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Biases in the NBA Draft

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ABSTRACT

Drafting in sports is an endeavor in which there is a great degree of subjectivity and value judgement. This requires the individuals responsible for decision making to have sound abilities to evaluate talent. However, each and every draft has a sub-optimal order of drafted individuals. Consequently, there is a need for identification of the biases and systematic errors that take place in the evaluation process.

This paper aims to identify and evaluate the decision making biases commonly present amongst the drafting process and combine them with a data-driven evaluation of the resulting performance of the drafted players. The study will then offer conclusions resulting from commonalities among over-achieving players to illustrate avenues in which teams are overlooking talent.

DEDICATION

To my supportive and wonderful wife, Tasmia Islam.

ACKNOWLEDGEMENTS

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Chapter 1: Introduction

In any profession, employers attempt to maximize the contributions of their employees. However, very few businesses possess as much variability within employee compensation as the world of professional sports. Individual players are compensated in wildly different amounts and expected to produce accordingly. However, as is often the case seen by fans of any sport, this does not happen as planned. Weaker players often overproduce, matching the expected contribution of a starting or even star player whereas others violently underproduce, resembling a fringe rotation player rather than at the level of the top tier salary they command.

Consequently, within professional sport, there is a large emphasis placed on the ability to predict future outcomes accurately. There are 3 main sources of player acquisition: trades, free agent signing and entry-level drafts. However, for the purpose of this paper, we will be evaluating the decision-making concerned with the entry-level draft, particularly that within the NBA. Within the Big 4 professional sports, each of them holds an annual entry-level draft, the details of which vary from league to league in both prior experience required to enter the draft and how exactly the top picks are allocated.

Each draft conducts some form of a reverse order draft where picks for the draft are allocated in the reverse order of the previous season's standings. The NFL and MLB conduct a true reverse order draft while the NHL and NBA conduct a lottery to allocate the picks of non-playoff teams from the previous year. The lottery is weighted towards the worst teams receiving the earliest picks in the draft but does include some chance for

each non-playoff team to receive the earliest picks in the draft. The reverse order nature of the draft is one that attempts to even the playing field within the professional sports leagues. By giving the worst-performing teams the highest selections, the leagues attempt to balance the competitiveness among the teams in the leagues. Each team is allowed to trade their draft picks both in advance of the draft and during the draft. This allows teams to trade up for players they prefer and down if there are players who are projected to be lower.

The number of players selected in each major sports draft varies wildly. The MLB and NBA each have 30 teams while the NHL and NFL have 32 respectively. Each draft has a different number of rounds. The NBA has only 2 rounds while the NHL and NFL have 7 rounds each in their draft process. The MLB has a staggering 20 round draft beginning in 2021. (Until 2019, the MLB had an even more monumental 40 round draft which saw over 1200 players chosen annually).

In terms of age selected, the NHL is the youngest of the big 4 in terms of entry level age with the draft being conducted for prospects aged 18 to 20. Despite the young age of these players, most of the prospects hail from either professional or semi-professional leagues. In 2023, 80 of the 224 picks came from the CHL, with many picks coming from international professional leagues in Sweden, Russia and Switzerland. Currently, the NHL draft has 7 rounds, a decrease from previous iterations of the draft which had 9 rounds (discontinued in 2004). The MLB also has the ability for high school students aged 18 to enter the draft, as well as 1st and 2nd year athletes from Junior College. However, for an NCAA athlete to enter the draft, it is required that they spend at least 3 years in college prior to doing so. Meanwhile, leagues such as the NFL and NBA

require a minimum number of years in college or post-secondary play to be eligible for the NBA draft. The NBA draft requires 1 year removal from high school graduation as well as a minimum age of 19. This age regulation was first seen in the 2007 draft. It is worth noting that while the NHL and MLB offer opportunities for players to enter their leagues the first year they are legally considered adults, each of them have well developed minor league programs with multiple levels. The MLB offers a slew of minor league levels, ranging from Rookie-Ball to AAA). Meanwhile the NHL offers 2 minor league levels present in the ECHL and AHL. These are important observations to make when considering the process of drafting as players who are selected earlier in their athletic maturation process require a significantly larger amount of time for an equivalent performing season. Furthermore, players who are selected earlier are often evaluated with respect to their age rather than with respect to their pre-draft performance. This can be seen in instances where the best performing collegiate players are often passed over in favor of younger athletes with more potential to be molded into a strong professional player. As demonstrated in table 1, with respect to the number of players chosen per year compared to the number of players across the league, the NBA has the smallest ratio of 60:450. The MLB, NHL and NFL have ratios of 614:800, 224:736 and 259:1696 respectively. The relative size of the NBA's drafted player ratio indicates that there is a stronger expectation for players selected in the NBA draft to actually play in the league, hence creating a higher relative value for an NBA draft. Furthermore, this results the notion that NBA draft picks are valuable and errors in decision making are more costly than in other sports.

Table 1: Table comparing different forms of Drafts

League	Yearly Draft Picks	Total Players	Ratio	Minor League Levels	Experience Requirement
MLB	614	800	0.77	4	0 years or 3 years collegiate
NFL	259	1696	0.15	0	3 years collegiate
NBA	60	450	0.13	1	1 year collegiate
NHL	224	736	0.3	2	0 years

Chapter 2: Literature Review

In this chapter of the major paper, I will be examining the existing literature related on decision making in the drafting process of all sports as well as decision making in general to contextualize it with the literature on the NBA draft. As the reverse order draft is present in all 4 major North American Sports Leagues, there will be similar biases and decision making provided by its structure.

