the number of football games won by a school was either zero or 7.

In situations when there is an upper or lower bound on an outcome variable, an appropriate statistical model is a Tobit model with left (lower) or right (upper) censoring.[8] When we estimated equation (1) for each measure of performance using a Tobit model, in each case the estimated coefficient of the ratio of the average AI of athletes to the average AI of the class as a whole was very similar to the estimated coefficient reported in Table 1.[9]

In concluding this section, we should note that there are several other extensions to the analyses that the data do not permit us to undertake. Athletes like to play for "winners" and one might therefore hypothesize that the performance of a team in recent years should influence the willingness of potential student athletes to apply to and accept offers of admission to an institution. Put simply, "success breeds success". Unfortunately, it proved impossible for us to include measures of past performance in our estimating equations because past performance, in

turn, depends upon the quality of the student athletes recruited by an institution in previous years. To the extent that the quality of recruits is correlated over time, lagged team records are endogenous and we had access to no variables that might serve as instruments in a model that included lagged team records as explanatory variables. Similarly, we could not attempt to identify whether knowledge of who the individual coach was for each school in each of the men's sports (e.g. Pete Carrill from Princeton in men's basketball) was an important determinant of team records. Again our data set was simply not rich enough for us to do this.

Our inability to pursue these extensions may provide an explanation for why only for female sports did we observe a negative relationship between the number of varsity titles won and the ratio of varsity athletes average AI at a school to the average AI for all freshmen students. Nationally, as well as in the Ivy League, male sports received a disproportionate share of the attention and financial resources from universities until gender equity legislation began to have a real impact at many institutions in the mid 1990s.[10] It is possible that the factors that we discussed above that could not be included in our empirical analyses were more important in recruiting male athletes than for recruiting female athletes to Ivy League institutions during much of the period that our data cover. Hence a reasonable conjecture is that our failure to include these factors in our estimating equation may be more likely to lead to omitted variable bias in the male equations than in the female equations. Some support for this view comes from the fact that the R^2 in the male equation found in column 1 of table 3 is lower than the corresponding R^2 from the female equation found in column 2.

V. Concluding Remarks

Our analyses confirm that among the Ivy League schools, the relative academic quality of each institution and the generosity of the institution's financial aid policy help to explain the number of Ivy League varsity athletic titles that each school wins. Focusing on improving the academic quality of the student body and on improving financial aid programs will have as a byproduct better athletic team performance.

The Ivy League prohibits any special treatment of athletes in the construction of aid packages. While league rules permit an institution to vary its self-help level for students with the same level of financial need as students' academic qualifications, leadership ability, or willingness to work to help finance their education vary, the league currently prohibits "preferential packaging" based solely on being a recruited athlete.

Recently, a number of the wealthier schools in the league - namely, Princeton, Harvard, Yale and Dartmouth - have announced vastly more generous financial aid programs.[11] Princeton, for example, has replaced all loan aid by grant aid for students coming from families with family incomes under $40,000 a year. For families with incomes less than $90,000, Princeton also eliminated families' equity in their homes from consideration of how much grant aid a student is eligible for. These new programs will have the effect of substantially decreasing the attractiveness of the poorer schools in the league to athletes who come from families whose income levels qualify them for grant aid.

The remaining four schools in the league (Brown, Columbia, Cornell and Pennsylvania) can not afford to match the policies of the richer schools. They could, however, probably afford to provide more generous financial aid packages for selected "star quality" recruited athletes who have financial need. Such an action would provide them with a fighting chance to continue to recruit high quality scholar-athletes and to remain competitive in league athletic competition. If

the Ivy League wants to maintain some semblance of a "level playing field," it thus might consider allowing the poorer schools to provide more generous financial aid packages for selected recruited athletes with financial need than they do for their classes as a whole. Such a policy would not violate the fundamental principle established by schools in the league long ago, namely that grant aid should be provided only for students with financial need.

