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DETERMINANTS OF PROFIT FOR DIVISION I MEN'S ICE HOCKEY

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DETERMINANTS OF PROFIT FOR DIVISION I MEN'S ICE HOCKEY

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Introduction

College Athletics History

College athletics and the National Collegiate Athletic Association (NCAA) have been around since the late 1800s and early 1900s, and have been a large part of the culture at universities across the United States (Osborne, Jensen, Weight, 2020). The oldest college athletic event dates back to 1852 when Harvard and Yale competed against each other in a regatta (Osborne, Jensen, Weight, 2020). Since then, the popularity of schools competing against each other has continued to grow and has formed some great rivalries between colleges and universities. Students were one of the main reasons why intercollegiate athletic programs continued to grow in the 1870s as they established associations for rowing in 1871, football in 1876, and baseball in 1879 (Osborne, Jensen, Weight, 2020). The NCAA itself was not formed until 1910 after President Roosevelt felt that colleges and universities needed to organize how college athletics were managed and operated (Osborne, Jensen, Weight, 2020). The NCAA has continued to grow since then as approximately 500,000 student-athletes are competing at over 1,117 NCAA member institutions throughout the United States (Osborne, Jensen, Weight, 2020).

As college sports became more popular to the general public, colleges and universities began investing more money into their athletic programs. Throughout the 1900s, some institutions built huge football stadiums seating up to 70,000 spectators, and college coaches were paid large salaries with the hope of having competitive teams (Osborne, Jensen, Weight, 2020). In 1973, the NCAA decided to separate into different competitive divisions to allow schools of different sizes and philosophies to be in conjunction with each other (Osborne, Jensen, Weight, 2020). “The membership voted to create three divisions, self-determined, and differentiated by athletics philosophy” (Osborne, Jensen, Weight, 2020, p. 15). This decision was

the reason why there are now three separate divisions (I, II, and III) within the NCAA. This way schools can be more competitive when it comes to athletics by playing schools that are of similar size and philosophy.

During the 1980s, cable television and media rights became increasingly popular for college sporting events (Osborne, Jensen, Weight, 2020). This had a huge financial impact on college athletics as schools with large amounts of resources were able to benefit from the media rights of broadcasting games, while in contrast, schools with fewer resources struggled to catch up (Osborne, Jensen, Weight, 2020). The two most popular sports that benefited from these television and media rights deals were football and men's basketball (Osborne, Jensen, Weight, 2020). This gave schools with popular football and basketball programs the opportunity to increase their revenue brought in by the sports to continue growing all of their athletic programs. Over the years college athletics has continued to grow in both popularity and fan following and likely continue to grow as schools are investing more into their athletic programs and facilities.

History of College Ice Hockey

One NCAA sport that is not focused on as much as football and men's basketball, yet still is very popular, is men's ice hockey. As of the current 2021/2022 season, there are 59 Division I men's teams competing in the NCAA (Men's Division, n.d.). In comparison to the number of Division I football programs, which is 254, men's ice hockey is considered more of a niche sport and is not as common at colleges and universities. Ice hockey is also a sport that is mostly played at schools across the Midwest and Northeastern parts of the United States (Crowl, 2016). A review of a map of universities that sponsor men's ice hockey would indicate that most schools that have teams are located in the Midwest and Northeast, making it not as popular and widely available as other sports such as football and basketball.

In terms of the history of the sport of ice hockey, it dates back to the late 1800s and early 1900s. There is some contention over who played the first-ever intercollegiate hockey game. Some sources say that it was between Harvard and Brown in 1895 (Thelin, n.d.), while others believe that it was first between Yale and Johns Hopkins on February 1st of 1896 (Schiff, 2003). Either way, during that time, ice hockey was becoming a popular sport in Canada as the Manitoba Hockey Association was formed in 1892, and had teams competing for what is now known as the Stanley Cup just four years later (Pearson, n.d.). The sport has grown over the years and become more popular at the collegiate level as well, as we see schools choosing to add the sport to their list of athletic activities offered.

Lesser-known sports, such as ice hockey, became more popular at the college level during the 1960s. Colleges and universities began shining more of a spotlight on hockey with its growing popularity (Thelin, n.d.). During this time, the Eastern Collegiate Athletic Conference (ECAC) also started gaining traction within the realm of collegiate ice hockey. The ECAC became well-known for successful college hockey programs as their numbers rose to 25 total member schools (Stutt, 2010). They decided to adopt the similar type of classification used for popular sports at the time, such as football, by classifying their teams as either “major” or “college” (Stutt, 2010). The “major” status was awarded to successful and well-known schools, where the term “college” was given to the smaller and less successful schools. Some of the popular hockey schools at the time such as Rensselaer and Clarkson were awarded “major” status in hockey, however, in other sports, they were considered as “college” status (Stutt, 2010). This is part of the reason why today some schools play ice hockey at the Division I level but compete at either the Division II or III level with every other sport that is offered at the school. For example, a school such as Ferris State, which has a deep history of success at the Division I

level for men's ice hockey, participates at the Division II level in football and every other sport that is offered by their athletic program (Crowl, 2016).

By the 1970s the athletic grants-in-aid began increasing for smaller sports such as soccer, lacrosse, hockey, wrestling, baseball, and swimming, which also increased the operating expenses of athletic departments (Thelin, n.d.). The issue that the athletic departments then faced was the fact that the smaller growing fan bases failed to cover the increasing costs associated with these sports (Thelin, n.d.). The issue now that many colleges and universities face is having enough funds to sponsor smaller known sports such as ice hockey. Even though it is a popular sport at colleges and universities around the country, and can potentially bring in revenue, it is still not as big as football and basketball.

