The Effect of Varsity Athletic Participation on Academic Performance
Evidence from the 2004 Graduating Class

Prepared by the Committee on Athletics
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Abstract: Complete data from the graduation class of 2004 are used to estimate the statistical effect of participation in varsity athletics on academic performance of undergraduate students in the class of 2004 at Bucknell University. Results suggest athletic participation among male and female athletes does not significantly affect cumulative in-major GPA. These results control for the separate effects on grades arising from a student's gender, ethnic group, U.S. citizenship status, participation in fraternal "Greek" organizations, high school academic index, and choice of major.

I. INTRODUCTION

The purpose of this study is to estimate the statistical effect of athletic participation on the academic performance of Bucknell students. The academic performance of each student is measured by the cumulative grade point average (GPA) earned in courses required by that student's chosen major and in the major department. The cumulative *in-major* GPA was selected as the measure of academic performance over the cumulative *overall* GPA to allow for a more accurate statistical comparison of student performance. Students within each major are likely to enroll in similar courses to fulfill requirements for that major.

II. THE DATA

The Office of the Registrar at Bucknell University provided complete data for the class of 2004. The data identify each student's cumulative overall GPA, choice of major(s), cumulative in-major GPA, number of required courses needed to complete the chosen major, high school Academic Index, gender, race, U.S. citizenship status, athletic status, and Greek life status.

Due to data limitations, the cumulative in-major GPA includes only grades earned in courses required and taught within the department but does not include grades earned in major related courses taught by other departments. The number of courses required to fulfill each major (a separate variable in the statistical analysis) includes both major and major-related courses.

Many students completed two majors during their collegiate career. For these cases, the GPA earned in the "first" major (Major 1 as identified by the registrar) was used in the analysis.

Each student's high school Academic Index is calculated by the Office of Admissions prior to admission to Bucknell. This index is based on a weighted average of each student's high school SAT score and high school class rank.

The athletic participation variable for each student was reviewed by the athletics department to confirm accuracy. A few students had been identified by the registrar as varsity athletes but had ceased varsity participation very early in their college careers. These students were identified as non-athletes for the analysis.

Demographic Characteristics

The table below provides a summary of the demographic composition of student athletes and non-athletes (male and female) from the class of 2004.

	MALES (A total of 373)		FEMALES (A total of 391)	
	ATHLETES (A total of 60)	NON ATHLETES (A total of 313)	ATHLETES (A total of 46)	NON ATHLETES (A total of 345)
White	50	264	43	304
Asian	1	33	1	23
Black	5	8	0	5
Hispanic	1	5	1	5
Other	3	3	1	8
American Citizen	56 (93%)	294 (94%)	45 (98%)	335 (97%)
Greek	30 (50%)	188 (60%)	24 (52%)	204 (59%)

To summarize, among the 60 male athletes, 50 were white and 10 belonged to minority ethnic groups. Among the 313 male non-athletes, 264 were white and 49 belonged to other ethnic groups, the majority of whom were Asian. Among females, all but three of the 46 athletes were white and all but 41 non-athletes were white. 93% of the 60 male athletes and 94% of the 313 male non-athletes were American citizens. These percentages were slightly higher for female athletes and non-athletes. Finally, 60% of the 313 male non-athletes and 59% of the 345 female non-athletes participated in Greek fraternal organizations compared to the roughly 50% of male and female athletes that participated in such organizations.

Choice of College Major

The table below provides a summary of the percentage of athletes and non-athletes from the class of 2004 that selected each Bucknell major.

MAJOR	ATHLETE (N=106)	NON-ATHLETE (N=658)	MAJOR	ATHLETE (N=106)	NON-ATHLETE (N=658)
ACCT	10%	6%	GEOG	1%	0%
ANBE	1%	1%	GEOL	0%	1%
ART	0%	1%	GERM	0%	0%
ANTH-SOCI	2%	2%	HIST	3%	2%
BIOL	7%	8%	IDPT	1%	0%
BICH	4%	2%	IREL	2%	5%
CENG	6%	4%	MGMT	18%	15%
CHEG	1%	3%	MATH	3%	2%
CHEM	1%	2%	MECH	5%	4%
CLAS	0%	0%	MUSC	0%	0%
CSCI	0%	3%	PHIL	1%	1%
CSEG	2%	2%	PHYS	0%	1%
EAST	0%	0%	POLS	7%	4%
ECON	8%	6%	PSYC	5%	5%
EDUC	5%	4%	RUSS	0%	0%
ELEC	2%	4%	SPAN	2%	1%
ENGL	3%	5%	THEA	0%	0%
ENST	3%	3%	WMST	0%	0%
FREN	0%	1%			