Decision-Making Biases:

As with any activity entailing a significant amount of subjectivity, there are several decision-making biases that affect the selections made in the entry-level drafts found in sports. While many GMs often consider themselves to be experts in the field, they are no stranger to decision-making biases. As the expectation in a rational and perfect draft would be that GMs would be able to pick the best player available with each pick. However, as evidenced by extensive research on drafting, not just in the NBA but in all sports, it is an imperfect science that has yet to be mastered.

Expected Utility Theory:

First discussed by Bernoulli in 1738 in his paper "Exposition of a New Theory and a Measurement of Risk", and then further formalized by John Von Neumann and Oskar Morgensten in 1945 in their paper "Theory of Games and Economic Behavior, Expected Utility Theory is among the most fundamental of concepts in economics and decision theory. The framework built by EUT provides an explanation for how individuals make choices when considering uncertainty and risk. Expected Utility Theory bases its foundations on the existence of rational decision-making which aims to maximize an individual's utility. There are four major axioms that Expected Utility

Theory is built upon : 1) Completeness, 2) Transitivity, 3) Independence 4) Continuity. (Van Neumann et. Al, 1945). However, the main issue with Expected Utility Theory in practice is that there the utility functions are not universal and vary wildly from team to team.

We can see that the utility function is not universal when considering the value of sports players. This can be seen most evidently in instances of mid-season trades where the player gets traded from Team A to Team B midseason. On Team A, the player had been drastically underperforming and underutilized. However, on Team B, the player was used more aptly towards their strengths and performed at the standard expected or perhaps even exceeded. Conversely, there are instances of players who decreased significantly in terms of their production after having been traded from one team to another. However, the metric used (Win Shares) is the utility function considered in both instances.

Prospect Theory:

Prospect Theory was a revolutionary idea concerning behavioral economics presented in the 1979 and further explored in later decades through a series of papers by Daniel Kahneman and Amos Tversky. The foundational paper for the field, "Prospect Theory: An Analysis of Decision Under Risk" explored how people made decisions under conditions of uncertainty and risk. Unlike traditional economic theories until that point, such as the Expected Utility Theory which assumed that people made rational decisions to maximize the expected utility of the outcome, Prospect Theory which assumed that real-world decision-making often deviates from these assumptions. Instead, Prospect Theory aimed to acknowledge that there were a number of cognitive

biases, emotions and heuristics that were at play when decisions were made in real life. The central tenet of Prospect Theory is the concept of Loss Aversion, which states that people are more sensitive to potential losses than they are to potential gains.

Examples of Loss Aversion presenting themselves in the NBA Draft are cases where players are selected from non-traditional backgrounds such as straight out of high school or internationally. There are numerous examples of individuals who had a greater a performance in their draft year than their draft position would suggest. For example, Kobe Bryant was drafted 13th overall in 1996 despite being the consensus number one player in the nation among high school players. Bryant was seen as a high-risk, high-reward commodity that had the potential to be among the best players in the league as well as an equal potential of becoming a complete and utter waste of a roster spot. Due to this polarizing characterization of his draft value, the majority of General Managers were not willing to take the risk on such a prospect as they risked the consequences of losing their jobs. Bryant went on to eventually become one of the best players in his era, winning the Most Valuable Player award in 2008 as well as 5 NBA Championships. Similarly in 2018, 22 years after the Bryant draft, Luka Doncic fell to the 3rd overall spot despite being the best player in the top league professionally outside of the NBA. The reasons cited were that European playstyles did not always translate effectively towards NBA performance. However, the fact in and of itself that Luka Doncic dominated his peers at a much higher level than the relatively lackluster performances of DeAndre Ayton and Marvin Bagley (the first 2 overall picks) to their collegiate peers should have indicated his superior value. Doncic ended up running away with the Rookie of the Year award, receiving 98 out of a possible 100 first place votes.

Anchoring Bias:

An anchoring bias refers to the cognitive bias where individuals/decision-makers rely heavily on the first piece of information they receive when making decisions. The initial information is referred to as an anchor. Once an anchor is established, people will adjust from that starting point to make their conclusions. Humans tend to want to reduce complex tasks of assessing probabilities and predicting values into simpler judgemental operations. Consequently, they tend to use heuristics to solve their problems. (Kahneman-Tversky 1974).

The heuristic approach to solving similar problems can be seen in many professional sports. A dominating team or player often leads to other teams trying to emulate their game plan. This happens often as the dominant team or player illustrates a viable strategy that the rest of the league has not adjusted for. For example, after the emergence and dominance of Stephen Curry and the Golden State Warriors in the mid 2010s, teams across the league began to more heavily value the 3-point shot. In the 2014/15 season when the Warriors won their first NBA title, the league average 3 pointers attempted was only 22.4. Only 5 years later, the league average 3 pointers attempted per game was 32.0. The Warriors had successfully illustrated a gap in the currently prevailing strategies in the NBA. In an effort to replicate the success enjoyed by the Golden State Warriors organization, teams began to more highly value players could space the floor and switch positions as well as shoot 3-point shots.

Sunk Cost in Sports:

The Sunk Cost Effect is a cognitive bias where individuals tend to invest repeatedly or excessively into a project beyond the point of rationality based on previous commitments to the project. This situation is one that finds itself frequently discussed in sports. This presents itself generally as General Managers and other Front Office executives hinge their futures and reputations on many of the high draft picks that are made under their tenure. These draft picks are seen as high-risk bets that are reflective of their ability as a talent evaluator. In general, as seen in the following papers: (Staw & Hoang,1995), (Berri & Simmons, 2009), (Keefer, 2016), the sunk cost effect shows itself in sports as being selected early in the draft are generally correlated not with high performance metrics but rather with high amounts of playing time.