Table 1
Number of Ivy League Varsity Athletic Titles Won During the 1981-82 to 1996-97 Period by Each Institution and the Institution's 1996-97 Endowment Per Student[a]

School	Number of Titles Won						
	Total	Male	Female	Football	Basketball	Hockey	Endowment Per Student (in $000)
Brown	56	13	43	0	1	2	128
Columbia	27	24	3	0	0	0	173
Cornell	48	29	19	2	1	5	111
Dartmouth	58	32	26	6	0	0	249
Harvard	129	66	63	3	0	11	610
Pennsylvania	70	38	32	8	7	0	131
Princeton	135	74	61	3	8	0	776
Yale	55	30	25	2	0	2	526

[a] Number of titles won in the individual sports can exceed 16 (the number of years in the sample) due to ties.

Source: *The 1997-98 Directory and Record Book of Ivy League Athletics* (Princeton, NJ: Council of Ivy Group Presidents, 1997); *Cornell University 1998-99 Financial Plan: Operating and Capital: May 1998 (Ithaca, NY, May 1998).*

Table 2

Average Values for the 1981-82 to 1996-97 Period Across Ivy League Institutions in the Differences Between the Average Academic Indices for Recruited Athletes and the Class as a Whole at Each Institution

Sport	Absolute Difference[a]		Relative Difference[b]	
	Mean	Range	Mean	Range
All Male Athletes	13.7	11.5 - 16.9	93.2	91.5 - 94.1
All Female Athletes	11.1	8.3-13.9	94.5	93.3-95.7
Male Basketball	16.8	12.5 - 19.0	91.6	90.4 - 93.6
Male Football	17.6	14.4 - 19.7	91.3	90.0 - 92.6
Male Hockey	19.0	17.9 - 20.9	90.7	89.5 - 91.5

Source: Confidential data provided by the Ivy League office.

[a] Absolute difference is the average over the 16-year period of the average AI for the class minus the average AI for the type of athletes at the institution in each year.

[b] Relative difference is the average over the 16-year period of one hundred times the average AI for recruited athletes divided by the average AI for the class as a whole at the institution in each year.

[c] Only 6 of the 8 institutions had male hockey teams during the sample period.

Table 3

Determinants of Ivy League Universities' Varsity Athletic
Teams' Performance: 1984-85 to 1996-97 Period
(absolute value t statistics)

	(1) Male Titles	(2) Female Titles	(3) Male Hockey Wins	(4) Male Basketball Wins	(5) Male Football Wins
SHELP	-.227 (1.4)	-.441 (2.6)	-.596 (1.7)	-.092 (0.2)	-.110 (0.5)
ACLASS	.139 (5.3)	.089 (3.2)	.192 (3.4)	.023 (0.3)	.043 (1.2)
MAENR	.077 (0.6)		1.076 (5.0)	.172 (0.6)	.311 (2.0)
FEENR		.276 (2.2)			
MAALL	.438 (2.3)				
FEALL		-.524 (4.3)			
HOALL			-.011 (0.1)		
BBALL				.273 (1.2)	
FBALL					.061 (0.7)
R^2	.242	.356	.288	-.007	.010
N	104	103	72	100	101

Where

SHELP Average freshman self help level in thousands of dollars for the current and past three classes

ACLASS Average admission index for all enrolled freshmen for the current and past three classes

MAENR Average full-time male undergraduate enrollment in thousands for the current and past three classes

FEENR Average full-time female undergraduate enrollment in thousands for the current and past three classes

ALL Average ratio over the current and past three years of one hundred times the average admission index for recruited athletes divided by the average admission index for all enrolled freshman

MAALL Male freshman athletes

FEALL Female freshman athletes

HOALL Male freshman hockey players

BBALL Male freshman basketball players

FBALL Male freshman football players

(a) An intercept team was also included in each model

(b) Sample sizes less than 104 are due to only 6 universities fielding male hockey teams and several institutions not reported for athletic index for a particular team in a year

(c) Data sources:

(1) Unpublished confidential data provided by the Ivy League Office (ACLASS, MAALL, FEALL, HOALL, BBALL, FBALL)