In recent years schools such as Alabama Huntsville and Robert Morris have announced that they were going to be cutting the sport due to the financial and operational costs of producing a competitive Division I program (Gabbey, 2021). For the University of Alabama-Huntsville, they decided to discontinue its hockey program due to budget restraints from COVID-19. Fortunately, the program gained a lot of support from the community and former players and was able to raise \$750,000 to keep the program alive for another year (Gabbey, 2021). With college athletics on the rise, issues began to come to light with the growing popularity. One of these issues that still exists today is the overall cost of sponsoring multiple teams, while still having enough money to be financially stable. In an article by Upham (2018), he notes that there were 31 Football Bowl Subdivision (FBS) schools that spent over \$100 million on athletics, showing the major financial costs of sponsoring athletic programs at the Division I level (Upham, 2018). One of the most important areas to focus on with the increasing costs of college athletics is figuring out how to maximize revenues (Osborne, Jensen, Weight,

2020). In a sport such as ice hockey, this is even more important because the profit margins are even smaller.

Literature Review

Finances

In terms of finances for all of the NCAA, the organization is almost entirely supported by the media and marketing rights of the Division I Men's Basketball Championship, known as "March Madness" (Osborne, Jensen, Weight, 2020). March Madness is one of the most popular tournaments for the sport of basketball at any level. The budget for the Division I men's basketball championship in 2018/2019 was \$28 million and the NCAA claimed that the total net income for the tournament was \$864.6 million (The Athletic Staff, 2021). The profits from this tournament alone will pay for just about every other NCAA championship across all divisions except for Division I baseball, men's ice hockey, men's lacrosse, and wrestling (The Athletic Staff, 2021). These sports all generate more revenue than expenses and help cover the costs of other championships.

The Division I College Football Playoff is also a large revenue-producing event for college athletics, however, not specifically for the NCAA itself. Even though the College Football Playoffs (CFP) produced over \$600 million in 2017, the NCAA did not receive any of that revenue, because it was run by the CFP and not the NCAA (Osborne, Jensen, Weight, 2020). The reason that the NCAA is not able to receive this money is due to the U.S. Supreme Court decision that the NCAA's control of the broadcasting rights for collegiate football violated antitrust law (NCAA v. Board of Regents, 1984). The money made from the CFP was distributed to schools from the 10 conferences that competed throughout the year (Osborne, Jensen, Weight, 2020). Even though the NCAA does not have any direct financial benefit from the College

Football Playoffs, the sport itself is still huge for all NCAA colleges and universities throughout the entire season. For example, during 2016/2017, the University of Texas was the school with the most revenue from all of athletics, which was \$182 million, and 70% of that revenue came just from football (Gaines, 2017).

As shown in figure 1, total revenues for college ice hockey indicate that it is the third highest revenue-generating sport behind football and men's basketball. According to the Department of Education in 2017, men's ice hockey had an average revenue for each Division I school participating of \$2.8 Million (Gaines, 2017). When compared to football with \$31 million, and basketball with \$8.1 million, it is still significantly less. However, it is still considered one of the most revenue-generating sports behind the top two (Gaines, 2017).

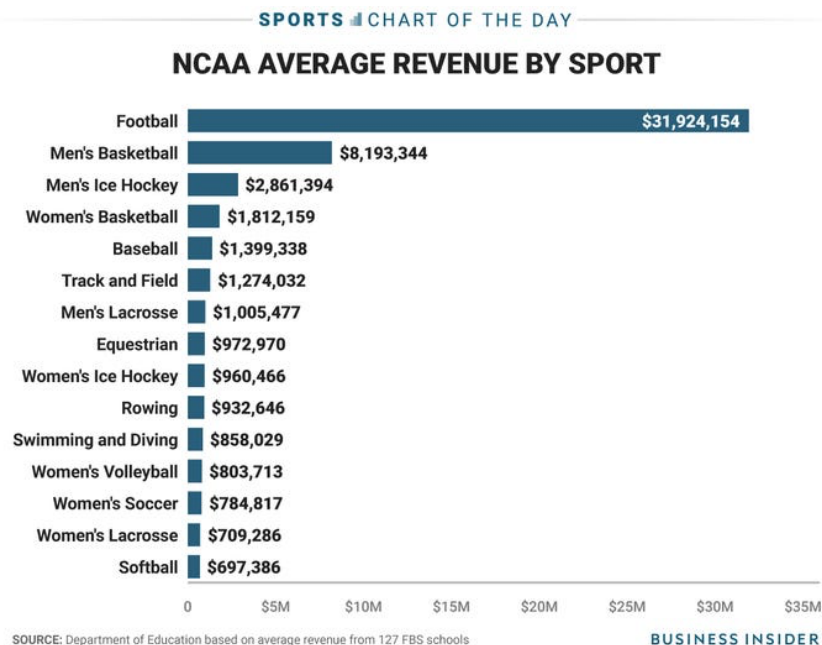


Figure 1. NCAA Average Revenue by Sport (Gaines, 2017).

