PENN STATE VERSUS THE STATE PENN: SALARY MAXIMIZATION AMONG NBA PROSPECTS IN CONTEXT OF UNIVERSITY CHOICE

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PENN STATE VERSUS THE STATE PENN: SALARY MAXIMIZATION AMONG NBA PROSPECTS IN CONTEXT OF UNIVERSITY CHOICE

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Abstract

The NBA Collective Bargaining Agreement (CBA) of 2005 instituted an age restriction upon entrants of the league's amateur draft. The majority of America's top high school prospects are now required to spend one year playing basketball at the NCAA level. This salary determination study is the first to examine professional athletes' rookie salary as a function of the university they attended. An ordinary least squared regression model is used as the estimating procedure to identify the determinants of draft order and salary among NBA rookies. University choice is examined along with other variables, including player performance, height and race. Results indicate that an athlete's university choice – independent of the other variables in the study – does significantly influence his professional salary.

KEYWORDS: (National Basketball Association Amateur Draft, Player Salary Determination, National Collegiate Athletics Association Basketball)

ON MY HONOR, I HAVE NEITHER GIVEN NOR RECEIVED
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CHAPTER I

INTRODUCTION

Professional sports are a big business and represent popular studies for economists due to the large number of quantitative data they produce and the established set of rules that govern them.[1] Yet rules do change, and changes have various effects on the games. This study pivots on a new rule change in the National Basketball Association (NBA) and its ramifications on college players entering the draft.

After the ratification of the NBA Collective Bargaining Agreement (CBA),[2] the amateur draft became restricted. Beginning with the 2006 draft, players are only eligible to enter if they are nineteen years of age and one year removed from high school. This rule change essentially funnels the best of American high school basketball players through the NCAA basketball system. This was the rule's intention: to morph the NCAA into an economic proving ground for potential NBA talent. Athletes serve one-year tenures as "student-athletes," where they very publicly compete for the glory of the school and the approval of scouts. The college game has become a stepping stone on the path to the NBA, the one option to which players are reduced. This study explores that

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[1] Philip K. Porter and Gerald W. Scully, "The Distribution of Earnings and the Rules of the Game, *Journal*, Volume, 2001: 140-162

[2] National Basketball Association Website, NBA Collective Bargaining Agreement Ratified and Signed, 13 September 2006, Available from http://www.nba.com/news/CBA_050730.html, accessed 1 May 2007

option and answers the question: which universities promise their athletes the greatest return on their time, and what is the effect on the athletes' future salary when choosing between different schools?

This will be the first article to examine the relationship between these two primary variables: salary and university choice among basketball players. Further the new CBA gives this topic increased importance: restricted from direct entrance to the amateur draft, high school players previously good enough to make the direct jump to the NBA can no longer do so. Because of this rule change players are no longer able to collect the large paychecks immediately after graduation. Prevented from the economic choice of best interest, the athlete's next best economic option becomes schooling – or at least one year of it.[3] But which school? The RPI routinely ranks over 300 universities;[4] but does the top school send the most players to the big leagues? Do their players get the largest paychecks? Or do smaller schools better showcase talent, giving their stars more opportunity to play earlier and shine?[5] Does this opportunity translate into a larger eventual paycheck for its stars? These questions have become increasingly relevant in the changed environment of basketball, and they are best answered through regression analysis.

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[3] A loophole has been proposed by Reebok rep Sonny Vaccaro: a player who is 19 completes the HS GED test and sits out of his senior year of HS would be eligible under the NBA's new CBA requirement.

George Dohrmann, "Skipping School," *Sports Illustrated*, Volume 105 No. 5, 2006: 19

[4] Ranking Percentage Index (RPI) is a measure of the quality of a college team

[5] It has been proven that scoring is constantly the factor that dominates the evaluation of playing talent in the NBA. Scoring is heavily dependent upon playing time and shots taken. Interestingly scoring efficiency is not constantly found to impact the evaluation of playing talent.

David J. Berri, Stacey L. Brook and Aju J. Fenn, "From College to the Pros: Predicting the NBA Amateur Player Draft," Working Paper

This study has built on a data set provided by Berri, it examines players' initial contracts[6] against their draft positions,[7] their last season's statistics,[8] and the characteristics of their alumni between the years 2001 and 2005.[9] From this model, salary can be predicted, the variables affecting salary can be pinpointed, and factors that eventually explain salary can be known. This study theorizes that some of these explanatory variables go beyond individual performance and that some will relate directly to the program with which the athlete is associated.

Salary is chosen as the primary independent variable in this data set because it accurately portrays the value the team associates with its player.[10] Salary is best predicted by draft rank. This study examines how a player best improves his salary through improving his draft position. The resulting model does not offer a better measure for evaluating players, rather a tool for players to understand how they are evaluated.

It is expected that draft position will be related to college production,[11] height,[12] and with college choice. It is predicted that the most successful schools, indicated by a high RPI, are so because they have the best players, and therefore have more players

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[6] David Dupree, USA Today's Salaries Database, 13 Sep 2006, Available from http://asp.usatoday.com/sports/basketball/nba/salaries/default.aspx, accessed 26 September 2006.

[7] David J. Berri, Stacey L. Brook and Aju J. Fenn, "From College to the Pros: Predicting the NBA Amateur Player Draft," Working Paper

[8] Ibid

[9] Ken Pomeroy, College Basketball Ratings Percentage Index by Year, 10 October 2006, Available from http://kenpom.com/rpi.php?y=2006, accessed 1 May 2007.

[10] Two related regressions are run in this study, the ultimate focus of these is player salary

[11] David J. Berri, Stacey L. Brook and Aju J. Fenn, "From College to the Pros: Predicting the NBA Amateur Player Draft," Working Paper

[12]Matthew S. Dey, "Racial Diffferences in National Basketball Association Player's Salaries: A New Look," *The American Economist*, Volume 41 No. 2, 1997: 84-90

drafted and under contract. It is also expected that the teams with the highest RPIs tend to be schools of historic prestige from highly visible major conferences that attract the best athletes. This progression of thinking works in a circular manner: the rich get richer. However it remains possible that players from less prestigious schools will have inflated statistics as they receive more minutes and shot opportunities, and that after adjusting for statistics will see some of the highest salaries relative to productivity.

The regression model utilized to answer these questions draws from previous social science literature on human capital and salary determinants. Many of the variables found significant in these studies will be applied to the game of basketball and directly to the regression. This study draws heavily on the previous regression models applied to basketball, which is most abundant in the study of discrimination. Chapter two will discuss the past research reviewed for the current study.

The third chapter will discuss the theory behind the selection of the variables used in this study. It will explain the purpose of the data collection and the necessity of each variable. The fourth chapter examines the source of the data and eventually delves into the reasoning behind the inclusion of the variables run in the final regression.

The results of the regression itself will be presented in the fifth chapter. This chapter concludes the empirical findings of this study and discusses their implications. Finally, the possibilities for further research are considered.

CHAPTER II

LITERATURE REVIEW

This chapter reviews the literature on salary compensation and its determinants. In addition it will review the methodology of previous regression analyses specifically targeting the economics of sports teams. First, the chapter will examine the theories behind human capital. Second, the chapter will move on to salary distribution among athletes within their teams, the causes and the implications. Finally, the chapter will discuss the variables that previous literature on discrimination within sports has found significant, as it will relate to the regression performed in this paper.

Human Capital

One of the most simplified macroeconomic growth models is written as:

Output = L * K * H   Where: L = Labor, K = Capital and H = Human Capital[1]

Human Capital has long been described as one of the key variables of output. By imagining a world of only one firm composed of only one person, this function is utilized in this paper: a basketball player's eventual salary as determined by their human capital. Under the new rules of the NBA CBA time spent at a particular university can be seen as

[1] Oliver Blanchard. *Macroeconomics 4*. New Jersey: Prentice Hall, 240

an investment in human capital. They must invest in their human capital to increase their salary. At which university do they profit the most though? Where is the opportunity cost of labor the least? As interns to the NBA, what makes the biggest statement on their resume?