Relative to non-athletes, athletes were slightly more likely to select accounting, biochemistry, civil and environmental engineering, economics, management, and political science and slightly less likely to select chemical engineering, computer science engineering, English, and international relations.

A Simple Comparison of Means

The means and standard deviations (in parentheses) of several student academic performance variables are provided in the table below for both athletes and non-athletes (male and female) from the class of 2004.

	MALES (A total of 373)		FEMALES (A total of 391)	
	ATHLETES (A total of 60)	NON ATHLETES (A total of 313)	ATHLETES (A total of 46)	NON ATHLETES (A total of 345)
Academic Index	185.03 (14.12)	195.47 (13.32)	197.13 (15.58)	196.83 (13.53)
GPA (overall)	3.11 (0.38)	3.18 (0.42)	3.43 (0.38)	3.46 (0.35)
GPA (in major)	3.17 (0.41)	3.26 (0.44)	3.47 (0.40)	3.50 (0.40)
Double Majoring	5 of 60 (8.3%)	44 of 313 (14.1%)	10 of 46 (21.7%)	89 of 345 (25.8%)
Courses to Fulfill Major	11.12 (3.33)	11.06 (2.88)	10.03 (2.91)	9.70 (3.56)

To summarize, the average male athlete earned 10 fewer high school academic index points than the average male non-athlete. A 10 point difference in the high school Academic Index is consistent with either a 133.33 point difference in average SAT scores *or* a 13.33 percentage point difference in high school class rank (or any combination of the two). At Bucknell the average male athlete earned an overall GPA that was 0.07 points less than the average male non-athlete. A 0.07 point difference in GPA is consistent with earning 2.24 fewer grade points over a 32 credit college career (roughly the difference between an A and a C- in a single course from a four year college career). The difference in the in-major GPA is slightly larger. Finally, the average male athlete was less likely to double major.

The average female athlete earned a high school academic index that was roughly equivalent to the average female non-athlete. At Bucknell the average female athlete earned an overall GPA that was 0.03 points less than the average female non-athlete. A 0.03 point difference in GPA is consistent with earning 0.96 fewer grade points over a 32 credit college career (roughly the difference between an A and a B in a single course from a four year college career). The difference in the in-major GPA is also 0.03 grade points. Finally, the average female athlete was slightly less likely to select a double major, but selected a major that involved slightly more courses to fulfill than the major selected by the average female non-athlete.

III. REGRESSION RESULTS

The linear regression technique has been used for decades by social scientists to estimate the statistical relationship among variables of interest. To use this technique, one variable is designated the *dependent* or *endogenous* variable. This variable is usually the focus of the empirical study. The dependent variable in this study is the four-year cumulative GPA earned in required in-department courses of a student's chosen major. The cumulative in-major GPA was selected over the cumulative overall GPA to allow for a better comparison of student academic achievement because students within each major are likely to enroll in similar courses to fulfill the required courses for that major.

A set of *independent* or *exogenous* variables is also identified. These independent variables are selected based on an *a priori* hypothesis that the variable somehow affects the dependent variable under study. Therefore, the set of independent variables selected for this study include factors that are believed to affect the cumulative in-major GPA earned by Bucknell students. These include a student's selected major, athletic status, gender, ethnicity, and high school Academic Index. Once all variables are selected, the linear regression technique identifies the causal relationship between each independent variable and the dependent variable. Thus, the role that athletic participation plays on cumulative in-major GPA can be identified.