First considered in the paper, Sunk Costs in the NBA: Why Draft Order Affects Playing Time and Survival in Professional Basketball by Staw and Hoang, 1995. The Paper examines the players selected in the first two rounds of the NBA Draft from 1980 to 1986 and followed all players' careers until they were either cut from the league or until the 1990-91 season.

The three main metrics used to evaluate the validity of the sunk-cost hypothesis was analyzing data on playing time, survival in the league and the likelihood of being traded. Regression showed that the higher a player was taken in the draft, even after controlling for other logical predictors of playing time such as performance, injury and trade status, the longer a player's NBA career was and the less likely he was to be traded. This study also challenged the prevailing notion that coaches only played the best players, regardless of their cost to the team.

(Berri & Simmons, 2009) performed a similar study to evaluate the correlation between the draft position associated with Quarterback selection and their corresponding performance in the NFL. Evaluating and comparing 4 decades worth of data, there was a relationship between aggregate performance and draft position. However, when considered on a per play basis, there was a very weak relationship between draft position and overall performance. Instead, it was found that draft position correlated strongly to number of plays on the field by a given quarterback. When coupled with the fact that the discussed quarterbacks do not outperform their later picked contemporaries on a per play basis, this is further evidence of the Sunk Cost effect in sports.

Chapter 3: Biases Present within the NBA Draft

As with any decision-making procedure that involves subjective analysis, the NBA draft is no stranger to biases. In the NBA draft, there are number of prospects entering each and every year and as a result teams are required to pick them in an order where they can maximize their overall incoming rookie talent. For players selected in the first round, the Collective Bargaining Agreement creates a pre-determined draft compensation table based on where the players are chosen. Teams are then able to sign the players chosen in the first round for anywhere between 80-120% of their CBA agreed upon slot value depending on the pick they are chosen at. This means that a team is able to often save millions of dollars in payroll by trading down to select a player they are interested in, creating room to select other players. Consequently, picking the best player available is not always the optimal strategy as it does not prove to be cash-effective.

Biases deter teams from making optimal decisions by clouding their judgement and deterring them from picking the best player available. Teams often use comparisons between players previously chosen to project the careers and potential of their current NBA draft prospects. Consequently, there is a great deal of bias towards players whose backgrounds have significantly higher amounts of comparable prospects.

From the research conducted, there appears to be 3 main biases apparent within the NBA Draft. They will be referred to as the International Bias, The Small School Bias and The Age Bias.

Traditional Path of NBA Prospects:

Prior to discussing the biases found, it is important to understand the reason behind them. This can be done through conducting an analysis of the traditional route followed by prospective NBA Players, then comparing them to understand the anomalies.

Basketball is one of the biggest sports in North America. Consequently, recognition and scouting for future professional stars begins at a young age. Prospects are ranked from the moment they enter high school by scouting services such as ESPN Top 100, 247Sports and Rivals. These prospects are classified onto a star ranking system, with 5 stars denoting the most acclaimed and talented players, and the 2 star the least. 5 stars, as the players who are classified under the 5-star ranking are often referred to, are the target of the top programs in college basketball and considered to be likely future NBA players. Furthermore, these players are being recruited by top basketball prep schools and AAU teams, giving them even further exposure to professional and collegiate scouts. Meanwhile, 2 stars find themselves to be fighting for walk-on spots at high-major schools, often finding themselves outside of the NBA pipeline. These players are given much less exposure as they find themselves playing for unsponsored teams and regional high schools or rarely receiving playing time should they be given a spot on highly acclaimed AAU/prep team.

Most collegiate and professional scouts find themselves attending games and tournaments where top prospects will be playing. This means that they are attending the largest tournaments throughout the high school season. These tournaments provide an economical way to view several potential scholarship candidates within a short period of time. Rather than being forced to travel individually to see each one, the scouts can see

many at once. These tournaments are often invite-only and are attended by only the best and biggest public schools as well as a number of prep/private schools where basketball is a large athletic focus. AAU teams, are split into 4 main competitive circuits. Each of Under Armour, Nike and Adidas offer their own sponsored circuits where teams are adorned in the gear and equipment of the sponsor. These teams are generally regional teams, with each state having at most one team on each circuit. (Larger states such as California or Texas often have more than one, but in general this is the case). A 4th group of players play on the Independent Shoe Circuit. Tournaments on this level are generally sparsely attended by college coaches at the high-major Division 1 level, rather being filled by college coaches at the low-middle major Division 1, Division 2 and Junior College level.

While there do exist instances of NBA players who played for unsponsored AAU teams, these players generally are subject to playing for mid-major Division 1 schools before reaching the NBA. The vast majority of future NBA players who play AAU are found to have played AAU basketball on one of the big 3 shoe circuits. Not doing so can seriously hamper the chances of a given player being capable of making the leap into high major Division 1 colleges, regardless of how well they play in their given high schools.

High School basketball is generally regionally determined, with the best players playing for the best and biggest schools within their regions. The elite programs are coached professionally and given the best resources for training, thereby providing the best environment for making the transition to collegiate basketball. This is often why many high schools such as DeMatha Catholic School in Prince George County, Maryland

or Duncanville High School in Dallas, Texas produce so many elite basketball players despite being public schools.