Human capital as a fundamental variable of economic growth was first introduced by Becker, Murphy and Tamura (1990). Their study dismisses Malthusian fertility and Neoclassical growth as dependent upon the investment of physical capital and describes human capital as the cornerstone of growth. "Since human capital is embodied knowledge and skills, and economic development depends on advances in technological and scientific knowledge, development presumably depends on the accumulation of human capital."[2] The study finds human capital to have increasing marginal returns but that it becomes increasingly labor intensive to harvest additional units of human capital.[3]

Macroeconomic theory suggests that people respond to changing economic conditions by engaging in intertemporal activities.[4] As the opportunity to earn wages decreases, individuals redirect themselves towards other pursuits. Dellas' and Sakellaris' study (1996) suggests the pursuit of education and further gains of human capital when restricted from wage earning opportunities. Through an examination of a data set from 1968 to 1988 they reveal that a one percent increase in unemployment is associated with nearly a two percent increase in college enrollment. Therefore their study suggests that

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[2] Gary S. Becker, Kevin M. Murphy and Robert Tamura, "Human Capital, Fertility, and Economic Growth," *The Journal of Political Economy*, Volume 98, No. 5: 13

[3] Ibid: 12-37

[4] Harris Dellas and Plutarchos Sakellaris, "On the cyclicality of schooling: theory and evidence," *Oxford Economic papers*, Volume 55, 2003: 169

when unable to earn wages rational individuals search out other options. In this study they pursue education which translates into higher human capital.[5]

On the other hand Ingram and Neumann (2004) reject the classic social science measurement for skill: "Years of education, however, is a coarse measure of skill: all colleges do not deliver the same product to their students, all degrees are not equivalent in terms of the skills they encompass, and all students – even those that graduate from the same institution with the same degree – do not achieve the same level of preparedness upon graduation."[6] Instead they outline a complex measure of skill broken into four categories and run a regression examining salary as a function of skill. Their findings support their hypothesis and conclude that the increasing returns to skill cannot be exploited by simply sending more students to college. There are other significant variables.[7]

Another study by Ingram in collaboration with Dejong examines the individual's pursuit of skill acquisition, defined as "schooling, continuing education, training programs, and informal activities such as on-the-job training and professional activities pursued outside of the workplace,"[8] in relation to the business cycle. By shocking an equilibrium model the authors determined the interactions between the economy and the

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[5] Harris Dellas and Plutarchos Sakellaris, "On the cyclicality of schooling: theory and evidence," *Oxford Economic papers*, Volume 55, 2003: 148-172

[6] Beth F. Ingram and George R Neumann, "The returns to skill," *Labour Economics*, Volume 13, 2006: 38

[7] Ibid: 35-59

[8] David N. DeJong and Beth F. Ingram, "The Cyclical Behavior of Skill Acquisition," *Review of Economic Dynamics*, Volume 4, 2001: 536

individual's pursuit of skill acquisition to be countercyclical; the pursuit of skill acquisition increases dramatically as the economy recedes.[9]

Chang, Gomes and Schorfheide (2002) utilize regression analysis by modifying a standard RBC model to include an additional variable: job experience. The model is dubbed LBD or Learning By Doing. The modification improves the overall fit of the data suggesting that wage profiles are indeed dependent upon work experience.

Past work performance determines basketball players' draft position and wages. As the barriers to entry into the world of professional basketball have risen, players now must determine which institution of higher education represents the best platform for their game. Restricted from the opportunity to earn wages, this study examines how a player can best boost their perceived human capital and ultimately earn a greater wage. As salary is the assumed ultimate goal of a practical worker, the next section will examine how salary is distributed among professional sports organizations.

Salary Distribution

Since the relatively modern introduction of free agency in professional sports, salary distribution has become increasingly concentrated among the elite. Individual players have earned hundreds of millions of dollars with a single pen's stroke – and media attention has followed. The abundance of available information on professional athletes' salaries and their performance as measured by statistics has made professional sports a popular testing ground for economic theories that are otherwise difficult to

[9] David N. DeJong and Beth F. Ingram, "The Cyclical Behavior of Skill Acquisition," *Review of Economic Dynamics*, Volume 4, 2001: 536-561

quantify. Understand the components that comprise a player's salary become essential when introducing a new variable in the equation – university attended. The following articles focus on salary as a dependent variable upon individual and team performance.

Stating the assumption that performance is the realization of talent, and therefore can act as an exact proxy for talent, Porter and Scully (2001) utilize the uniformity in which sports are able to measure performance to determine salary distribution. Twelve data sets are examined and it is discovered that the distribution of salaries varies tremendously among professional sports. It is concluded that this is due to differences in the rules of the sports in accordance to the value of team play within the sport. Individual sports saw greater variance than team sports; these team sports saw different degrees of variance dependent upon the isolation of the individual within the game. Baseball has the most variance followed by basketball, football and hockey.[10]

It has been proven that beyond an athlete's own individual-level attributes, team-level attributes also must be accounted for in regards to salary. Kahane (2001) applies a hierarchical linear model (HLM) to hockey: viewing individual players as products of their team. At a ten percent level of significance the hypothesis is accepted that the mean salary of the team is positively correlated to the individual player's salary. Further refinement of the team and player performance is limited by the degrees of freedom

[10] Philip K. Porter and Gerald W. Scully, "The Distribution of Earnings and the Rules of the Game, *Journal*, Volume, 2001: 140-162

associated with the low number of teams within the National Hockey League (NHL), but the study agrees with the general concept of the small market franchise.[11]

Major League Baseball (MLB) provides an abundance of statistical data over a very long time period. For this reason it has been studied frequently. DeBrock, Hendricks and Koenker (2004) examine teams as firms competing for similar workers and the resulting wage dispersion that ensues. Regression analysis shows that teams that consistently spend more money achieve better on-field results. Further it is shown that rosters with flatter salary profiles outperformed teams with high variance in salaries among players.[12]

This conclusion has been debated. Depken (2000) also unveiled a negative relationship among team wins and salary dispersion in professional baseball.[13] The study tests two opposite hypothesizes offered by Levine (1989)[14] and from Ramaswamy and Rowthorn (1991)[15] against MLB seasons between 1985 and 1998. Depken determines that while higher salary correlates with increased wins, greater dispersion reduces this effect. A study into professional hockey by Sommers (1998) matches Depken. Sommer concludes that a negative relationship exists in regards to team performance and salary

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[11] Leo H. Kahane, "Team and player effects on NHL salaries: a hierarchical approach," *Applied Economics Letters*, Volume 8, 2001: 629-632

[12] Lawrence DeBrock, Wallace Hendricks and Roger Koenker, "Pay and Performance: The Impact of Salary Distribution on Firm-Level Outcomes in Baseball," *Journal of Sports Economics*, Volume 5 No. 3, 2004: 243-261

[13] Craig A. Depken, "Wage Disparity and Team Productivity: Evidence from Major League Baseball," *Economic Letters*, Volume 67 No 1, 2000: 87-92

[14] David Levine, "Cohesiveness, productivity and wage dispersion," *Institute of Industrial Relations*, 1989: 14-89

[15] Ramana Ramaswamy and Robert Rowthorn, "Efficiency wages and wage dispersion," *Economica* Volume 58, 1991: 501-514

inequality within professional hockey.[16] These two conclusions contradict Fuess (1998), who finds that increased variance in salary increases productivity using a similar model.[17]

Berri's (2004) study examines the NBA directly after the introduction of free agency following the 1995 season: a period of rapid increase in the variance of salaries as stars signed large contracts. This study found no statistically significant correlation linking salary distribution and number of wins among teams in professional basketball. However, the article remains very useful in defining the current state of the NBA and its salary structure.[18] The next section examines a series of articles that highlight variables significant to this study.

Discrimination Articles

There is a large collection of regression based articles analyzing racial discrimination among professional sports. Because the empirical research performed in this paper uses similar data sets and will essentially parallel the steps of past research targeting a new variable. The following articles were reviewed.

Returning to sport economics' most studied pastime, Bodvarsson and Pettman (2002) study the effects of reduced monopsony power on racial discrimination. This

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[16] Paul M. Sommers, "Work Incentives and Salary Distribution in the National Hockey League,: *Atlantic Economic Journal*, Volume 26 No 1, 1998: 119

[17] Scott M. Fuess, "Paying Professional Baseball Players: Tournament Pay for Teamwork," *Presented at the Western Social Science Association meeting, 1998*

[18] David J. Berri and R. Todd Jewell, "Wage Inequality and Firm Performance: Professional Basketball's Natural Experiment," *American Economic Journal*, Volume 32 No. 2, 2004: 130-139

study uses a sample population of 629 major league pitchers during the 1992 season (318 players) and the subsequent 1993 season (311 players) after league expansion and extended free agency. The sample is further divided into two groups: veterans with more than 4 years of experience eligible for free agency and players with less than 4 years experience who were not eligible for free agency until the abolishment of the limiting rule in 1993. They discover that during the 1992 season nonwhite pitchers were indeed subject to monetary discrimination. There is no statistical evidence of discrimination the next year; this provides evidence that increased options available for nonwhite pitchers and increased competition among employers resolved discrimination.[19]

A very similar conclusion came from the research of a small population of NBA players. Excluding first round draft picks who have a specific salary scale for their first three seasons and free agents, Kahn and Shah (2005) examine the 96 players drafted in later rounds who did not have free agency rights. They assume that discriminatory pay differentials are most likely to occur in a situation where individual teams have market power. Like Bodvarsson and Pettman's research, Khan and Shah find statistically significant evidence of salary discrimination among nonwhites in situations where they were subject to monopsony power.[20]

Kahn was also involved in the first published article examining racial discrimination among NBA salaries, with Sherer (1988). A regression is run against the data of the 1985-86 season: white players were discovered to earn a 20% salary premium,

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[19] Orn B. Bodvarsson and Shawn P. Pettman, "Racial wage Discrimination in Major League Baseball: do free agency and league size matter," *Applied Economics Letters*, Volume 9, 2002: 791-796