The set of independent variables used in the estimation process is often constrained by the availability of data. Lacking data on an important variable will bias results if the missing variable is correlated with an independent variable in the data set. For example, the data obtained for this study lack information on each student's employment status. The accuracy of results below thus depends on the assumption that the employment status of a student is not related to that student's choice of major, athletic status, gender, race, and high school academic index. This assumption may be deemed plausible. But if working students are, for example, less likely to participate in athletics, then the effect of athletic participation on in-major GPA would be estimated with bias. Specifically, if athletes are less likely to be employed than non-athletes and if employment reduces grades, then omitting employment status from the model would generate a positively biased estimate of the effect of athletic participation on grades.

Each student's cumulative in-major GPA was regressed on that student's (1) athletic status, (2) gender, (3) ethnicity, (4) U.S. citizenship status, (5) Greek Status, (6) Academic Index, (7) choice of college major and (8) the number of courses necessary to fulfill that major. This estimation is designed to control for all other factors that could affect cumulative in-major GPA. See the technical appendix for the original regression results. By controlling for the separate effects on grades arising from a student's gender, ethnic group, U.S. citizenship status, participation in fraternal "Greek" organizations, high school academic index, and choice of major, results suggest:

- ➢ **Athletic participation among males insignificantly decreased in-major GPA by 0.033 points.**
- ➢ **Athletic participation among females insignificantly decreased in-major GPA by 0.030 points.**

The 0.033 point difference in the in-major GPA for male students is consistent with earning 0.36 fewer grade points over a 12 course college major (roughly the difference between an A and an A- in a single course from a twelve course college major). As mentioned above, athletes on average earned an in-major GPA that was 0.09 points lower than non-athletes. Only 0.033 of this difference can be explained by athletic participation. The remainder of the difference can be explained by other attributes possessed by athletes that effect GPA.

> The average female non-athlete earned an in-major GPA that was 0.176 points higher than that of the average male student
> The average Asian student earned an in-major GPA that was 0.137 points lower than that of the average white student
> The average black student earn an in-major GPA that was 0.236 points lower than that of the average white student
> The average Hispanic student earned an in-major GPA that was 0.161 points lower than that of the average white student
> The average student with of an "other" racial designation earned an in-major GPA that was 0.089 higher than that of the average white student
> The average student with American citizenship earned an in-major GPA that was 0.011 points higher than that of the average student without American citizenship (essentially no difference)
> Greek participation decreased in-major GPA by 0.018 points.
> A students in-major GPA increased by 0.009 points for every point increase in that student's Academic Index (a 1 point increase in the Academic Index is once again consistent with either a 13.33 point increase in average SAT scores or a 1.33 percentage point increase in high school class rank).
> A students in-major GPA increased by 0.034 points for every course necessary to complete that student's selected college major.

Results above also controlled for the affect of the choice of college major on the in-major GPA earned. The expected in-major GPA is provided in the following table for the following cohort: a white male without U.S. citizenship who is a non-athlete, non-Greek, earned an Academic Index of 195 and participated in a major with 10 required courses. The average GPA across majors for any other statistical cohort can be obtained by adjusting these numbers with the results given above.

Selected Major	In-Major GPA	Selected Major	In-Major GPA
ACCT	3.18	GEOG	2.85
ANBE	3.40	GEOL	3.23
ART	3.21	GERM	3.16
ANTH-SOCI	3.25	HIST	3.46
BIOL	3.17	IDPT	3.71
BICH	3.26	IREL	3.45
CENG	3.08	MGMT	3.16
CHEG	3.13	MATH	3.14
CHEM	2.98	MECH	2.93
CLAS	3.46	MUSC	3.21
CSCI	3.11	PHIL	3.32
CSEG	3.17	PHYS	2.66
EAST	3.86	POLS	3.21
ECON	3.18	PSYC	3.01
EDUC	3.54	RUSS	3.67
ELEC	2.96	SPAN	3.58
ENGL	3.42	THEA	3.69
ENST	3.41	WMST	3.80
FREN	3.44		

TECHNICAL APPENDIX

Model Summary

Model	R	R Square(a)	Adjusted R Square	Std. Error of the Estimate
1	.994(b)	.989	.988	.371

a. For regression through the origin (the no-intercept model), R Square measures the proportion of the variability in the dependent variable about the origin explained by regression. This CANNOT be compared to R Square for models which include an intercept.