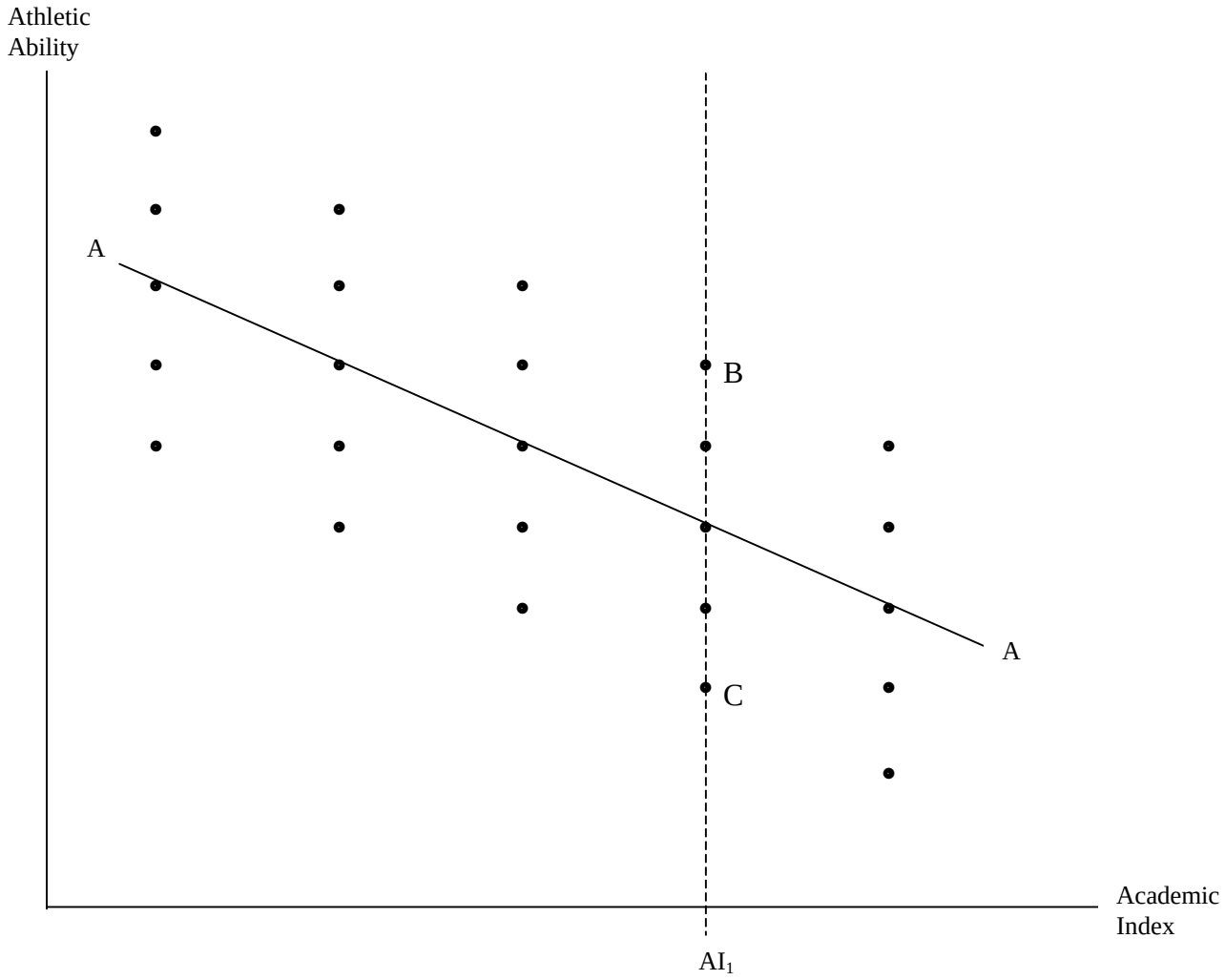
(2) The *Ivy League Directory and Record Book,* 1997-98 (1997, Council of Ivy Group Presidents) (Numbers of Titles and Team Records)

(3) National Science Foundation CASPAR system and individual institution's web page (MENR, FEENR)

(4) Unpublished confidential data provided by the Consortium of Financing Higher Education (COFHE) via Cornell University's Office of Institutional Research and Planning (SHELP)

Figure 1

Relationship Between Athletic Ability and the Academic Index For Recruited Athletes to an Ivy League School



REFERENCES

Robert A. Baade and Jeffrey O. Sundberg, “Fourth Down and Gold to Go? Assessing the Link Between Athletics and Alumni Giving”, *Social Science Quarterly* 77 (December 1996): pp. 789-803.