[20] Lawrence M. Kahn and Malav Shah, "Race, Compensation and Contract Length in the NBA: 2001-2002," *Industrial Relations*, Volume 44, No. 3, 2005: 444-462

ceteris paribus.[21] Similar findings are reported by Brown, Spiro and Keenan (1991) who observe a 15% white premium in the 1984-85 season using a different regression model.[22]

This model was replicated by Dey (1997) for each season between 1987 and 1993. The results show a statistically significant white premium existing for two seasons of these seasons and for the entire pooled dataset; this premium disappears when a dummy variable was added for centers. Dey concludes that the white premium discovered in his model and in Brown, Spiro and Keenan's may in fact be a premium for centers.[23]

Hill (2004) examines racial discrimination by running two regressions against a panel data set spanning the 1990 to 2000 time period. The first regression found race to be a statistically significant factor for salary with an adjusted R-squared of .62. A variable for height was added in the second regression, and found race to be statistically insignificant and had a slightly stronger R-square of .63. This matches and confirms Dey's conclusion in 1997.[24]

The only article that links university choice to professional sports is written by Berri, Brook and Fenn (2005). This study identifies the rank of school as a determinant

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[21] Lawrence M Kahn and Peter D. Sherer, "Racial Differences in Professional Basketball Players' Compensation," *Journal of Labor* Economics, Volume 6 No. 1, 1988: 40-61

[22] Eleanor Brown, Richard Spiro and Diane Keenan, "Wage and Nonwage Discrimination in Professional Basketball," *American Journal of Economics and Sociology*, Volume 50 No. 3, 1991: 333-345

[23] Matthew S. Dey, "Racial Diffferences in National Basketball Association Player's Salaries: A New Look," *The American Economist*, Volume 41 No. 2, 1997: 84-90

[24] James R. Hill, "Pay Discrimination in the NBA Revisited," *Quarterly Journal of Business & Economics*, Volume 43, No. 1 and 2, 2004: 81-92

of draft position, and finds that the final rank of the school, the player's height, shooting efficiency and scoring total to be the most significant determinants draft position.[25]

Berri, Schmidt and Brook specifically note the determinants of salary among current NBA players in the book *Wages and Wins*. They discover points scored to be greatly overvalued relative to performance. Their model is modified in this study as it examines salary as dependent upon players' past statistics.[26]

These articles should put into perspective the fact that choice of college will become an investment in a player's human capital as it relates to the eventual salary of college basketball players with aspirations to becoming professionals. The succeeding chapter builds upon the discoveries of this one, eventually constructing a model that determines the initial rookie salary of NBA rookies. As college becomes a necessary stepping stone to the NBA with the new rule change, this study specifically examines the weight of this new variable as it determines a player's perceived human capital – and therefore his compensation before he ever sets foot on the floor. This analysis represents a new twist on data sets that have been previously analyzed.

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[25] David J. Berri, Stacey L. Brook and Aju J. Fenn, "From College to the Pros: Predicting the NBA Amateur Player Draft," Working Paper

[26] Berri, David, Martin Schmidt and Stacey Brook. *The Wages of Wins: Taking Measure of the Many Myths in Modern Sports*. California: Stanford University Press, 2006.

CHAPTER III

THEORY

Salary = F (Draft Order, Year Drafted, Market Size)

Draft Order = F (College Productivity, Height, Race, Team Selected, College Attended)

This thesis examines rookie salary in two parts. First, it examines salary as a function of the player's draft position, the year the player was drafted and market size. Second, it measures the variables significant to the player's draft position: draft order as a function of college production, height, race, team selected and college attended. This chapter tackles these variables individually, further defining them and explaining their purpose within the model and why they were specifically chosen over other similar measures. The chapter will proceed in the order laid out above: first, the dependent variables (salary and draft order), followed by the independent variables (the year drafted, the production of the player as measured by the statistics accumulated at college, the height of the player, the race of the player played, and the university the player attended). Additionally, variables identified in the literature review not utilized in this regression analysis are examined within this body and after it, dependent upon their relevance to variables used within the study. These include position played and team need.

Salary

Salary is defined as a fixed monetary sum paid to the athlete for his services. This study measures salary as the amount paid by the athlete's team for his first contract year. As this study examines the player's initial contract, it is based upon what his perceived contribution to the team will be, prior to him ever suiting up for the organization or competing in the NBA. As the NBA is a professional league, meaning players work exclusively as basketball players, and careers are typically short – this study pivots on the notion that players seek to maximize their salaries.

Draft Order

Salaries are maximized by improving position in the NBA draft because contracts are typically negotiated in context to similar deals. A player drafted tenth will likely have a contract salary between that of the players drafted ninth and eleventh. Further the lower the draft number the more valuable of a prospect the player is. Predictably, pattern has proven that the lower a player is drafted, the higher the salary he will receive. Therefore it is expected that salary and draft order will have a strong inverse relationship.

Year Drafted

The world of professional sports is a world of escalating contracts. It is assumed that with each succeeding year, increased experience will lead to increased performance; and increased performance merits higher pay. The vast majority of sports contracts observe an escalating payroll. This system of escalating salaries transcends individual contracts; team payroll tends to increase each year, and the NBA is no exception. The

NBA salary cap – a league-wide limit on team's total annual salary – has increased in every year but one since its inauguration in 1984 and since 2002 has risen from $40.3 million to its present level of $53.1 million (2006).[1] With the rising salary cap the average player salary has also risen.[2] It is important to control for this factor as this study examines data spanning multiple years – and the salary of a player selected tenth in one year is more likely to fall between the salaries of the ninth and eleventh selections from the same year than from previous years.

College Productivity

Statistics are the measure of a player's performance. The NBA and NCAA keeps extensive records of player's scoring, rebounding, assists, turnovers, steals, blocks, free throw attempts and shooting percentages. While intangible factors that cannot or have yet to be quantified certainly exist, these numbers aid in the comparison of players. Previous literature has highlighted points scored, shooting efficiency, rebounds and blocks to be statistically significant in determining the draft order of college graduates.[3] A strong statistical correlation has also been proven between salary and both scoring and NBA efficiency,[4] one of many formulas created to measure the value of a player. Because statistics act as a measure of a player's performance, better statistics are likely to

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[1] Wikipedia, The NBA Salary Cap, 13 September 2006, Available from http://en.wikipedia.org/wiki/NBA_Salary_Cap, accessed 26 September 2006.

[2] Ibid

[3] David J. Berri, Stacey L. Brook and Aju J. Fenn, "From College to the Pros: Predicting the NBA Amateur Player Draft," Working Paper

[4] Berri, David, Martin Schmidt and Stacey Brook. *The Wages of Wins: Taking Measure of the Many Myths in Modern Sports.* California: Stanford University Press, 2006.

result in lower draft position. The following chapter will examine measures of statistics in greater detail.

Height

Height is often applied as a measure of a player's predicted potential and has been found significant in previous studies. Hill contradicted a previous study showing racial discrimination in the NBA by including a variable for height.[5] Berri found height to be a significant variable in determining the NBA draft order in a related article.[6] Height, like the ability to hit the outside shot, is an asset to the player and taller players are typically more desired ceteris paribus.

Race

Race may be the most researched topic in basketball. A whole section of the literature review is dedicated to the topic. While race is not the focus of this study, it is included as this study examines new data that can contribute to the ongoing debate.

Team Selected

Kahane finds that the team affects a player's salary in the NHL, as large-market franchises are capable of higher spending.[7] However, the nature of the NBA's structure

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[5] James R. Hill, "Pay Discrimination in the NBA Revisited," *Quarterly Journal of Business & Economics*, Volume 43, No. 1 and 2, 2004: 81-92

[6] David J. Berri, Stacey L. Brook and Aju J. Fenn, "From College to the Pros: Predicting the NBA Amateur Player Draft," Working Paper

[7] Leo H. Kahane, "Team and player effects on NHL salaries: a hierarchical approach," *Applied Economics Letters*, Volume 8, 2001: 629-632

makes this unlikely to be true in basketball. The NBA has a relatively low salary cap in place. This maintains a higher competitive balance in a league where a great diversity in market size exists. Further the low cap comes in sharp contrast to the relative wealth of the owners.

University

The independent variable university is of special interest in this study. It is believed that the university attended will affect the player's eventual salary. However, as there is no previous literature on this topic, it becomes difficult to theorize exactly how the much of an effect the university attended will have on salary. It would be expected that a player's ability to elevate his college team to national success would be noticed by the NBA. Therefore, playing for a ranked program may help secure a prominent draft position and a greater eventual wage. Again, the following chapter will further define this variable as it functions in this study.

Position

Position and height are highly correlated. There are no six-foot centers in the NBA just as there are no seven-foot point guards. Height typically determines position. Taller players typically play near the hoop and accumulate high rebound and block totals while shorter players typically play further from the basket and collect a higher number of assists, steals and turnovers. Hence as height often determines position, position often determines performance and statistical accumulation. To avoid multicolinearity, only one of these two related variables can be used.