However, in truly exceptional cases, players are able to play for prep schools and boarding schools designed entirely behind the idea of placing athletics first. Schools such as Montverde Academy or IMG Academy, boarding schools in Florida, aim to emulate the collegiate and professional training environment for top level athletes. The majority of the players on these teams go on to receive Division 1 scholarship offers, even those who receive minimal playing time. These schools boast professional training facilities with dedicated training staff, including amenities such as recovery rooms equipped with state of the art facilities as well as staffed with professional physical therapists and private training facilities where players can attend extra individual practice, either on their own or with a trainer. Being able to attend and play for these schools is a privilege that allows players to gain a great deal of exposure as well as extra training.

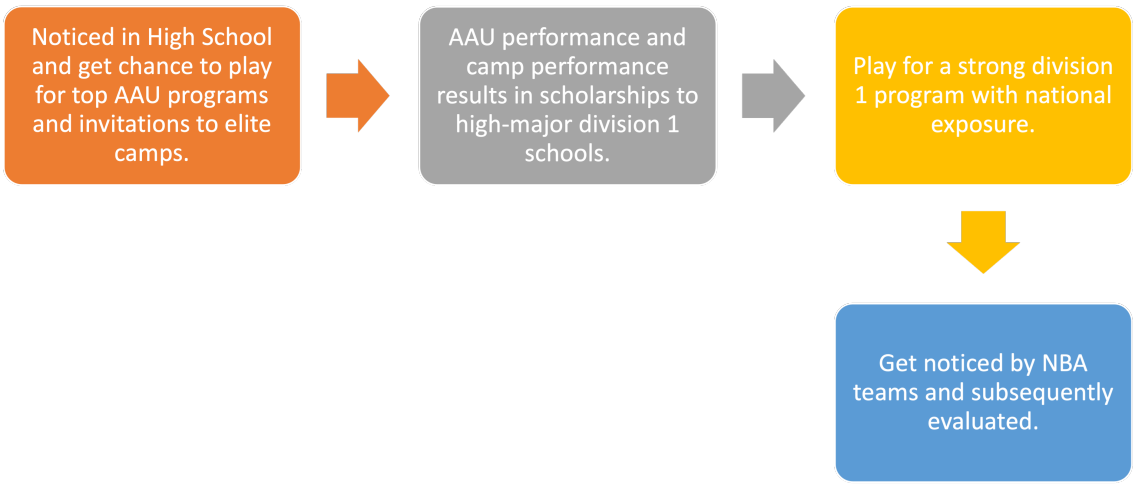
Players who attend smaller and more local schools lack exposure and are often relegated to attending only regional basketball programs regardless of how well they play throughout. State Championships and interschool competition is often determined by the size of the high school attended. This results in smaller schools being relegated to the 3rd or 4th division and receiving less exposure. These teams, even in instances of state championship runs, are rarely viewed by scouts at the Division 1 level aside from those within a small driving distance. Most of the scholarship offers that result from these are those schools that are nearby. Top athletes who attend these schools are often forced to take a post-grad year to play at a prep school or enroll in Junior College in order to gain adequate exposure to pursue a future as a Division 1 basketball player.

Among Division 1 college basketball programs, there are levels of distinction awarded to the varying calibers of teams. The premier conferences in the NCAA are referred to as High Majors. This term generally refers to the following conferences: ACC, SEC, Pac 12, Big 10 and Big 12. Within basketball, specifically the Big East is also considered a high major conference. These conferences are the largest revenue generating and consequently the most well-funded of the conferences in the NCAA. These conferences are generally those that garner the most exposure, attract the top recruits and have the highest overall level of competition. Within these conferences, there is a higher distinction for the top 6 teams. The term used to describe this elite group is referred to as the Blue Bloods. The following teams are considered to be Blue Bloods: Kansas, Kentucky, UNC, UCLA, Duke and Indiana. Additionally, UConn and Villanova in recent years have garnered attention and praise as potential additions to the list. As NBA scouts are limited in both their time and attention, these schools and conferences tend to receive significantly more exposure and scouting. This results in a significantly higher amount of high draft selections made for players from these schools. Certain players attend mid-major schools after being overlooked from high school, however this is a much smaller number than the aforementioned high-major group.

As shown in table 2 and a summary of the above discussion, NBA players are typically noticed first in High School and given a chance to play for state-wide or metropolitan teams in the form of AAU programs and invitational national camps. The performance in AAU and invitational camps are noted by high-major division 1 school coaches and scouts. The players are then awarded with scholarships and given the opportunity to play at division 1 programs with national exposure. These programs are

viewed by professional scouts and the players are evaluated. The best players from these high-major collegiate programs are then selected in the NBA draft and are given the opportunity to play in the NBA.

Table 2: Typical Path-Way for NBA Players



Style of Play (AAU vs High School):

In this section, we will be discussing the differences in style of play between AAU and High School.

AAU basketball is often composed of the best players from a given region who come together for the sole purpose of competing in tournaments. These teams seldom if at all practice and instead are composed as pseudo-all-star teams of high school players from a given state. The result is a team of immensely talented individuals who are playing individualistic basketball that is more similar to a star-studded pickup game than a team-sport. This style of competition rewards individual skills. Conversely, high school

basketball teams are gathered before the season begins and practice throughout. They play as a unit and are generally more organized and coherent together than the AAU teams. While the overall talent is generally lower than that present on the AAU circuit, this style of competition emphasizes much more team skills than the individual ones seen on the AAU circuit.

International Bias:

Basketball is a global sport which means that there are players available to be drafted from all around the globe. In fact, some of the NBA's premier players have arrived from countries outside of North America. This has been even more pronounced in recent years, as from 2019-2023, the NBA's premier individual award has been awarded to a player who was born outside of the United States with 4 of the 5 awards being awarded to a player who had played the entirety of their pre-NBA basketball career outside of the United States.