Ronald G. Ehrenberg, *Tuition Fever: Why Colleges Can t Control Their Costs* (Cambridge, MA: Harvard University Press, forthcoming)

William H. Greene, *Econometric Analysis* (New York: MacMillan Publishers, 1990)

Franklin Mixon, Jr., “Athletics vs. Academics? Rejoining the Evidence from SAT Scores”, *Education Economics* 3 (December 1995): pp. 277-283

National Collegiate Athletic Association, *1998 NCAA Graduation Rates Summary,* available on the World Wide Web at http://www.ncaa.org/graduation_rates.html.

“Princeton Plans Major Increase In Aid for Middle- and Low-Income Students”, *Chronicle of Higher Education,* January 30, 1998.

Andrew Zimbalist, *Unpaid Professionals: Commercialism and Conflict in Big-Time College Sports* (Princeton, NJ: Princeton University Press, 1999)

ENDNOTES

[1] See Andrew W. Zimbalist (1999) and Ronald G. Ehrenberg (forthcoming), chapter 17 for more extensive treatments of the business of intercollegiate athletics.

[2] See for example, Robert A. Blaade and Jeffrey O. Sundberg(1996) and Franklin Mixon Jr.(1995).

[3] See National Collegiate Athletic Association (1998).

[4] Varsity athletes' graduation rates are not an issue in the Ivy League, as they are in many other conferences. Indeed, varsity athletes who first enrolled as freshman at Cornell University in the fall of 1991 actually had a slightly higher six-year graduation rate (90.3%) than all students who first enrolled as freshman that fall (90.2%).

[5] For example, a search of the World Wide Web pages in February 1999 of the universites in two major athletic conferences, the Atlantic Coast Conference and the Big Ten, and the Ivy League indicated that the average number of varsity athletic teams fielded by universities in the three leagues were 20,23 and 32 respectively (In compiling these numbers, we treated indoor and outdoor track as one sport. Similarly, swimming and diving were counted as one sport. Cross-country was counted as a separate sport from track)

[6] Formal F tests indicate that there are significant differences in these two variables across the eight Ivy League institutions.

[7] We experimented with diffent forms of averages and the unweighted 4-year average performed the best. Colinearity prevented us from including the variables for all four years classes individually.

[8] See William H. Greene (1990), p. 727-739, for a description of the Tobit Model. The typical Ivy School competes in 32 varsity sports, so the number of male and female titles won each vary between roughly 0 and 16. There are 6 hockey teams and each team plays each other twice, so the number of hockey games won varies between 0 and 10. Each team plays each other team twice in basketball, so the number of basketball games won similarly varies between 0 and 14. Finally, the number of football games won varies between 0 and 7.

Whether integers varying between these limits should be treated as continuous variables or as count data is an open question. By using the Tobit model, we have chosen to treat them as continuous, allowing for the possibility of both left censoring (0) and right censoring (the maximum values possible). Right censoring rarely occurred and with a continuous variable and left censoring, the Tobit model is appropriate to use.

[9] The corresponding coefficients of the ratio of the average AI of athletes to the average AI of all entering students (with the absolute value of their t statistics in parentheses) were as follows:

performance measure	OLS estimate	Tobit estimate
male titles	.438(2.3)	.557(2.7)
female titles	-.524(4.3)	-.604(4.5)
hockey wins	-.001(0.1)	.009(0.0)
basketball wins	.273(1.2)	.237(1.3)
football wins	.061(0.7)	.110 (0.6)

Complete tables of all of the coefficient estimates from the tobit model, as well as summary and diagnostic statistics, are available from the authors.

[10] See Ronald G. Ehrenberg (forthcoming), chapter 17 for a discussion of the history of gender equity legislation. While the gender equity legislation was part of Title IX of the *1972*

Educational Amendments to the Civil Rights Act, it was not until Congress passed the *Civil Rights Restoration Act* in 1988 that it was clarified that the Title IX was intended to apply to intercollegiate athletics. Multple court suits by female athletes at a number of institutions in the early and mid 1990s then produced pressure that caused colleges and universities to take gender equity laws seriously.

[11] See, for example, "Princeton Plans Major Increase in Aid for Middle- and Low-Income Students" (1998)