Need

With good reason drafting for need is one of the least popular claims a franchise can admit to. One of the most historic examples came in the 1984 draft. The Portland Trail Blazers, needing height and having selected Clyde Drexler, a shooting guard the previous year, chose Sam Bowie as center – thus passing on Michael Jordan. Sam Bowie would eventually manage just over 10 points per contest over 4 injury plagued seasons for the Blazers, while Michael Jordan would go on to become one of the greatest players to ever play the game. While unpopular, drafting for need is fairly common and has a direct effect on the draft order, and therefore the player's salary. This variable is difficult to quantify' but it remains a necessary component regarding a rookie's initial contract.

The variables listed in this chapter compose the foundation from which the rest of this study is built. Specifically, salary will be determined through a model examining the year the player was drafted and his draft position. A player's draft position is examined in context of this college productivity, his height and race, the team that selected him and the university he played for. Just how much does the university a basketball player attends affect his draft position and eventually his salary? The next chapter will convert these variables into quantitative measures that allow for regression analysis and eventually define the equation that lies at the heart of this study.

CHAPTER IV

DATA AND METHODS

The purpose of this chapter is to familiarize the reader with the empirical methodology used in this study to test the theoretical implications of Chapter III. This chapter will proceed in four major sections. First, the chapter discusses the sources of the data. Second, it will explain the Ordinary Least Squares Regression (OLS) method that is utilized in this study. Third, the chapter will examine the Salary Regression model, the first of two OLS regression equations, and explain the significance of its variables. Fourth, it will define the Draft Order model. Results regarding these two regressions will be discussed in the proceeding chapter.

Data

This study combined multiple data sets. USA Today published a listing of salaries for all NBA players between the years 2001 and 2005.[1] Relevant rookie salaries from this listing were selected and added to a data set previously built by Berri to forecast the NBA draft according to college performance over the years of 1999 to 2005.[2] Upon this foundation dummy variables were added breaking down draftees' university and

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[1] David Dupree, USA Today's Salaries Database, 13 Sep 2006, Available from http://asp.usatoday.com/sports/basketball/nba/salaries/default.aspx, accessed 26 September 2006.

[2] David J. Berri, Stacey L. Brook and Aju J. Fenn, "From College to the Pros: Predicting the NBA Amateur Player Draft," Working Paper

NBA team by conference.[3] Additional time and cross-sectional dummy variables further divide the data into variables measurable with OLS Regression.

OLS Regression

This study makes use of the multiple-regression model, where one dependent variable is predicted as a function of at least two independent variables. The Ordinary Least Squares method was chosen because it minimized the squared distances between actual data points and the regression line. Because distances are squared, the OLS's emphasis is on error terms far from the predicted value. "OLS thus fits our intuitive notion that a line with several small misses fits the data better than a line with a few very large ones."[4] This model is applied to both of the subsequent regression equations.

Model One Equation

The first equation predicts salary as a function of draft order, year drafted and market size. The section reviews the dependent variable and its three independent predictors.

$$\text{Log}\ (\textit{Salary}) = f\ (\textit{Draft Order, Year Drafted, Market Size}) \qquad (4.1)$$

Table 4.1 briefly explains and summarizes the variables that comprise the model one equation.

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[3] ESPN, National Basketball Association Teams by Conference, 13 September 2006, Available from http://sports.espn.go.com/nba/standings, accessed 1 May 2007

[4] Michael Leeds and Peter Von Allmen, "The Economics of Sports," Boston: Addison Wesley, 2002, 62

Table 4.1

Descriptions of Equation One Variables

	Explanation	Average	Standard Deviation	Expected Sign of Coefficient	Count
Log (Salary)	Logged value of first year salary	5.9843	5.9676	n/a	183
Draft Order	Order in which player was drafted	29.07	16.9638	-	183
Year Drafted	Year in which the player was drafted	2002.88	1.4551	+	183
Market Size	1 if franchise city in USA top 10 pop.	0.23	0.4251	+	43

Dependent Variable

Salary

Salary is the dependent variable in the first equation. Salary is defined here as the amount the organization pays the player as it affects the team's salary cap. Data has been compiled for both the initial contract year and the contract's total value. Because not all players signed for the same number of seasons a much greater disparity exists with this second measure. For this reason the salary for the initial contract year is chosen as the dependent variable. The data spans the five years between 2001 and 2005 but it is not adjusted for inflation. It is theorized that annual salary cap growth plays a larger factor than inflation, thus inflation is ignored and an independent variable has been created to adjust for the year the player is drafted. Because the number is so much larger than the independent variables that define salary, it is necessary to take the log of salary for a better distribution of errors within the regression.

Independent Variables

Draft Order

Draft order acts as an independent variable in the first equation. A number is assigned to rookies in the order that NBA teams select them, the first selection being number one and every subsequent selection growing by one. A lower draft number thus represents a player chosen over others because of their perceived potential and are typically rewarded with a richer contract. Therefore a strong negative correlation between these two variables is expected.

Year Drafted

This measure is chosen to place contracts in context with deals in the same year. It is expected that contracts generally grow with the increasing salary cap. This variable can be measured in two ways: as a digit ranging from 2001 to 2005 according to the year the player was selected, or as a dummy variable dependent on the year the player was selected. Both measures improve the model fit, but ultimately the first measure (digit based) was chosen as it better predicted the dependent variable.

Market Size

A dummy variable has been assigned to franchises within the ten most populous cities in the United States according to the 2000 census.[5] There are ten franchises within this grouping, separating exactly one third of the teams from the rest of the league.[6] This grouping also divides approximately along the one million population mark. Toronto is

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[5] Infoplease, Cities Ranked by Population, 10 December 2006, Available from http://www.infoplease.com/ipa/A0763098.html, accessed 1 May 2007

[6] New York Knicks, Los Angeles Lakers, Los Angeles Clippers, Chicago Bulls, Houston Rockets, Philadelphia 76ers, Phoenix Suns, San Antonio Spurs, Dallas Mavericks, Detroit Pistons (San Diego, the eighth largest city, is the only city in the top 10 without a team)

Ibid

excluded from this group because Canadian teams are typically considered among small market franchises because the sport is less followed outside of the United States. A larger market is typically associated with a more profitable franchise and therefore it is predicted that this variable will be linked positively with salary.

In summary, salary becomes a function of draft order, the year the player was drafted and market size within this first equation. Draft order by itself is a very strong predictor of salary but these additional variables aid in the examination. In the second equation draft order is examined itself. Because draft order is the most significant variable with regards to salary, it is important to examine the variables that affect draft order as it becomes the most vital component in understanding salary, i.e. this study's ultimate goal.

Model Two Equation

This section examines draft order and its independent predictors.

Draft Order = f (Points/min, Steals/min, Turnovers/min, Assists/min, Personal Fouls/min, Blocks/min, Rebounds/min Free Throw Percentage, Height, Race, Eastern NBA Conference, Western NBA Conference, Big 10, Pac 10, ACC, SEC, Big East, Big 12, Mid-Major, RPI, Final Four) (4.2)

Table 4.2 briefly explains and summarizes the variables that compose the model two equation.

Table 4.2

Descriptions of Equation Two Variables

	Explanation	Average	Standard Deviation	Expected Sign of Coefficient
Draft Order	Order the player was drafted	29.07	16.9638	n/a
Points/min	Points per minute played	0.52	0.0949	-
Steal/min	Steals per minute played	0.04	0.0163	-
Turnover/min	Turnovers per minute played	0.08	0.0193	+
Assists/min	Assists per minute played	0.09	0.0503	-
Personal Fouls/min	Personal Fouls per minute played	0.08	0.0212	+
Blocks/min	Blocks per minute played	0.03	0.0302	-
Rebounds/min	Rebounds per minute played	0.21	0.0773	-
Free Throws %	Free Throw Percentage	0.73	0.1084	-
Height	Height measured in inches	78.67	3.4148	-
Race	1 if black	0.82	0.3855	+
Eastern NBA C	1 if signed by an Eastern NBA team	0.58	0.5013	-
Western NBA C	1 if signed by a Western NBA team	0.42	0.4782	-
Big 10	1 if drafted from a Big 10 university	0.09	0.2832	-
Pac 10	1 if drafted from a Pac 10 university	0.17	0.3809	-
ACC	1 if drafted from a ACC university	0.17	0.3809	-
SEC	1 if drafted from a SEC university	0.10	0.3059	-
Big East	1 if drafted from a Big East university	0.14	0.3501	-
Big 12	1 if drafted from a Big 12 university	0.09	0.2911	-
Mid-Major	1 if drafted from a Mid-Major university	0.16	0.3712	-
RPI	Power ranking of university	0.59	0.0490	-
Final Four	1 if reached final 4 in NCAA tournament	0.15	0.3556	-

Dependent Variable

Draft Order

Draft order becomes the focus of the second equation. It is examined as a function of 1) past performance in college (measured by points per minute, steals per minute, turnovers per minute, assists per minute, personal fouls per minute, blocks per minute, rebounds per minute and free throw percentage), 2) height and race, 3) which conference of the NBA the player was chosen by, and 4) the college the player attended (in the Big 10, Pac 10, ACC, SEC, Big East, Big 12, Mid-Major and the strength of the program during the year they were drafted (measured by RPI) and if the team made the final four in that years NCAA tournament). As stated above, draft order is the number assigned to the player according to when he was selected within the draft, the first selection being number one and every pick thereafter one higher. Because the player's ultimate goal is a low draft number, many of the independent variables will be negatively correlated with draft order.