In general, the sport of ice hockey can be very costly with factors such as facilities, team travel, and overall expenses. In an article by the *Chicago Tribune* in 2019, the University of Illinois was considering adding an NCAA Men's hockey program. One of the issues that the

Athletic Director, Josh Whitman, talked about was the costs associated with adding a Division I hockey program. One of those issues was having enough money to build a “\$100 million, 5,000-seat multi-purpose arena in downtown Champaign” (Ryan, 2019, para. 12). Unfortunately, the sport, in general, can be very costly with high operating budgets and high costs per student-athlete. According to Ryan (2019), “Experts estimate the operating budget for hockey is second only to football in college sports, requiring between \$1.5 million and \$2 million to implement a program, not counting the cost of an arena” (para. 32). This can be a very costly expense that some colleges and universities may not want to deal with.

Revenue and Profit in College Athletics

When it comes to revenue and expenses for the two biggest sports in college athletics, just about half of the Division I football and men’s basketball teams either don’t turn a profit or break even. In the 2017 Revenues and Expenses Report compiled by the NCAA, only 54% of Division I FBS programs and 47% of Division I men’s basketball programs generated revenue greater than their expenses (Osborne, Jensen, Weight, 2020). This is one of the main concerns for a majority of athletic departments. A lot of athletic departments are just focused on breaking even instead of turning a small profit. The main objective becomes equaling revenues and expenses so that they don’t lose any money for the year.

According to financial information from the NCAA for 2016/2017, the schools with the highest athletic department revenue were Texas, Texas A&M, Ohio State, Michigan, and Alabama, with Texas bringing in over \$214 million in revenue (Osborne, Jensen, Weight, 2020). While that is still a large amount of revenue to bring in throughout the year, their overall expenses were just over \$207 million, meaning that their profit percentage was just 4%, or about \$8 million (Osborne, Jensen, Weight, 2020). Even though large Division I schools are bringing

in millions of dollars each year, they are still spending millions as well. Colleges and universities continue to spend more money each year in hopes of increasing their competitive success by, “building lavish facilities to attract the best recruits, paying exorbitant salaries for the best coaches, and sometimes even recruiting more athletes than available scholarships or allowed roster spots” (Osborne, Jensen, Weight, 2020, p. 22).

Since NCAA Division I football is known as the most popular sport in all of college athletics, there is a lot of research surrounding the financial side of the sport. Baade, Baumann, and Matheson (2008) examined the economic impact of college sports on local economies. They gathered data from 63 different areas that hosted big-time college football programs and looked at factors such as the number of home games played, winning percentage, and winning a national championship to determine if there were any economic impact on local economies (Baade, Baumann, Matheson, 2008). Based on their research they did not find any of the variables examined to be statistically significant in having a positive correlation between college football and the local economy (Baade, Baumann, Matheson, 2008).

Omondi-Ochieng (2019), looked at factors most significant in determining net income for 101 university football programs competing at the Football Bowl Subdivision (FBS). Independent variables such as the number of men’s and women’s teams, home attendance, win-loss records, conference rankings, and age of each program were used (Omondi-Ochieng, 2019). Based on the findings from the research, the author found that home attendance and conference ranking had the highest association with net income with home attendance being the best predictor (Omondi-Ochieng, 2019). This research was important in understanding where specifically revenue comes from and how to manage the different factors that affect positive net income.

Similar research was also conducted for Division I women's basketball, which is the highest revenue-generating sport for women in the NCAA. From this study, Terry, Pjensky, Patterson (2010) examined multiple factors of profitability for 217 Division I college athletic programs and used a multiple regression equation to determine which were statistically significant. Variables such as percent of student aid given to women, size of the institution, and the number of female athletes were all positive and statistically significant in determining women's college basketball profitability (Terry, Pjensky, Patterson, 2010). The factors that were found to be positive and statistically significant were the percent of student aid to women, size of the institution, and the number of female athletes (Terry, Pjensky, Patterson, 2010). One of the biggest findings from this research was that percentage of aid allocated to women's athletics was a large factor in success and profitability, which shows the importance of supporting women's programs beyond the minimum Title IX requirements (Terry, Pjensky, Patterson, 2010).

Terry, Pjensky, Patterson (2011) also examined the overall determinants of profits for 217 Division I Men's Basketball programs for the athletic department using the same multiple regression equation. Similar to the study on women's basketball, Terry, Pjensky, Patterson (2011) examined variables to see which ones were considered to be statistically significant in determining profits for the athletic program. Based on the research, the variables found to be statistically significant were football status, amount of student financial aid to athletics, size of the institution, recruiting expenses, and compensation of head coaches (Terry, Pjensky, Patterson, 2011). The findings from this research were beneficial in understanding which areas are most influential in predicting profits for the men's basketball programs.

NCAA Ice Hockey

NCAA college ice hockey is a unique sport in comparison to most other sports due to the number of schools that participate in either men's or women's ice hockey as well as the student-athletes that participate. For both men's and women's ice hockey, teams compete for a national championship at either the Division I or Division III level. There is a Division II level for ice hockey, however, it is only made up of one conference with no national championship due to the lack of sponsoring programs (Full List, n.d.). Overall, the sport of ice hockey within the NCAA is a very regional sport, with a majority of schools that participate being located in the northern half of the United States (Crowl, 2016). Some of the most popular ice hockey schools are smaller schools, in terms of enrollment, that only participate at the Division I level in ice hockey and participate at the Division II or Division III level with every other sport. For some of these schools that have Division I ice hockey and only Division II or III football or basketball, hockey becomes that sport that the school is known for. "The growth in popularity of basketball and football have created an opportunity for smaller schools to dominate other sports" (Crowl, 2016, Small programs are steeped in local pride).