However, many times players are often discounted based on the fact they had played outside of the United States. This often arrives due to the stylistic differences between professional basketball overseas and the NBA.

European basketball is the primary source of talent outside of the United States for NBA teams to draft from. In general, European basketball is considered much more of a team game than their American counterpart. Coaches in European basketball leagues are known to apply strict systems where ball movement and defensive rotation is emphasized. Consequently, players are given much less of an opportunity to demonstrate

their individual ability. The defensive and offensive schemes involve significant cooperation among team members. This is in stark contrast to the American style of basketball. American basketball emphasizes much more isolation-style offensive schemes and individual defensive matchups. Consequently, players are able to demonstrate their individual athleticism and ability on a much more consistent basis than the European draft prospects. While European basketball emphasizes more team basketball, player success is often determined by superior basketball IQ, shooting, and passing ability. While these are important in all styles of basketball, the primary focus of all levels of American basketball, including the NBA is athleticism and ability to adapt to the speed of the game. This has often caused for players who succeeded in Europe to struggle when asked to implement their game into the NBA. An example of this is Milos Teodosic who was among the best players in the Euroleague, garnering several All-Euroleague first and second team selections throughout his career. However, in 2017 after arriving into the NBA, struggled to make any legitimate impact onto his Los Angeles Clippers roster as he lacked the athleticism and speed necessary to adapt to the much more fast paced American game.

However, despite the merits of the skepticism related to the ability to transition stylistically between the EuroLeague and the NBA, this bias discounts a number of other relevant factors in success in professional basketball. For example, a number of soft skills are reflected in a player given their ability to succeed at a high level of professional basketball. They must be coachable, professional, and mature enough to handle the rigors of an intense level of basketball. The Euroleague is a much higher level of competition than any other comparable American league for pre-draft prospects,

namely the NCAA Division 1. This reflects a player's ability to meet and succeed at a high level of basketball as well as their ability to play a role on a team, something they will likely be asked to do their first few years in the NBA regardless of how talented they are. Furthermore, European model of development for basketball players is one that begins in a professional setting much earlier than that of their American counterparts. Euroleague teams develop their athletes from a very young age through their academy program, giving them a professional environment from youth which in turn maximizes their development. This allows players to be much more mature and adapted on average to the professional setting than their American counterparts of the same age.

Additionally, in recent years, the stylistic gap has shrunk with that of the NBA as the NBA has moved towards a more position less and skilled style of play that emphasizes flooring spacing, shooting and ball movement. While the athletic gap remains, many of the newly emphasized qualities desired for in NBA prospects are reflected through the Euro league style of play.

Age Bias:

Throughout the NBA draft process, players of all ages are eligible to join be selected. For much of the NBA's history, players were allowed to make the jump from high school to the professional leagues but few did. The first high school player to successfully do so in the NBA draft was Kevin Garnett in 1995, being selected 5th overall by the Minnesota Timberwolves. Garnett's successful transition to the NBA spurred a number of prep-to-pro prospects over the next decade with several going on to have Hall of Fame careers such as Kobe Bryant, Tracy McGrady, Dwight Howard and Lebron

James. Beyond solely affecting the number of entrants arriving from high school, this draft trend also brought forward a significant decline in the age of drafted players. Groothius et al. discovered that the median age of first round picks declined from 22.4 to 20.4 through the years 1994 to 2004. Also discussed in this study was the performance of those early entrants consisting of college freshman and high school players. These players were found to play fewer minutes and exhibit lower performance than their older counterparts for the first two years of their professional career. However, by the third year their performance rose to meet the level of their older counterparts. By the fourth year, the evaluated players were found to not only meet but also significantly exceed the performance of the older upperclassmen draft picks.

However, for every successful individual, there were a number of unsuccessful prep-to-pro candidates entering the league. Multiple players found the transition to be difficult, flaming out and underperforming candidates who were ranked similarly to them but decided to enter college instead. 18 year olds were seen to lack the mental and physical maturity to merit the early investment into them. Through this, it became clear to the NBA that this was an untenable trend, leading to a rule change beginning in the 2006 NBA Draft where players were required to spend at least one year in college prior to declaring for the draft. This led to the "One and Done" era, where top prospects spent only a single season in college prior to declaring for the NBA draft. From 2007 to 2022, only 1 first overall selection was spent on a player who was not a freshman (Blake Griffin in 2009).

Teams became more and more inclined to spend top first round picks on Freshman/Sophomores rather than older, more polished players. Discussed by (Groothius

et. al), teams were willing to gamble on a player's potential to become a superstar because they believed that within a professional setting, players could improve more quickly than spending the same time in college. In other words, a talented player who enters the NBA rather than spending his sophomore year in college would improve in his would-be-sophomore season through spending it under the NBA teams' guidance rather than under the college team's one. In an employment context, this can be viewed as teams investing in players through on-the-job training rather than picking more polished prospects. Furthermore, it was viewed that the top prospects would declare for the draft, aiming to capitalize on their high earning potential rather than spend another year of unpaid college basketball participation. This meant that teams could get a more talented player with more potential if they drafted younger. Using an option value hypothesis as an analogy, young players were seen to merit the premium as they had significantly higher upside potential value. The NBA is a superstar driven league which meant that for most teams, especially those rebuilding and selecting at the top of the draft, they aimed to prioritize the ability to grab superstars than high floor, low ceiling players.