Independent Variables

All college production statistics (points, steals, turnovers, assists, personal fouls, blocks and rebounds) were broken down to the minute to better explain the player's actions while on the floor. Total figures would not be as accurate as teams play a different number of games. Per minute figures were also chosen over per game figures because they more accurately reflect production. With the exception of turnovers and personal fouls, an increase in any of these measures is expected to improve a player's draft order.

Points/min

Points per minute played reflect a player's ability to score. In a game where the goal is to outscore the opponent, it is perhaps the most actively followed statistic. Berri believes it to be a greatly overvalued figure, but it remains a very accurate predictor of franchise decision making.[7]

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[7] David J. Berri, Stacey L. Brook and Aju J. Fenn, "From College to the Pros: Predicting the NBA Amateur Player Draft," Working Paper

Steals/min

Steals per minute are one of the two measures of a player's defensive ability, the other being blocks, tracked by the NCAA. They are recorded when a defensive player gains possession of the ball during an offensive possession, thus giving the defensive player's team an extra possession. Smaller players and guards typically generate the highest number of steals.

Turnovers/min

Turnovers are the opposite of steals. They are recorded when an offensive player loses the ball and therefore the team forfeits an opportunity to score. This statistic is theorized to increase as the player spends more time with the ball in his possession. Therefore, smaller players and guards are likely to have the highest numbers of turnovers although they are typically regarded as the best ball handlers and the most capable to run the offense. It is expected that turnovers will be negatively correlated with draft order.

Assists/min

Like turnovers, assists typically are correlated with possession of the ball. A player is rewarded with an assist when he makes the pass that leads to a score. Like the previous two measures, smaller players who run the floor tend to accumulate the greatest number of assists.

Personal Fouls/min

A player commits a foul when he violates one of the game's rules. Personal fouls act as penalties for violations of a set of specific rules. When a player commits a set number of fouls (5 in college and 6 in the NBA) they are forced to leave the game. Fouls are expected to be negatively correlated with draft order.

Blocks/min

Blocks represent the second defensive measure tracked by the NCAA; they are recorded when a defensive player stops or redirects an offensive player's shot attempt. Taller players who play closer to the hoop typically generate the most blocks.

Rebounds/min

Rebounds are recorded when a player gains possession of a missed shot attempt. It is possible to examine offensive and defensive rebounds (whether the rebound is recovered while on offense or defense) individually. However, this study ignores this further division as there is a high correlation between offensive and defensive rebounds. Rebounds, on both offense and defense, are typically collected by taller players who play near the basket, and it is theorized that dividing the rebound statistic would rob the significance of the rebound within the regression.

Free Throw Percentage

The percentage of converted free throws (awarded to a team when the opposing team violates the game's rules) is also examined in this study. A higher percentage is preferred, and it is expected that a player's ability to convert free throw attempts would improve his draft status. However, because the best shooters are typically smaller players and past research has shown that taller players are typically drafted earlier, this variable's ability to predict draft status comes into question.[8]

Height

Player's height is measured in inches and included in the regression. This variable has been shown in the past to decrease the significance of race within the regression[9] and also has been found significant in a previous study examining the draft order.[10]

Race

Race is included in the regression as a dummy variable. The race variable takes on a value of one for a black player and a value of zero otherwise. If this variable tests significant, it is expected that it will be positively correlated with draft order, that is, black players will be drafted later in the draft eventually resulting in a lesser contract.

Eastern / Western NBA Conference

This series of dummy variables takes into account competitive balance within the NBA. There are 183 players drafted in the data set and of these 154 were signed. Of the

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[8] David J. Berri, Stacey L. Brook and Aju J. Fenn, "From College to the Pros: Predicting the NBA Amateur Player Draft," Working Paper

[9] James R. Hill, "Pay Discrimination in the NBA Revisited," *Quarterly Journal of Business & Economics*, Volume 43, No. 1 and 2, 2004: 81-92

[10] David J. Berri, Stacey L. Brook and Aju J. Fenn, "From College to the Pros: Predicting the NBA Amateur Player Draft," Working Paper

players that were signed nearly 60 percent were from the Eastern Conference (90 of 154). The Western Conference has been considered the dominant conference over the years of this study, and its teams have generally had worse draft choices. This disparity of competitive balance between the conferences must be adjusted for; the Eastern and Western NBA Conference dummy variables exist for this purpose.

NCAA Conference Specific Dummy Variables

These dummy variables represent the six major conferences in the NCAA. There are too many universities in the NCAA to examine individually with the developed data set. Instead universities are grouped with other universities in their same conference. This variable will illustrate which conferences the NBA believes produce the best professional basketball players. If one conference is not significant, it is likely a conference a high school player with aspirations of entering the NBA amateur draft will want to avoid. It is theorized that players from major conferences have competed against superior competition and have had more exposure to scouts. It is therefore expected that playing for a major conference will improve the player's draft position.

Mid-Major

An additional six conferences compose the Mid-Majors.[11] A dummy variable is assigned to players drafted from teams within these conferences. This separates them from the eight other conferences that had players drafted. This variable is examined because players could potentially shine against the competition in these conferences that

[11] Atlantic 10, Mountain West, West Coast Conference (WCC), Conference-USA (C-USA), Mid-Atlantic Conference (MAC), Western Athletic Conference (WAC)

are generally considered second-tier. It is therefore expected that athletes from Mid-Majors will improve their draft status (be negatively correlated with draft order).

RPI

Ratings Percentage Index (RPI) is a measure of the quality of a college team.[12] It is the primary ratings number for selecting and ranking teams for the NCAA tournament. This study makes use of this ranking system to determine the strength of the team the player came from. If this variable tests significant, then being from a strong team is important to NBA teams. Coupled with dummy variables for conference, this measure further defines the importance of the athlete's college team.

By combining these two variables in the regression, the study better determines the value associated with college choice to NBA decision makers. If both prove significant, then being from a strong team in one of the primary conferences is important. If only RPI is significant, then only the strength of the team matters – and if through his talent a player can elevate his team, then the program he attends becomes insignificant. If only the conference is important, perhaps only the national exposure generated within major conferences are important. Hence, the combination of these two variables further highlights individual programs. As mentioned earlier, there are too many teams in the NCAA to examine individually, but by examining both variables an athlete knows how being associated with different programs among various conferences affects his future.

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[12] The Basic RPI formula is 1/4*(Winning Percentage) + 1/2*(Opponents' Average Winning Percentage) + 1/4*(Opponents' Opponents' Winning Percentage

Ken Pomeroy, College Basketball Ratings Percentage Index by Year, 10 October 2006, Available from http://kenpom.com/rpi.php?y=2006, accessed 1 May 2007.

Final Four

Final Four is a dummy variable assigned to players coming from programs that made the Final Four of the previous years NCAA tournament. This tournament generates high national exposure, and it is expected that players from teams that made it this deep in the tournament will improve their draft status.

In this second equation, draft order becomes a function of a player's past performance in college, his height and race, and several conference-specific variables for both the drafting NBA teams and NCAA programs from which the players are drafted. Setting draft order against these variables enables this study to understand and rank the most important components regarding college basketball players and their draft position. The proceeding chapter will review and analyze this study's results, specifically as they relate to the research question: which universities promise their athletes the greatest return on their time, and what is the effect on the athletes' future salaries when choosing between different schools?

Table 4.3 displays contract summary statistic for drafted players. Contract figures for the players are broken down by conference.