Over the last few years, there have been multiple colleges and universities announcing that they will be sponsoring Division I men's ice hockey. Schools such as Arizona State University, Long Island University, and St. Thomas University are three of the newest schools that chose to add Division I men's ice hockey programs (Wells, 2020). A majority of the schools that choose to add a Division I program either move up from the Division III level or from the ACHA club level since it is easier to make the jump up with an existing program. Arizona State, for example, was originally an ACHA Division I club program that had years of success at the club level and wanted to make the jump up to NCAA Division I in 2015 (Wells, 2020). That

success then carried on at the NCAA Division I level when they earned their first NCAA tournament berth in 2019 (U.S College, n.d.).

One of the reasons why a small number of colleges and universities choose to participate in ice hockey at the Division I level comes down to money. There are a lot of hockey programs that can turn a small profit for their school, however, in comparison to football and basketball, the profits are not nearly as high (Crowl, 2016). Operating costs of the sport can be very high, which impacts the number of schools that choose to participate. According to a hockey feasibility study conducted for the University of Illinois in 2018, the operating budgets of hockey programs within the Big Ten averaged \$1.15 million per year. The highest operating budget was \$1.3 million and the lowest was \$900,000 (Illinois Athletics, 2018). Other factors such as coaches' salaries, recruiting budget, scholarship dollars, and facility costs all play a large role in the high costs of producing a successful Division I program (Illinois Athletics, 2018).

In terms of financial research of intercollegiate athletics, the main focus has been on football and basketball since they are the two most revenue-generating sports. Very little research has focused on the sport of ice hockey, especially when it comes to revenues and profits. Most of the research regarding the sport has been in the medical field. Ice hockey is not a sport that is funded by many colleges and universities, yet it is still third on the list for generating revenue. Therefore, it would be important to examine the profits for this sport just like it has been done for football, men's basketball, and women's basketball. It would give insight into schools looking to add ice hockey as a new sport or provide information for schools with ice hockey looking to increase revenue and profits from the sport.

It would be valuable to research Division I men's hockey to examine the variables that influence the overall profit within that particular sport, similar to those done for football and

basketball. Terry, Pjensky, Patterson (2011), was able to determine the factors that are most influential in determining profits for the sport of men's and women's basketball. This same equation can be used to determine the factors that influence profits within Division I men's ice hockey to further understand where profits come from within the sport. The purpose of this study is to examine Division I collegiate ice hockey programs and determine which financial and institutional variables associated with each school are significant in predicting profits. This information will give a better understanding of which factors are most influential in determining profits for one of the higher revenue-generating sports in all of college athletics.

Methods

The focus of this study will be on measuring the overall determinants of profits for men's college ice hockey programs for an Athletics Department and the University. Finances and other factors will be reviewed (e.g., athletic department profit, coaches' salaries, amount of aid provided to both men and women sports) to examine the amount of profit the hockey program may provide to the athletics department. Other institutional variables will be used such as the size of the school, number of students, as well as private versus public institutions. When put into the equation listed below, these variables will be analyzed to determine the significance of each variable that affects the overall profit for men's ice hockey. Each variable may influence the overall profits for the men's ice hockey program and can give an idea of the overall financial impact on athletics.

Information will be collected from the *Postsecondary Education Equity in Athletics Disclosure* website where financial information from each school's athletic department is posted. The data that is being used is from the 2018/2019 season is the newest data available and will

avoid any inconsistency from the Coronavirus pandemic during the 2019/2020 season. During the 2018/2019 hockey season, there were a total of 60 teams that competed at the NCAA Division I level for men's ice hockey. There are only financial records for 58 of those 60 schools as the Army and the Air Force are not required to submit all financial records to the Postsecondary Education in Athletics Disclosure website. (Schrotenboer & Berkowitz, 2017).

Financial and institutional information that is provided by each university will be evaluated and used in a multiple regression equation. A variation of a method implemented by Terry, Pjensky, Patterson (2011) will be used. Terry, Pjensky, Patterson (2011) examined the financial information and profit for all 217 NCAA Division I Men's Basketball Programs in 2007. He then used that information in a multiple regression equation to find which variables were most significant in predicting profit or men's basketball programs. From this research, Terry, Pjensky, Patterson (2011) was able to find that football status, amount of financial aid to athletics, size of the institution, recruiting expenses, and average head coach salary were all positive and significant factors in predicting profit for men's basketball programs.

Design

For the equation that is used, there are factors such as the amount of student financial aid to athletics, size of the institution, overall recruiting expenses, head coach salaries, and rating percentage index (RPI) ranking of the team. The formula has eleven independent variables in total and is outlined below. Terry, Pjensky, Patterson (2011) used the equation listed below to measure basketball profits:

$$\begin{aligned} BPROFIT_i = & B_0 + B_1APROFIT_i + B_2DIA_i + B_3AID_i + B_4AIDWOMEN_i + B_5STUDENTS_i + \\ & B_6PUBLIC_i + B_7FATHLETES_i + B_8RECRUIT_i + B_9COACH_i + B_{10}ASSISTANT_i + B_{11}RPI_i \\ & + u_i. \end{aligned}$$