The prioritization of drafting for potential and believing that players could be molded into serviceable NBA talent resulted in numerous upperclassmen players being overlooked and drafted much later. This age bias resulted from two main notions. The first notion was that if a player was capable of being drafted earlier in their career, reflecting a high physical talent, they would have entered the draft. This thereby communicated to teams that the player was a late bloomer and had a lower ceiling, making him unlikely to ever reach superstar or even star status. Furthermore, this lack of physical talent was even more exacerbated by the fact that players of similar age would

already have years of intense professional training and adaptation to the rigors of the NBA lifestyle, increasing the already significant gap between them and the late bloomer class of prospects.

The second notion was that the college game prioritized different sets of skills than the NBA game. The NCAA has a 30 second shot clock rather than the 24 second shot clock practiced in the NBA. Coupled with the presence of much less athletic players on the floor, this leads to a significantly slower pace of play that is more methodical and set-oriented. While college is considered the traditional route for most NBA prospects, spending multiple years in college indicates that a player has optimized their game to meet the demands of a collegiate schedule. This meant that players would require dedicated time to adapt their skillset to meet the NBA style of play. Teams were more inclined to develop a player in-house from a young age than they were willing to develop an older player as the potential payoff was significantly lower.

Despite this age bias, players who emerge as late bloomers are often significantly more polished than their younger counterparts as they have spent years honing their skills to master a certain style of play. Meanwhile, their younger counterparts have progressed through AAU, High School and College basketball, all very different styles of basketball. This has led to a higher breadth but smaller depth in skills developed.

Furthermore, players who are developed in-house are generally limited in their ability to play actual games. This has slightly changed in recent years with both the growth of the NBA G-League, the NBA's development minor league, and the addition of two-way contracts, a contract where players are sent back and forth between teams main roster and their G-League affiliate. However, it is important to note that despite the

improvements, teams are limited to allocating 2 two-way contracts per season which means that most players are still relegated to being developed through fringe rotation minutes on the main roster. This method of development emphasizes the improvement of players through participation in practice rather than games. However, this provides a very limited approach to improvement. Players are limited in their opposing competition, which does not adequately replicate the diversity in play styles and roles they will encounter in the NBA. This often means that for most players, development through collegiate participation will be superior as they are able to truly test their skills in a comprehensive manner rather than a limited one.

Finally, the age bias often results in early specialization by players as they attempt to maximize their talent from a young age. This is done in an effort to gain entry into the extremely competitive AAU pipeline. However, the early-onset fear-driven specialization can often result in a much higher likelihood of overuse injuries. Athletes who play multiple sports and are more well-rounded in their athletic approach find themselves much more physically well-rounded as well, whereas athletes who specialize early become much stronger in those specific movements but not in others. Different sports develop different aspects of athleticism. For example, soccer develops footwork, while baseball develops hand-eye coordination. Both of these are important skills to develop for a successful basketball player but may never occur to the extent they should given the early specialization of the athlete. Finally, early specialization refers to sport specialization that takes place prior to adequate physical maturation of the athlete. Consequently, sports are chosen often by interest at the time rather than a long-term physical match, which can lead to mental burnout as they are in sports based on early

commitment. As a result, athletes who pick their basketball as their desired sport after years of multi-sport interest are often much more suited mentally and physically for a long-term commitment to the sport which is an important characteristic for professional teams aiming to invest their future in the player.

Small School Bias:

Throughout the evaluation of basketball players from youth, top prospects are filtered and identified through a rigorous series of stages. This begins from the moment they enter high school and continues for most of their teenage careers. As a result, players who are talented and stand out are given copious amounts of opportunities to prove themselves to high-major college coaches, who spend much of the year looking for these players across varying age groups. Players who are not identified as having high-major potential by the time they reach college are often relegated to attending and playing for mid-low major schools. This creates a stigma that players who attend and play for the aforementioned schools are less talented and less deserving of professional attention. Furthermore, it discounts any achievement accomplished by these players as it is seen as being done primarily against inferior competition. On average, the lottery (top 14 picks in the draft allocated to the teams that did not reach the playoffs in the preceding year) only has 1 player chosen each year from this group of schools and in the majority of cases is an upperclassman who was one of the best players in college basketball. Whereas there are a number of cases of players who did not perform well in their sole collegiate season who are selected within the lottery on the basis of physical potential.

However, despite this there are several instances of players who arrive from small schools doing tremendously well in the NBA, even winning Rookie of the Year and

going on to make All-NBA teams. Examples of this include players such as Damian Lillard from Weber State University. For a player to stand out from a small school is significantly more difficult than doing so from a large school as they are given less coverage and less respect for their accomplishments. Consequently, it demonstrates a consistency in excellence within their performance to garner the attention and respect from NBA scouts. Consistency in excellence is a high indicator of skill and competency and demonstrates a high floor for players chosen. Furthermore, the act of minimizing the gap between players who were not seen as high-major prospects to being one of the best players in the nation demonstrates a number of intangible qualities that bode strongly for a long and prosperous career in the professional ranks.

Effects of Biases Not Being Addressed:

For General Managers and Front Office Executives, player acquisition and roster construction are pivotal aspects of their career. Team executives are under the expectation that they are pressured to find players who will strongly contribute to their team and at a level where they could not be replaced by the average player. Otherwise, teams would just aim to sign an average, proven veteran player to fill spots on their team rather than take significant chances, often at a salary premium on unproven young talent. Picking a player in the draft is a multi-year investment in development in the hopes that the player will outperform their salary. Consequently, the risk associated with missing on a prospect is gargantuan. In the beginning of the draft, teams tend to select players they feel will translate accordingly into the professional league, often based on a combination of physical attributes. Players are overlooked for not having adequate physical attributes to make it at the next level. However, this method of evaluation often discounts the

importance of intangibles in professional sports which leads to a mispricing of players in the draft setting as these are non-measurable and subjective, judgement calls. There is a long history of undersized players slipping in the draft, only to outperform their draft standing and reach All-League status later in their career due to a strong set of intangible qualities. To combat the biases and invisible qualities present in evaluation of professional athletes, sports analytics experts have developed methods of evaluating statistical contribution of athletes with a series of advanced metrics. These methods can the isolate the presence of desired qualities.