Table 4.3

Summary Statistics for Drafted Players by NCAA Conference

Major:	**Big 10**	**Pac 10**	**ACC**	**SEC**	**Big East**	**Big 12**	**Major**
Drafted:	16	32	32	19	26	17	142
Signed:	13	27	30	13	23	15	121
Total Salary:	17,629,297	24,337,914	41,844,014	9,922,198	33,529,950	17,699,012	144,962,385
Avg Salary:	1,356,100	901,404	1,394,800	763,246	1,457,824	1,179,934	1,198,036
Total Years Signed	45	73	97	36	79	53	383
Avg Years:	3.46	2.70	3.23	2.77	3.43	3.53	3.17

Mid-Major:	**Atlantic 10**	**Mnt West**	**WCC**	**C-USA**	**MAC**	**WAC**	**Mid-Major**
Drafted:	8	6	5	5	2	4	30
Signed:	6	5	4	5	2	4	26
Total Salary:	5,633,935	9,359,151	2,440,204	4,268,192	2,761,931	3,958,298	28,421,711
Avg Salary:	938,989	1,871,830	610,051	853,638	1,380,966	989,575	1,093,143
Total Years Signed	19	17	12	14	6	13	81
Avg Years:	3.17	3.40	3.00	2.80	3.00	3.25	3.12

Minor:	**Metro AAC**	**Horizon League**	**Big West**	**Southern Missouri**	**Ohio Valley**	**Southern Conference**	**NEC**	**Sun Belt**	**Minor**	**GRAND TOTALS**
Drafted:	1	1	1	1	3	1	1	2	11	**183**
Signed:	1	1	1	1	1	1	0	1	7	**154**
Total Salary:	385,277	366,931	385,277	366,931	332,817	872,046	0	398,762	3,108,041	**176,492,137**
Avg Salary:	385,277	366,931	385,277	366,931	332,817	872,046	0	398,762	444,006	**1,146,053**
Total Years Signed	1	1	2	1	1	4	0	2	12	**476**
Avg Years:	1.00	1.00	2.00	1.00	1.00	4.00	0.00	2.00	1.71	**3.09**

CHAPTER V

CONCLUSION

This study took special interest in examining NBA rookies' salaries as a function of their university while controlling for other factors. Rookie contracts were selected because they are signed prior to competing at a professional level as opposed to later contracts which are signed based on performance in the NBA. These contracts are essentially forecasts of expected future contribution to the team. In other words they are predictions of potential. The first regression examined salary in the context of draft order. It is theorized and relatively intuitive that these two variables are linked. The second regression examined the determinants of draft order, and therefore the eventual salary. The underlying focus of this study was to determine how players are viewed by NBA organizations coming out of college, a question made increasingly relevant as the new CBA funnels American players through the college system.

Focusing this question on university choice brought forth an interesting paradox: while college athletes are understood to be representative of their program, this paper theorized that the NBA examines players through the opposite lens of this looking glass. Similar to how a name on a business card is judged according to the company name with which it is associated, athletes may in fact be represented by their universities. The NBA may be calculating a player's potential based on the program he came from.

Along with university, an athlete's college performance, height and race were included in the regression. This chapter will first analyze the empirical results of this regression, and then conclude with implications and topics for future and expanded research.

Empirical Results

It first must be stated that both the regression models suffer from positive first-order correlation.[1] This problem could only be fixed at the expense of normality, thus completely rendering the t-statistics useless. Positive first-order correlation brings the regressions' results into question, but it is much less significant than having a problem with normality. Using an alternative estimator such as a GMM is beyond the scope of this thesis. Appendix C reviews the results of more advanced econometric regression models that reach similar conclusions to the simple OLS regression run in this study. Because various regressions report similar findings, the results of this study become more credible. Many models that have problems with positive first-order correlation contain variables that only prove significant when examined in one model. This problem does not pertain to this study. It is important to stress that the reliability of the results generated by the regressions remains uncertain. However, enough evidence supports the results that they remain valuable in analysis.

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[1] The Salary regression has a Dublin Watson statistic of 0.87. With the given data set an inconclusive test would measure between 1.748 and 1.789, above a 1.789 would signify that first order correlation does not exist.

The Draft Order regression has a Dublin-Watson Statistic of 1.21. With the given data set an inconclusive test would measure between 1.54 and 1.991, above a 1.991 would be signify that first order correlation does not exist.

Table 5.1 examines the results of the salary regression model as it is defined by draft order, the year drafted and by the market size of the drafting city.

Table 5.1

Ordinary Least Squared Regression Results
Salary Determinants for NBA Rookies

Variable	Coefficient	t-Statistic	Count
Constant	-107.2282	-3.7646	-
Draft Order	-0.0455	-33.5857	183
Year Drafted	0.0609	4.2856	183
Market Size	-0.0413	-0.8775	43
R-squared	0.8861		
Adjusted R-squared	0.8838		
F-statistic	389.0653		
Dublin-Watson statistic	0.8696		

[2]

As expected, the first regression model is a strong predictor of salary, with an adjusted r-squared of .88, meaning that 88 percent of the data is accurately explained by the model. The F-statistic of 389 further shows the model's accuracy in defining the data. The Jarque-Bera statistic is below the critical 95 percent value of 5.99, indicating the errors are normally distributed. The White test registers an observed R-square of 30.2913 confirming the null-hypothesis that heteroskedasticity does not exist. Two of the three independent variables are significant. They will be discussed in order.

Draft Order

Draft order is particularly relevant in this regression with a t-statistic of -33.59. The negative correlation was expected, as a lower draft number indicates a player drafted prior to others, predicting a higher relative salary. The coefficient is low, at -0.0455.

[2] OLS Salary Model has a Jarque-Bera statistic of 1.7679 and an Observed R-square value of 30.2913

However, the variable ranged from 1 to 60; therefore the coefficient affects the logged salary as much as 2.6854.[3]

Year Drafted

The year the player was drafted also affects the salary of the player. The t-statistic of 4.2856 is significant beyond the 1 percent level. The positive correlation represents that in each successive year players receive higher salaries, *ceteris paribus*. This confirms the expectations that the increasing salary cap would be correlated with an increased value of rookie contracts. Multiplying the coefficient by the data range shows that only 0.2436 of the logged salary variable is explained by this variable.[4]

Market Size

Market size is insignificant. This finding suggesting that the NBA's salary cap facilitates competitive balance or that rookie contracts are small enough that all teams are able to sign their draftees.

Table 5.2 shows the results of the draft order regression, the primary explainer of first year salary.

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[3] Coefficient multiplied by the range of the Draft variable (.0455*(60-1)) = 2.6854. The mean value of logged salary is 5.9843.

[4] Coefficient multiplied by the range of the Draft variable (.0609*(2005-2001)) = 0.2436

Table 5.2

Ordinary Least Squared Regression Results
Draft Position for College Players

Variable	Coefficient	t-Statistic	Count
Constant	213.8843	4.4266	-
Points/min	-83.2903	-6.2883	183
Steals/min	-65.5362	-0.8831	183
Turnovers/min	14.6788	0.2254	183
Assists/min	-114.6084	-3.1494	183
Personal Fouls/min	-10.9096	-0.1828	183
Blocks/min	-108.9744	-2.3732	183
Rebound/min	20.8965	1.0294	183
Free Throw %	11.3522	1.0105	183
Height	-1.0208	-1.7472	183
Race	0.6286	0.2444	150
East NBA	-17.9296	-6.6721	90
West NBA	-14.8830	-5.2928	64
Big 10	-14.2673	-2.6650	13
Pac 10	-13.6306	-2.7653	27
ACC	-12.8802	-2.7156	30
SEC	-14.7380	-2.7678	13
Big East	-13.9805	-2.9142	23
Big 12	-12.9582	-2.4554	15
Mid-Major	-10.5394	-2.2820	26
RPI	-53.2348	-2.2240	183
Final 4	-8.9017	-2.8715	27
R-squared	0.5605		
Adjusted R-squared	0.5032		
F-statistic	9.7769		
Durbin-Watson statistic	1.2134		

[5]

The second regression is much less accurate than the first, with an adjusted R-square of .50. However, the F-statistic of 9.7769 implies that the independent variables describe draft order very well. Thus, while only 50 percent of the data is explained in this model, the chosen variables accurately reflect draft order. As stated previously, a low draft number is preferred and many variables are negatively correlated with draft

[5] OLS Draft Model has a Jarque-Bera statistic of 3.4100 and an Observed R-square value of 25.5074

order. Hence this regression begins with a very high constant, a draft position of 214 (relative to the 60 total draft-picks every year), that the majority of independent variables detract from. Like the previous regression, the Jarque-Bera statistic and the Observed r-squared values indicate that errors are evenly distributed and the Dublin-Watson statistic indicates that heteroskedasticity does not exist. Given that the primary measures of model reliability are acceptable, it is important to discuss the independent variables.

Points/min

Points-per-minute played is the second most significant variable in the entire study with a t-statistic of 6.2883. Further, with regards to performance, points-per-minute played is the most accurate predictor of draft order. Of all the measures of college productivity, points-per-minute has the highest mean and the broadest range. Coupled with its coefficient of -83.29, points-per-minute played influences the player's draft position by as much as 57 places.[6] To put this in perspective – had the player with the lowest scoring efficiency in the model been the last player chosen in the draft for his year, and instead he had been the most proficient scorer in the model, the change in this variable alone would have catapulted him into a top-three selection. The average draftee, scoring .52 points-per-minute improves his draft position by 43 spots with respect to his scoring ability.

Steals/min

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[6] Coefficient multiplied by the range of the Points/min variable (83.29035*(.7983-.1091)) = 57.4077

Steals-per-minute played is insignificant in the regression with a t-statistic of 0.88. The slope of insignificant variables in regressions must be assumed to be zero; therefore additional review of this variable becomes irrelevant.