The model for this study would be similar, but instead of profits for Division I men's basketball, profits for Division I men's ice hockey would be used (HPROFIT). By looking at the same variables examined for 58 schools that have a Division I men's ice hockey program, the formula for this study would look like this:

$$\begin{aligned} HPROFIT_i = & H_0 + H_1APROFIT_i + H_2DIA_i + H_3AID_i + H_4AIDWOMEN_i + H_5STUDENTS_i + \\ & H_6PUBLIC_i + H_7FATHLETES_i + H_8RECRUIT_i + H_9COACH_i + H_{10}ASSISTANT_i + \\ & H_{11}RPI_i + u_i. \end{aligned}$$

The dependent variable HPROFIT would measure the overall profit recorded by the men's ice hockey program. This value is calculated by taking the hockey program's total revenue minus total expenses. For the 58 men's ice hockey programs, there were 16 that reported turning a profit. The programs with the highest profits were the University of North Dakota (\$1,230,718), University of Minnesota-Duluth (\$1,179,028), University of Wisconsin (\$801,918), and Penn State University (\$770,193). In total 34 programs reported breaking even as well as 8 programs reported a profit loss. The schools with the highest reported losses were the University of Notre Dame (-\$3,170,175), Ohio State University (-\$2,536,366), and Boston College (-\$2,009,562).

The independent variable APROFIT would represent the overall athletic profits for the institution itself. This is also represented by taking the overall athletic department's revenue

minus expenses. For the 58 different athletic departments, there were 22 that reported turning a profit for that year. The programs that reported the highest profit were the University of Notre Dame (\$19,258,385), Penn State University (\$13,485,287), and the University of Minnesota (\$11,287,784). The remaining 36 schools all reported breaking even for the 2018/2019 academic year.

The DIA variable is looking at institutions' football status, as football is considered the most revenue-generating sport within the NCAA. Ice hockey is a unique sport since some schools that participate at the Division I level either do not have a football program or have a program that only competes at the Division II or III level. Terry, Pjensky, Patterson (2011) used this variable to measure the differences between DI-A and DI-AA schools since all of the schools in the study of Division I men's basketball also participated in Division I football. This study for men's ice hockey will examine either having Division I football or not having Division I football. Of the 58 teams whose data was collected, 37 schools competed at the Division I level for football, with the other 21 either not having a football program or having a program that played at the Division II or III level. Schools that offer Division I football are expected to have higher profitability in theory since they should earn more revenue from all of their major sports such as football.

The next variable, AID, represents the total athletic aid, both men and women, given to student-athletes by each school. The highest recorded amount of athletic aid given to student-athletes was the University of Michigan with over \$26.8 million. AIDWOMEN represents the percentage of athletic aid distributed to women athletes and was calculated by dividing the women's athletic aid by the total athletic aid. This variable is expected to have a more negative

impact on profitability since an increase in financial aid for women's sports will mean less financial aid for men's sports and thus lead to a decrease in profits.

The next three variables, STUDENTS, PUBLIC, and FATHLETES, are considered institutional control variables. The STUDENTS variable would measure the overall size of the institution by looking at enrolled undergraduate students. The school with the largest undergraduate enrollment was Ohio State University with 42,646 undergraduates, and the school with the lowest enrollment was American International College with 1,211 undergraduates. The PUBLIC variable would represent the type of institution – either public or private. Next, the FATHLETES variable would represent the total number of female student-athletes at the institution. This variable is expected to have a negative impact on profitability for men's ice hockey based on the knowledge that more female athletic programs and participants would take away monetary resources from men's teams. The school with the largest female athletic participation was Cornell with 573, and the University of Alaska Fairbanks had the lowest participation with 57.

The last few variables in the equation are RECRUIT, COACH, ASSISTANT, and RPI. The variable RECRUIT measures the overall budget that is used for recruiting male student-athletes at each school. The schools with the largest male recruiting budgets were Penn State University (\$2,487,483), the University of Michigan (\$2,363,227), and the University of Minnesota (\$2,035,629). This variable should have a positive effect on the overall profits since a higher budget for recruiting talented athletes should result in greater success, and thus higher profits for the program. The next two, COACH and ASSISTANT measure the average pay for both the head coach and assistant men's coaches at each college or university. The highest reported average head coach salary was the University of Notre Dame (\$1,016,304) and the

lowest reported was St. Lawrence University (\$46,824). The school with the highest average assistant coach salary was Ohio State University (\$349,132), and the lowest was Rochester Institute of Technology (\$11,405). Both variables should have a positive impact on profits since programs with a better coaching staff should improve the overall performance and produce more revenue-generating programs.

Lastly, the variable RPI, is what is used to rank teams based on their win/loss record and strength of schedule. For Division I men's ice hockey, the rankings were taken from the NCAA RPI archives and represent the final rankings for the 2018/2019 season. The top three teams based on RPI rankings were St. Cloud State, Minnesota Duluth, and the University of Massachusetts respectively. Overall, RPI should have an inverse relationship with men's ice hockey profits since the better teams will have overall lower RPI rankings.