The effect of not addressing biases can also be separated into small-market and big-market teams. Small-market teams denote those that play in smaller media markets. These are considered less desirable locations for free agents. Consequently, the roster is primarily constructed through home-grown talent acquired through the draft and through trades conducted using their home-grown assets. For these teams, the draft is incredibly important. Mistakes in draft selection are significantly more costly which means that their ability for future success is significantly hampered by incorrect draft selections. For these teams, addressing biases is incredibly important as it allows them to select players who are undervalued during what may be their only opportunity to acquire these players.

Big-market teams are those in major media markets. Consequently, they can overpay for free-agents and bear the burden of penalizing restrictions such as the luxury tax. (A bill paid by teams who exceed the salary cap by a given amount). These teams aim to acquire stars through free agency but acquire their role players and supporting cast through the draft. These teams are also expected to compete for major playoff success and contend for championships at which level of competition there is very little room for

error. Big-market teams that do not draft optimally will struggle to compete for championships.

Chapter 4: Different Advanced Metrics

Following the research conducted by the literature previously discussed, it was pivotal to select an advanced metric which adequately and effectively summarized the value or contribution of the player in the given season. Among the most popular advanced metrics for player evaluation are Wins Produced, Win Shares, PER and VORP. Each of the analytic measures have their individual strengths and weaknesses in determining individual player contribution and will be considered.

PER (Player Efficiency Rating):

The player efficiency rating, colloquially known as the PER, is a per-minute rating developed by John Hollinger, a columnist at ESPN.com. Per Hollinger's own description, the PER sums up all a player's positive accomplishments, subtracts the negative accomplishments and returns a per-minute rating of the player's performance, while also adjusting for pace. The positive accomplishments include statistics such as field goals, free-throws, 3 pointers, assists, rebounds and blocks. The negative accomplishments include statistics such as missed shots, turnovers and personal fouls. The ratings for each player are then adjusted for the team's pace. Furthermore, it is normalized that league average is set to be 15.0.

The main criticisms of PER are that it overrates Offensive Performance and that it gives undue weight to a player with lower amounts of playing time. With respect to the offensive performance criticism, the stat equates defensive contributions to the accumulated number of blocks and steals. This can often oversimplify the characteristics of a good defensive player. Furthermore, it does not equally weight offensive and defensive contributions, rather choosing to reward offensively proficient

players with disproportionately high PERs. There are instances of the best defensive players in the league being categorized as fringe rotation players by the PER metric. An example of a player who routinely posted single digit PERs (a range normally indicative of the caliber of player who would find themselves on the verge of exiting the league), yet was perennially considered among the top defenders in the league (Was a 5 time member of the All-NBA Defensive First Team) was Bruce Bowen, a forward playing on the San Antonio Spurs. The second criticism of PER is that overrates statistics obtained against weaker opposition or in minutes that are unimportant. For certain players, particularly those at the end of the roster minute allocation, much of their statistical accomplishments take place towards the ends of games. This means that these statistics, since PER is calculated on a per minute basis, are considerably overrated in the broader comparison of player value.

VORP (Value Over Replacement Player):

VORP, also known as Value over Replacement Player, is an adjusted version of the Box Plus Minus metric, designed to also include playing time. Box Plus Minus is a statistic developed by Daniel Myers. BPM, as it is colloquially termed, is a basketball box-score based metric that aims to measure a player's contribution in points above league average per 100 possessions. However, BPM does not incorporate playing time as it is solely a rate statistic. League Average for the BPM statistic is created to be 0.0, while a replacement value (bench player) is considered to be -2.0. BPM uses a player's box score statistics, position and team's overall performance into account when estimating the player's contribution in points per 100 possessions above league average.

BPM and consequently, VORP has its fair share of criticisms as well. BPM uses comparisons made to a player's peers in their individual position in order to properly and fairly contextualize their performance. However, as the NBA shifts towards a much more positionless league where individual responsibilities have become non-traditional, this comparison can become misleading. For example, Nikola Jokic of the Denver Nuggets, is a player who is known for his playmaking abilities despite playing the majority of the time out of the post. Consequently, Jokic averages an inordinate amount of assists compared to the average center, resulting in an extraordinarily high BPM. This is also reflected on the defensive end, where despite not even being considered one of the best defenders currently in the league, he boasts a historically high DBPM. Consequently, BPM does not adequately adjust for players who operate in non-traditional offensive schemes. For example, this gamification of the weighting system is not only limited to centers who can pass. Guards who are skilled rebounders also receive similar over-valuation of their box score statistics. A prominent example of this is the 2017 Russell Westbrook season, in which Westbrook infamously averaged a triple-double for the first time in NBA history since Oscar Robertson. However, Westbrook was the beneficiary certain rebounding rotations in which his big men teammates would box out for him and allow him to grab the rebound. In turn, Westbrook would begin sprinting immediately and be able to turn the play around into an offensive possession much more quickly. Regardless of the intent of this strategy, it was not a rebound in the traditional sense for guards where a guard is expected to run after a loose ball that has bounced its way to the perimeter, a play that does demonstrate and correlate to team success as demonstrated by the linear regression computed to find the relative weightings by position.