Turnovers/min

Turnovers-per-minute played is also insignificant with a t-statistic of 0.23. This was the lowest t-statistic in the regression, and this variable is dismissed with a slope of zero.

Assists/min

This variable is highly significant with a t-statistic of 3.15. However, its high coefficient of -114.61 is a poor predictor of draft order. The average player records only 0.09 assists per minute and thus increases his draft position only 9.75 places. This variable explains up to 28.4 draft spots when examining the whole range.

Personal Fouls/min

This variable has a t-stat of 0.18. It is therefore insignificant at the 95 percent level. Because fouls are a negative measure of performance, it is interesting that the regression found that an increase in fouls improves a player's draft order. It is possible that this is because better players are likely better athletes and defended the opposing team's best and most aggressive players, and therefore picked up more fouls. This theory supposes that within fouls hide a greater defensive measure. It remains more likely that this negative correlation occurred because the regression dismisses the variable as insignificant. Regardless, the slope of this variable is dismissed because of the low t-statistic.

Blocks/min

Blocks-per-minute is significant at the 95 percent level with a t-statistic of 2.37. However, of the three significant variables that measure performance (points and assists), blocks per minute is the worst predictor of draft status. Blocks are exceedingly rare (the mean is 0.03) and perhaps because of this the average player only improves his draft position by 3.36 places due to blocks. When examined against the range, the regression predicts a 14.8 difference in draft order between the most proficient shot blocker and the least.

Rebounds/min

Like personal fouls rebounds-per-minute affect the regression opposite of what was theorized. It was expected that, all else being equal, better rebounders are valued by NBA franchises: that by improving this statistic a player improves his draft position. Instead, rebounds were positively correlated with draft order. However, because the t-statistic is only 1.03 the slope of this variable is ignored and this abnormality is dismissed.

Free Throw Percentage

This is the third measure with a coefficient opposite of what was theorized. Like the others it is insignificant at the 95 percent level, with a t-statistic of 1.01. The coefficient's sign is likely explained by the variable's insignificance. It remains possible that this performance measure may be influenced by the bias towards taller players in the draft.[7] Tall centers and forwards are typically drafted early despite being poor free throw shooters. The regression's preference towards poor free throw shooters may merely be a throwback of this trend.

Race

The race of a player has no effect on his draft position according to this regression. The t-statistic was one of the lowest of the regression at 0.24. Even had race been significant the low coefficient, 0.63, indicates that black players in the study were taken less then one spot later on average. No other variable affects the regression so little. While race was not a focus of this study, it is found that race has very little if any affect on draft order.

Height

The model only found height to be significant at the 80 percent level. This was a surprise. Previous studies have found height to be a significant variable in NBA regressions.[8] To assume a slope of zero for height is troublesome, it is the only insignificant variable that came near the critical t-statistic value of 1.96 (at 1.75), and the variable greatly influenced the regression. The variable's coefficient is -1.02, meaning

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[7] David J. Berri, Stacey L. Brook and Aju J. Fenn, "From College to the Pros: Predicting the NBA Amateur Player Draft," Working Paper

[8] Ibid

James R. Hill, "Pay Discrimination in the NBA Revisited," *Quarterly Journal of Business & Economics*, Volume 43, No. 1 and 2, 2004: 81-92 for every inch the player measures he improves his draft status by roughly one spot. Accordingly, the shortest player in the draft, at 5 feet 9 inches, improves his draft rank approximately 70 spots,[9] and the average player standing 6 feet eight inches improves his draft position roughly 80 spots.[10] It is difficult to completely disregard this variable because the numeral value of this variable is so high for all draftees. Height essentially reduces the constant from 214 to a range between 144 and 128 for all players.

Eastern and Western NBA Conference

These two variables came out very significant with t-statistics of 6.67 and 5.29, respectively. Their coefficients were 17.93 and 14.88, suggesting that being drafted by an Eastern Conference team as opposed to a Western Conference team improves a player's draft rank by three positions. This variable indicates a disparity in competitive balance between the two NBA conferences – as teams with worse records are given earlier draft selections.

NCAA Conference Specific Dummy Variables

Every one of the major conferences came out significant at a very high level. With the exception of the Big 12 (significant at the 98 percentile) all the major conferences had t-statistics significant at the 99 percentile. Coming from one of the major college conferences improves a draftee's draft position between 12.88 to 14.74

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[9] Coefficient multiplied by the height of the shortest player drafted (1.02*69) = 70.38

[10] Coefficient multiplied by the height of the tallest player drafted (1.02*78.67) = 80.24

places. This negative correlation was expected. The implications of this variable are best concluded in context to other university variables.

Mid-Major

The Mid-Major variable also came out highly significant, at the 97 percentile. Playing for a Mid-Major conference team improves a player's draft rank by 10.54 spots – a value less than that of a Major conference. Chapter III theorized that Mid-Major Conference teams might offer more opportunity for their athletes to shine, to take more shots and excel against weaker competition. The Mid-Major conferences sent only 30 players to the NBA compared to the 144 from Major conferences. The thinking was that these athletes would be observed as standouts and NBA scouts would forecast them to be stars. Thus the Mid-Major variable might be associated with a high coefficient. It appears that this is untrue. While the difference between the two variables is not extreme, it appears that an athlete competing at a Major Conference school benefits more from his program than one from a Mid-Major.

In one sentence: it appears that players talented enough to be drafted into the NBA are good enough to stand out at any level, and within any college conference.

RPI

RPI is significant with a t-statistic of 2.22. Therefore playing for successful team improves a player's draft status. This offers further evidence that the university a player came from affects his draft position. RPI had a high coefficient of -53.23, but the range of the variable between teams is low at 0.2192. Therefore RPI only influenced draft position by up to 11.66 places. This figure is relatively low when compared to conference variables. When the two are compared side by side it becomes apparent that merely playing for a major conference has a greater influence on a player's draft position than by playing for the best team

Regardless of the low range associated with the variable, RPI has a lot of weight in the regression: multiplying the coefficient by the average RPI results in a 31.56 change in the draft order.[11]

Final Four

A player who leads his team, or by some luck is led to a final four appearance dramatically improves his draft status. This variable is very significant with a t-statistic of 2.87 and has a coefficient of -8.90. Regardless of conference or RPI, a player from a team that reaches the final four in the NCAA tournament improves his draft rank by only a few spots less than can be explained by the maximum variance associated with the RPI variable. It is evident that the exposure generated by the college tournament is a very significant factor in determining the draft order.

The regression finds the following variables significant at the critical 95 percentile value: points per minute, assists per minute, blocks per minute, Eastern and Western NBA Conferences, the Big 10 Conference, the Pac 10 Conference, the ACC, the SEC, the Big East Conference, the Big 10 Conference, Mid-Major Conferences, the athlete's team's RPI and whether or not the team reached the Final Four of the previous

[11] Coefficient multiplied by the average team RPI (-53,23*0.593) = -31.56

years NCAA's tournament. Height was important in the regression and significant at the 80 percent level. The adjusted R-square value indicates that the regression explains roughly half of the data and the F-statistic signifies that the independent variables collectively explain the draft order with precision.

Conclusion

As the most recent CBA has tailored college basketball into a one-year proving ground for NBA talent, understanding the determinants of contract salary among college draftees has become increasingly relevant. This study linked rookie salary to several university variables. They all are significant. This study therefore concludes that a NBA rookie's salary and his college alma mater are certainly correlated.

So which universities promise their athlete the greatest return on their time? This study suggests that playing ball for a major conference boosts an athlete's draft position between 12.88 and 14.73 places. Playing for a mid-major conference was associated with a 10.54 jump in draft order. Substituting the Mid-Major Conference variable for a variable representative of the Minor Conferences in the regression shows that players drafted from minor conferences are taken 10.68 spots later in the draft after adjusting for statistics.[12] Thus, a player choosing a Minor conference over the SEC[13] would essentially be forfeiting 26 places – nearly an entire round – in the draft. It is evident that to a NBA front office, being associated with a well known and respected conference is very significant.

[12] Appendix B

[13] The SEC had the greatest positive influence on a players draft order. Improving draft position by 14.74 places

Being associated with the best team in the conference is less significant. This study finds that while RPI variable carries significant weight in the regression,[14] its low variance meant it did little to separate players within the draft.[15] So while being from a known conference is important; being successful within the conference shows surprisingly little difference in determining the draft order.

This was contradicted by the Final Four variable. By reaching the final four in the NCAA tournament a player rose in the draft by nearly 9 spots. It is odd that success in the tournament and success over the regular season are valued so differently at the next level. Nonetheless, it is apparent that reaching the final four dramatically improves a player's draft position.