Each of the variables are shown in the chart below with what they represent:

HPROFIT	Represents the overall profit for the men's ice hockey program
APROFIT	Represents the overall athletic profits for the institution itself
DIA	Represents the overall level of football at the institution – Either schools with D1 football (0) or schools without D1 football (1)
AID	Represents the total athletic aid given to student-athletes
AIDWOMEN	Represents the percentage of athletic aid distributed to female athletes
STUDENTS	Represents the overall size of the institution by looking at enrolled undergraduate students
PUBLIC	Represents the type of institution – either public (1) or private (0)
FATHLETES	Represents the total number of female student-athletes at the institution
RECRUIT	Represents the overall budget that is used for recruiting male student-athletes at each institution
COACH	Represents the average pay for the men's head coaches
ASSISTANT	Represents the average pay for men's assistant(s) coaches
RPI	The national ranking scale which is used to rank teams based on their win/loss record and strength of schedule

Results

Table 1

Model 1 Descriptive Statistics

Variable	Minimum	Maximum	Mean	Std. Deviation
HPROFIT	-\$3,170,175	\$1,230,718	-\$53,309.38	\$690,472.42
APROFIT	\$0	\$19,258,385	\$1,406,861.90	\$3,871,281.70
DIA	0	1	.36	.49
STUDENTS	1211	42646	10739.57	10276.65
PUBLIC	0	1	.50	.50
AID	\$0	\$26,893,298	\$7,965,273.64	\$7,093,874.91
AIDWOMEN	0	64	39.88	17.07
RECRUIT	\$33,171	\$2,487,483	\$517,926.93	\$609,752.10
COACH	\$46,824	\$1,016,304	\$238,912.36	\$252,394.47
ASSISTANT	\$11,405	\$349,132	\$73,682.33	\$71,205.07
FATHLETES	57	573	318.50	128.30
RPI	1	60	29.90	17.49

N=58

Table 2

Model 1

Variable	Coefficient	t-stat	Sig.
HPROFIT	389054.771	.934	.355
APROFIT	-.002	-.056	.955
DIA	-183895.516	-1.063	.293
STUDENTS	44.388	3.255	.002*
PUBLIC	172187.982	.926	.360
AID	-.017	-.748	.458
AIDWOMEN	2996.023	.440	.662
RECRUIT	.201	.673	.505
COACH	.761	1.057	.296
ASSISTANT	-15.090	-5.123	<.001*
FATHLETES	-28.334	-.033	.974
RPI	-2824.258	-.719	.476

N=58, R-square for Model 1 is .626, adjusted r-square is .536, and *p<.05

Table 1 shows the descriptive statistics for each of the variables that were included in the equation. The total number of schools used was 58 and the tables give insight into the minimum, maximum, mean, and standard deviation for each variable. Based on the results found, the model 1 summary showed that the r-square value is .626, meaning that the model explains 62.6% of the variance in profits for Division I men's ice hockey.

Table 2 shows each variable, the coefficient, t-statistic, as well as the significance in determining ice hockey profits (HPROFIT). The APROFIT variable, which represents the overall athletic department's profit, was negative but not significant in determining hockey profits. This supports what Terry, Pjensky, Patterson (2011) found where for men's basketball where a negative coefficient would imply that hockey is not the main provider of profits for the athletic department. In general, this variable was not significant and did not have much of an impact on men's ice hockey profits.

The variable that categorized teams based on Division I football status (DIA), was negative but not statistically significant. This showed that schools with no Division I football had higher profits for ice hockey when compared to schools with a Division I football program. Football is a very popular sport at colleges and universities across the country, so having a Division I football program will likely take away attention, resources, and fans from a sport such as ice hockey. This also means that schools with Division I men's ice hockey and no Division I football are more likely to be profitable.

The size of the institution, or the STUDENTS variable, was positive and one of two variables that were statistically significant in the model. This could be since larger schools likely have more resources, better facilities, and a larger fan base that will help in producing more

revenue for a hockey program. Some of the smaller schools will struggle in terms of both fan base as well as resources when compared to the larger and more well-known public schools.

The PUBLIC variable was positive but not statistically significant. In terms of data collected, it showed that public schools were more likely to be profitable when compared to schools that are private institutions. This could again come down to size, where private schools are usually smaller in comparison to public institutions. The variable for AID was negative but also not statistically significant. Surprisingly, an increase in athletic aid to student-athletes did not have a positive impact on increasing hockey profits. Instead, an increase in total athletic aid on average showed a small decrease in hockey profits. The variable representing athletic aid to women (AIDWOMEN), was surprisingly positive, however, still not statistically significant. The positive coefficient is surprising as the assumption would be that more aid given to women would decrease profits for men's ice hockey. In general, athletic aid given to women did not have a negative effect on hockey profits.

Both the RECRUIT and COACH variables were positive, however, not statistically significant. The average men's coach salary showed that an increase in head coach salary at an institution usually leads to higher profits for men's ice hockey, however, it was not statistically significant. The average recruiting budget for men was also positive, but still not significant and had no real impact on increasing profits. These two variables were positive as predicted; however, they did not show any statistical significance in determining profits for men's ice hockey.

The ASSISTANT variable for average assistant coach salary was negative and one of the other statistically significant variables. Schools such as Ohio State and the University of Michigan who had the highest average assistant coach salaries, with \$349,132 and \$257,167

respectively, reported some of the highest losses for men's ice hockey. Since assistant coaches are not quite as important as head coaches, schools that pay a higher average assistant coach salary are likely to earn less profit for sports such as ice hockey. A majority of schools that showed having high assistant coach salaries did not turn a profit in men's ice hockey or even reported losing money.

The FATHLETES variable was negative and did not have a significant impact on profits for men's ice hockey. This did show that on average an increase in the number of female student-athletes had a negative effect on profits for men's ice hockey, however, was not enough to be statistically significant. Lastly, the RPI variable was negative as expected but not statistically significant. The negative coefficient is expected because teams that have an RPI ranking closer to 1 should have an increase in profits due to their success on the ice. However, in terms of this model, it did not show that it was a large factor in producing profits but indicated that teams with lower rankings were more likely to see an increase in profits.