b. Predictors: femath, WMST, THEA, RUSS, PHYS, PHIL, MUSC, MECH, IDPT, HIST, GERM, GEOL, FREN, ENST, ELEC, EAST, CSEG, CSCI, CLAS, CHEG, CENG, ART, ANTH-SOC, CHEM, ECON, ANBE, POLS, IREL, SPAN, ACCT, ENGL, EDUC, PSYC, MATH, BIOL, MGMT, GEOG, BICH, HISPANIC, OTHER, ASIAN, BLACK, ATHLETE, GREEK, FEMALE, CITIZEN, CREDITS, INDEX

ANOVA (c,d)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8734.551	48	181.970	1325.290	.000(a)
	Residual	98.174	715	.137		
	Total	8832.725(b)	763			

a. Predictors: femath, WMST, THEA, RUSS, PHYS, PHIL, MUSC, MECH, IDPT, HIST, GERM, GEOL, FREN, ENST, ELEC, EAST, CSEG, CSCI, CLAS, CHEG, CENG, ART, ANTH-SOC, CHEM, ECON, ANBE, POLS, IREL, SPAN, ACCT, ENGL, EDUC, PSYC, MATH, BIOL, MGMT, GEOG, BICH, HISPANIC, OTHER, ASIAN, BLACK, ATHLETE, GREEK, FEMALE, CITIZEN, CREDITS, INDEX

b. This total sum of squares is not corrected for the constant because the constant is zero for regression through the origin.

c. Dependent Variable: GPA_MAJOR

d. Linear Regression through the Origin

Coefficients (a,b)

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	ATHLETE	-.033	.055	-.004	-.602	.547
	FEMALE	.176	.033	.037	5.283	.000
	BLACK	-.236	.100	-.011	-2.368	.018
	HISPANIC	-.161	.111	-.006	-1.444	.149
	ASIAN	-.137	.056	-.011	-2.457	.014
	OTHER	.089	.102	.004	.872	.384
	CITIZEN	.011	.069	.003	.155	.877
	INDEX	.009	.001	.544	8.595	.000
	GREEK	-.018	.030	-.004	-.598	.550
	CREDITS	.034	.009	.108	3.644	.000
	ACCT	1.090	.274	.080	3.974	.000

ANBE	1.310	.270	.044	4.853	.000
ART	1.116	.295	.027	3.781	.000
ANTH-SOC	1.157	.254	.049	4.553	.000
BICH	1.163	.273	.046	4.260	.000
BIOL	1.076	.253	.087	4.259	.000
CENG	.985	.260	.057	3.787	.000
CHEG	1.033	.266	.054	3.883	.000
CHEM	.883	.277	.035	3.187	.002
CLAS	1.363	.348	.021	3.913	.000
CSCI	1.014	.265	.048	3.829	.000
CSEG	1.073	.280	.043	3.837	.000
EAST	1.767	.444	.019	3.983	.000
ECON	1.086	.243	.082	4.467	.000
EDUC	1.449	.260	.089	5.569	.000
ELEC	.862	.268	.049	3.215	.001
ENGL	1.328	.257	.087	5.176	.000
ENST	1.319	.243	.064	5.439	.000
FREN	1.346	.304	.032	4.435	.000
GEOG	.753	.445	.008	1.694	.091
GEOL	1.135	.309	.024	3.674	.000
GERM	1.065	.321	.020	3.315	.001
HIST	1.363	.256	.062	5.327	.000
IDPT	1.619	.451	.017	3.588	.000
IREL	1.351	.227	.084	5.940	.000
MGMT	1.064	.257	.124	4.135	.000
MATH	1.044	.278	.043	3.760	.000
MECH	.836	.269	.050	3.107	.002
MUSC	1.110	.364	.020	3.051	.002
PHIL	1.220	.277	.039	4.408	.000
PHYS	.566	.296	.015	1.913	.056
POLS	1.115	.253	.069	4.405	.000
PSYC	.911	.253	.062	3.597	.000
RUSS	1.579	.441	.017	3.585	.000
SPAN	1.489	.281	.039	5.290	.000
THEA	1.595	.358	.024	4.457	.000
WMST	1.708	.360	.026	4.749	.000
femath	.003	.082	.000	.036	.971

a. Dependent Variable: GPA_MAJOR

b. Linear Regression through the Origin