These results allude to the significance of another variable not included in the regression: exposure. It is possible that it is the exposure that colleges generate for their players that influence NBA scouts the greatest. Further, exposure best answers some of the questions the results of this study leave. Why does the conference in which a player competed weigh so heavily among NBA organizations? Why does a team's success matter so little over the regular season? It is arguable that the NBA cares about players, not teams. That major conferences merely attract better players then mid-majors, which in turn draw better players then minors. This basic hierarchal order makes logical sense – but then why does a team's success in the NCAA tournament so dramatically influence the draft? Perhaps there is another element at work here, an element that covers all three

[14] Appendix A

[15] The average RPI value of 0.5930 is associated with a 31.5700 reduction in draft position, making RPI the third strongest predictor within the model. However, the variable does little to separate players from one another. The RPI variable has a low range (0.2192), and multiplying the range with the regression coefficient (53.2348) shows that RPI can explain a maximum of 11.6691 places within the draft order.

questions – and perhaps it does a better job of explaining the first two questions than the simple hierarchal model mentioned.

Perhaps it all comes down to cameras. The NCAA tournament retains a near religious public following and records some of the highest Neilson ratings every year. The shear attention this tournament generates may explain the discrepancy between regular and postseason success that scouts seem so subject to. Further, it may be that the difference in draft order between major, mid-major and minor conferences also comes down to print and television.

All major conferences have television deals. Their teams play in front of vast audiences at primetime hours. Athletes from major conferences are seen, judged and discussed by the general public. ESPN devotes an entire channel to college sports. Major conference athletes are so exposed to the public world that scouts cannot ignore them; moreover they are bombarded by them. The largest problem facing an athlete not from a major conference aspiring to play in the NBA may not be his jumper, his coach or the supposed weaker competition; it may be the lack of a play-by-play announcer, a cameraman and a petite girl hosting post-game interviews.

Future Research

This study found salary and university choice to be positively linked. However, the strength of the relationship is harder to determine. The first regression successfully explains salary as a function of draft order with an r-squared of .88, but the second regression determining draft order is only able to explain half of the data with an adjusted R-square of .50. The significance of the university variables is justified through their t-statistics, but it is obvious other variables exist that would allow the regression to better fit the data. This section will touch on the possibilities for future research this study leaves.

The first and most obvious suggestion would be to increase the size of the sample. This would allow the inclusion of more variables within the regression. Specific universities could be targeted and conferences could be further segmented. With the new CBA funneling more athletes through the college system, this study could improve with every year.

Alternatively, additional variables could be included to the study. Series of variables measuring the exposure player's have received could greatly enhance the study. Simple variables tracking the Neilson ratings over the course of the season, the number of nationally televised games the university played in could be included. Measures of individual exposure might also be helpful. Dummy variables for the nomination of player of the year, or all-conference selections could be added. Essentially any measure that indicates the player was known would aid in this study.

Another variable could be included examining the coach of the player's college team. Variables that measure the coach's experience such as the number of seasons the coach has been with the university and in the NCAA would likely aid the regression. Possibly a dummy variable for NBA experience could be included. Coaches' experience and success, via winning percentage, would help quantify the stability of an athlete's college program. So many historic programs have been remembered in the context of their coaches, and it would be foolish to think the NBA does not take note when a coach is consistently shaping college recruits into NBA leaders.

Additionally, the regression itself could be modified. The RPI variable was very significant in the regression itself, but as mentioned it did little to separate the players. A similar regression could be run replacing the RPI value with a variable identifying the difference of a player's team's RPI from the average, further stressing the separation of teams. Any of the variables of this study could be substituted or replaced.

In conclusion, this research provides the initial framework for examining salary as it relates to university choice. As the rules of the game have changed, this study becomes increasingly relevant, and could potentially have long-reaching implications within the recruiting process. It is found that university choice does affect salary. An athlete who wants to maximize his contract must consider these variables. Moreover it must be assumed that this study has been done many times by athletes themselves. This is merely the first time it has been conducted in economic fashion, and for the first time by an outsider. As this study reaches its conclusion it opens the door for refinement and for new research. Hopefully it can act as a building block for future analysis.

APPENDIX A

INDEPENDENT VARIABLES WEIGHT WITHIN THE REGRESSION

This table is an illustration of the weight each individual independent variable carries within the regression. An average of all of the variables the regression analyzes was taken and multiplied against the regression assigned coefficient. The results convey a simple picture that shows the amount that each specific variable affects the regression for the truly statistically average player.

Variable	Coefficient	Average	**Weight**		
Constant	213.8843				
Points/min	-83.2903	0.52	**-43.1424**		
Steals/min	-65.5362	0.04	**-2.5985**		
Turnovers/min	14.6788	0.08	**1.1721**		
Assists/min	-114.6084	0.09	**-9.7479**		
Personal Fouls/min	-10.9096	0.08	**-0.8505**		
Blocks/min	-108.9744	0.03	**-3.3586**		
Rebound/min	20.8965	0.21	**4.3297**		
Free Throw %	11.3522	0.73	**8.3171**	-45.8789	Difference due to performance
Height	-1.0208	78.67	**-80.3085**		
Race	0.6286	0.82	**0.5153**	-79.7932	Difference due to Height / Race
East NBA	-17.9296	0.58	**-10.4783**		
West NBA	-14.8830	0.42	**-6.1851**	-16.6634	Difference due to NBA Conference
Big 10	-14.2673	0.09	**-1.2474**		
Pac 10	-13.6306	0.17	**-2.3835**		
ACC	-12.8802	0.17	**-2.2523**		
SEC	-14.7380	0.10	**-1.5302**		
Big East	-13.9805	0.14	**-1.9863**		
Big 12	-12.9582	0.09	**-1.2038**		
Mid-Major	-10.5394	0.16	**-1.7278**	-12.3312	Difference due to NCAA conference
RPI	-53.2348	0.59	**-31.5700**		
Final 4	-8.9017	0.15	**-1.3134**	-32.8834	Difference due to individual NCAA team
				-61.8780	**Sum of difference due to NCAA**

Constant	Sum of Coefficients	Predicted Draft Selection of the Average Player
213.8843	-187.5502	26.3342

APPENDIX B

OLS REGRESSION CONSIDERING MINOR CONFERENCES

Appendix B displays the results of an OLS regression very similar to the one run in the study. The Mid-Major dummy variable is replaced by one representing Minor conferences; the Minor Conference variable is found significant. In this regression major conferences lose their significance but the other variables, including the university specific RPI and Final Four variables, maintain their significance.

Variable	Coefficient	t-Statistic	Count
Constant	200.9307	4.1314	-
Points/min	-82.2854	-6.1359	183
Steals/min	-75.5020	-1.0101	183
Turnovers/min	25.2940	0.3855	183
Assists/min	-115.0599	-3.1326	183
Personal Fouls/min	-14.6985	-0.2441	183
Blocks/min	-112.5779	-2.4293	183
Rebound/min	20.2859	0.9904	183
Free Throw %	10.6953	0.9430	183
Height	-0.9997	-1.6952	183
Race	0.8622	0.3316	150
East NBA	-17.5808	-6.3865	90
West NBA	-14.8028	-5.1367	64
Big 10	-3.5754	-0.8891	13
Pac 10	-2.4271	-0.7486	27
ACC	-2.1922	-0.6561	30
SEC	-4.0705	-1.0557	13
Big East	-3.3439	-0.9861	23
Big 12	-2.3770	-0.6201	15
Minor	10.6831	2.2917	7
RPI	-52.6651	-2.1804	183
Final 4	-8.8250	-2.8204	27
R-squared	0.5524		
Adjusted R-squared	0.4940		
F-statistic	9.4603		
Durbin-Watson statistic [1]	1.1887		

[1] The OLS Minor Regression has a Jarque-Bera statistic of 3.4195 and an Observed R-square value of 29.9275

APPENDIX C

TOBIT REGRESSION

Appendix C is a more advanced version of the regression model used in this study. The Tobit Regression model acts as an econometric fix for positive first-order correlation, i.e. the problem that brings the study's results into question. Both regressions find the same independent variables significant and have very similar R-square values.

Variable	Coefficient	t-Statistic	Count
Constant	214.8093	4.6881	-
Points/min	-84.0182	-6.6733	183
Steals/min	-64.1059	-0.9056	183
Turnovers/min	12.2960	0.1987	183
Assists/min	-114.7948	-3.3292	183
Personal Fouls/min	-8.8782	-0.1568	183
Blocks/min	-110.2583	-2.5221	183
Rebound/min	20.7143	1.0775	183
Free Throw %	12.2120	1.1465	183
Height	-1.0232	-1.8449	183
Race	0.7846	0.3218	150
East NBA	-18.0713	-6.8876	90
West NBA	-14.8673	-5.4257	64
Big 10	-14.1483	-2.7849	13
Pac 10	-13.4350	-2.8652	27
ACC	-12.7653	-2.8384	30
SEC	-14.5194	-2.8563	13
Big East	-13.7704	-3.0118	23
Big 12	-12.6734	-2.5089	15
Mid-Major	-10.3443	-2.3517	26
RPI	-55.3667	-2.4274	183
Final 4	-8.7805	-2.9899	27
R-squared	0.5656		
Adjusted R-squared	0.5028		
Log likelihood[1]	-698.4825		

[1] The Tobit Regression has a Jarque-Bera statistic of 3.3788.

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