Since the STUDENTS variable, which measured the overall size of the school was considered significant, the regression analysis was performed again in terms of private versus public schools, to further analyze the different variables concerning ice hockey profits. In general, private schools are smaller when compared to public schools, and with the data collected there was an even number of public schools and private schools to compare (29 private and 29 public). The hope was to group schools with similar institutional variables to find more significant factors within each grouping. The Private Model and Public Model showed multiple variables that were statistically significant for both but also one variable that was significant for private schools and not public schools.

Public vs. Private Schools

The variable PUBLIC was split between private schools and public schools and a regression analysis was performed for each with the dependent variable still being ice hockey profits (HPROFIT) and still using the other 10 independent variables. The R-square value for the private model was very high (R-square = .964), meaning that 96% of the variance in HPROFIT for private schools can be explained in the private model. For the public model, the R-square value was .681 meaning that 68% of the variance of HPROFIT for public schools can be explained by the public model. Looking at tables 3 and 4 show that the variables statistically significant for both private and public schools were APROFIT, ASSISTANT, RPI, and COACH. DIA was a variable that was statistically significant for private schools but not for public schools.

For private schools, the APROFIT variable is negative and significant meaning that at these schools, hockey does not seem to be the main provider of profits for the athletic department as a whole. The private model also showed that football status (DIA) was statistically significant in determining profits for men's ice hockey. A scatter plot graph for this variable shows that private schools without Division I football are more likely to be profitable in hockey than private schools that have DI football.

For the private model, both the STUDENTS, AID and FATHLETES variables were all negative and not significant. Both AID and FATHLETES were negative in the first model, however, in contrast to the first model, the private model showed that private schools with a larger student population lead to less average profit in hockey. Neither of them was statistically significant, however. The ASSISTANT variable, which was significant in the first model was also statistically significant in the private model. This again reinforces the idea that schools that have a larger average assistant coach salary are less likely to be profitable in men's ice hockey.

The COACH variable on the other hand was positive and statically significant at the $p < .10$ level for private schools.

The last variable that was statistically significant for private schools was RPI. This variable was both negative and statistically significant meaning that private schools that had a lower RPI ranking were more likely to be profitable overall.

Table 3

Private Model			
Variable	Coefficient	t-stat	Sig.
HPROFIT	811916.491	3.677	.002
APROFIT	-.061	-3.347	.004*
DIA	-204020.252	-2.112	.049*
STUDENTS	-1.143	-.112	.912
AID	-.009	-.776	.448
AIDWOMEN	3637.089	1.147	.267
RECRUIT	.452	1.691	.108
COACH	.834	1.727	.101**
ASSISTANT	-18.109	-6.419	<.001*
FATHLETES	-25.839	-.057	.955
RPI	-7126.545	-2.957	.008*

N=29, R-square for Private Model is .964, adjusted R-square is .945, * $p < .05$ and ** $p < .10$

The variables that were considered statistically significant for public schools were APROFIT, COACH, ASSISTANT, and RPI. Just as it was for private schools, APROFIT is statistically significant in determining profits for ice hockey. The APROFIT variable for public schools on the other hand was positive and statistically significant meaning that on average an increase in overall athletic profits was helped by an increase in hockey profits. For public

schools that were able to have a successful and profitable hockey program, there was also an increase in total athletic profits.

The COACH and ASSISTANT variables were also significant for public schools just as they were for private schools, with the same coefficients. Lastly, the RPI variable was negative and statistically significant for public schools meaning that schools with lower-ranking were more likely to be profitable. Similar to private schools, public schools were statistically more likely to turn a profit if they had a winning and successful team on the ice with a high-ranking RPI.

Table 4

Public Model			
Variable	Coefficient	t-stat	Sig.
HPROFIT	1540498.276	1.472	.158
APROFIT	.102	2.478	.023*
DIA	-169145.758	-.632	.536
STUDENTS	-7.605	-.290	.775
AID	.090	1.646	.117
AIDWOMEN	-2458.249	-.095	.925
RECRUIT	-.564	-1.300	.210
COACH	2.202	2.117	.048*
ASSISTANT	-14.473	-4.169	<.001*
FATHLETES	-2729.904	-1.248	.228
RPI	-13973.696	-2.165	.044*

N=29, R-square for Private Model is .681, adjusted R-square is .504, *p<.05

Impact of Division I Football

While football status (DIA) in the original model was not statistically significant, it was found to be statistically significant in the private school model. Since football is one of the most popular and revenue-generating sports in all of intercollegiate athletics, the DIA variable was

examined again in terms of hockey profits. An independent samples t-test was performed which compared the mean hockey profits for schools with Division I football and schools without Division I football. As you can see in table 5, in terms of average hockey profits for schools with Division I football and schools without Division I football, it is clear that hockey programs without Division I football at their school are more likely to bring in profits when compared to schools with Division I football.

Schools such as Clarkson and Rensselaer Polytechnic Institute (RPI) who were able to turn a profit in hockey (\$513,955 and \$501,567 respectively), either do not have a football program or only have a Division III program that they do not have to compete against for resources and fans. Instead, ice hockey is the main sport that people pay attention to and follow at these schools. This provides an opportunity for ice hockey to be the main revenue-producing sport at schools without a Division I football program.

Table 5

Independent samples test						
	DIA	N	Mean	f	t	Sig.
HPROFIT	D1 Football	37	-\$180,770.89	3.067	-1.909	.085
	No D1 football	21	\$171,265.67			

Discussion

Previous literature on this topic examined the profits of other top revenue-generating college sports for both men and women. Terry, Pjensky, Patterson (2011), found that the most positive and significant factors for determining men's basketball profits were football status, amount of student financial aid given to athletics, size of the institution, recruiting expenses, coaches' salaries, and RPI ranking. For women's basketball, Terry, Pjensky, Patterson (2010)

found that the percent of student aid given to women, size of the institution, and the number of female athletes at an institution were all positive significant determinants of women's profits. This study examined the third-highest revenue-generating college sport for men and found significant variables that affect the profits for Division I college ice hockey. Similar to the results for men's basketball, the size of the institution, football status, coach salary, and RPI all had a significant impact on profits for men's ice hockey as well.

The results from this research could be used by colleges and universities looking at adding men's ice hockey as a sport. Due to the high predictability of the original model as well as the private and public models, these schools would be able to estimate the profitability based on their individual schools' variables when input into the regression equation. This information would provide each school with an idea of what the potential profit would be from adding a Division I men's ice hockey program. There is now more of an understanding of how different factors can influence the popularity and financial success of the sport at colleges and universities across the country. The results also provided statistical evidence of the impact that other sports such as football have on a smaller sport like ice hockey.

In terms of variables that were found to be significant, there were two in the original model and multiple in the public and private school models. For the first model, the significant variables in determining hockey profits were the size of the institution and assistant coach salaries. For the private school model total athletic profit, football status, coaches' salaries, and RPI were all significant in predicting profits. For public schools, the significant factors were total athletic profit, coaches' salaries, and RPI.

Total athletic department profit was significant in terms of hockey profits for both public and private schools. For public schools, an increase in total athletic department profit will lead to

an increase in hockey profit since these schools will have more resources available to use to improve sports such as ice hockey. This also shows that ice hockey at these schools is helpful with increasing the overall profits of the athletic department. Private schools on the other hand showed that an increase in total athletic department profit will lead to a decrease in hockey profits. At private schools, ice hockey is not always the sport that is producing revenue for the rest of the athletic department.

Football status (DIA) was one variable that had a significant impact on overall hockey profits at private schools. This could be explained by the fact that men's ice hockey at smaller private schools without a Division I football team, are more likely to have ice hockey as the main sport which would result in an increase of overall resources and attention to the sport from students, staff, and community members. Football status in the original model was not statistically significant, however, after performing a t-test on the DIA variable (Table 5), the average means of hockey profits for schools with Division I football and without Division I football were statistically significant. This test showed that schools without Division I football programs had higher average ice hockey profits than schools with a Division I football program. In general, colleges and universities with ice hockey that do not have a large Division I football program to compete against for resources and fans are more likely to be profitable. This supports ideas written in the article by Crowl (2016), *Why Do Small Schools Dominate College Hockey?*. The results from this research show that smaller schools, specifically without elite football programs, are more likely to be successful on the ice and also produce more revenue. This is one of the reasons why smaller schools seem to be more dominant in college ice hockey.

Both average head coach and assistant coach salaries were statistically significant for the public and private models. What was interesting was that the average head coach salary was

positive and significant while assistant coach salary was negative and significant for both models. This means that private schools and public schools with larger average head coach salaries were more likely to be profitable in men's ice hockey. It also meant that schools who have higher average assistant coach salaries were less likely to be profitable in hockey as they are spending more on coach salaries that do not have as much of an impact as head coaches do. Spending more on having a well-known and experienced head coach is likely to increase profits for the hockey program due to the impact and importance a head coach has on the overall team's success.

RPI for both public and private models was statistically significant for each. In general, this shows that hockey teams who are more successful on the ice and have a higher RPI ranking are also more likely to report higher profits throughout the season. This is because they will likely have a strong following from students, staff, and other people in the community. Team ranking and success on the ice are likely to lead to larger profits for the hockey program for both private and public schools.

One of the reasons why some variables were not shown to be statistically significant in the first model can be explained by the fact that private schools are very different from public schools in terms of size, student population, and resources. Comparing institutions that are more closely related in those institutional factors will provide more statistically significant variables. Ice hockey is a very unique college sport since there are a smaller number of schools that participate at the Division I level, and of those schools, some participate at lower divisions in other sports. This means that schools with Division I men's ice hockey will have very different institutional values. It also allows some schools the opportunity to have ice hockey be the main sport on campus instead of sports such as football or basketball.

The research showed which variables were significant in predicting ice hockey profits for institutions. This information may be valuable for both Athletic Directors and anyone working within an athletic department to identify what factors they should be focusing on when trying to increase the overall profits for an athletic team such as men's ice hockey, as well as give insight into factors that have the largest influence on profits for college ice hockey. It also showed the potential impact that other sport such as football can have on the sport. Schools without a Division I football program are more likely to be successful financially. For schools looking to add a Division I men's ice hockey program, using these individual variables can estimate whether or not men's ice hockey will be profitable at that institution. This is one of the first types of research that examined the financial side of Division I men's ice hockey. Further research into this topic would be beneficial in understanding the sport in relation to an institutions' athletic department as well as other popular revenue-producing college sports.

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