Wins Produced:

Wins Produced is a metric whose innovation is attributed to David Berri, Martin Schmidt and Stacey Brook. Discussed thoroughly in the book titled Wages of Wins, the metric aims to summarize how a given's player's contributions affects the act of winning basketball games. After performing a series of linear regressions on various statistics from previous seasons, Berri created a statistic he claims can explain 95% of the total wins produced by a team. The model is based off the the idea of equating wins and possessions. Plays that increase the number of possessions a team has increase the chance of winning and vice-versa. In essence, Wins Produced aims to divide a team's efficiency, dividing them to each player and attempting to show how closely they correlate to wins.

However, like the other advanced statistics discussed, Wins Produced is not without its flaws. Wins Produced treats every statistic evenly. However, if one wishes to be true to the assumption that additional possessions correlate to additional wins, this cannot be the case. For example, a block that is tipped to teammates accomplishes very different things than a block that is sent out of bounds.

Win Shares:

Win Shares was originally a statistic developed by sabermetrics godfather Bill James to gauge contributions to a team's total wins in baseball. They are considered to be a calculation of the number of wins a player contributed to his team. In baseball, each team was credited with 3 win shares for each team win. Justin Kubatko, creator of the basketball statistical tracking site, Basketball Reference adapted the statistic to fit basketball tracking. Each win obtained by a basketball team is equivalent to a single win share in his system. Furthermore, Kubatko adapts the system to make the possibility of

negative win shares as well, something James did not make possible in his original statistic. A criticism against win shares is that individual contributions on winning teams are often overrated. For example in 1995, Hakeem Olajuwon was considered among the league's best players. However, his team on the other hand was not. Consequently, Hakeem was rated below players like Detlef Schrempf and Dana Barros in Win Shares. However, the counterargument against this criticism and consequently argument for win shares, is that players are evaluated based on games they won rather than games they may have been able to win under different circumstances.

Draft Curves:

When considering previous drafts, it is important to develop a measure of success. This allows teams to understand their previous results honestly and assess the best methods of moving forward. The measure of draft success can be done in a myriad of different ways. Some papers measure player success through the longevity of individual careers, grading players on the basis on how many games they have played. However, most papers reviewed attempt to categorize success based on advanced metrics such as Win Shares and contextualizing them by normalizing them in comparison to the rookie-scale salaries which will be discussed at length later on.

Several advanced metrics exist to measure the seasonal and career contributions of individual athletes. (Barzilai, 2011), created a relative draft chart that was based off production in four different metrics: PER-minutes, Player Wins, WS and Estimated Salary over the course of three different time periods: Career, First Four Years and Years with Rookie Team. The conclusion was that the value of NBA draft picks are incredibly top heavy, with the difference between the 1st and 7th pick being equivalent to

the drop-off between the 13th and 30th pick. Furthermore, there was very little difference between picks towards the end of the first round in terms of their value but a very large amount of difference in the picks towards the beginning of the draft. Barzilai's draft curve is consequently of a non-linear fit nature. He personally chose to use an exponential decay model to evaluate the results of his graph. This allows for a singular equation to be given at the end of the process which represents the result. However, draft curves can be made over a variety of different techniques. For example, Schuckers (2011) used a locally estimated scatterplot smoothing, colloquially known as LOESS, when creating his draft curve. LOESS smoothing is a non-parametric method for smoothing a series of data in which there is no assumption made regarding the structure of the data being evaluated.

Contextualization based on Salary:

While the produced amount of each asset can be measured by data such as Win Shares and other similar metrics, it is important to contextualize the value given by each asset with the cost of obtaining and employing each asset. Within the context of the draft, there is a set rookie salary scale provided by the league themselves, following which the teams are expected to pay their players. While each paper uses different metrics, the papers evaluated provided a pattern of determining the value of a metric (Win Share, VORP etc.) and then finding the expected salary based on the production of this metric per player, subtracting the actual salary and calling the result the surplus value.

First done by (Massey & Thaler, 2010), the result was that there was a higher surplus value found at the end of the NFL draft than at the beginning. Given that draft picks could be traded often for multiple additional picks when attempting to move down

in the draft order, trading down was often beneficial for teams to do, which was completely counterintuitive when having considered the very nature of the draft. This was seen again in the context of basketball teams (Galletti, 2010) which found that draft picks in the middle of the first round had a similar, sometimes lower surplus value when being compared to those at the end of the first round. (Silver, 2017) evaluated a similar data set of NBA first round draft picks when compared to their surplus value but gave the option of dropping a player who had not met their salary obligation by the end of the second year. This stipulation allowed for players chosen at the end of the round to be more profitable, however the result was still a quite similar surplus value for players chosen in the middle towards the end of the draft. Since trading down can result in more picks later in the draft, similar draft pick surplus values can be considered beneficial. The overvaluation of the earlier draft picks was considered by (Massey & Thaler, 2010) to have arrived due to a combination of non-rational expectations by team owners as well as due to mispricing of players.

Chapter 5: Data Analysis

Data Evaluation/Methodology:

To evaluate NBA Drafts within proper context, this paper takes data from the 2012, 2013 and 2014 NBA Draft as well as the first 3 seasons under which the draftees played. This refers to the 2012-13 season through the 2016-17 season.

Replicating the Massey-Thaler surplus value, players were evaluated based on their win shares and contextualized based on what their draft slot salary expected. The expected win shares were computed by taking the league-wide payroll then dividing by the total number of win shares in a season across the league. This allows for several million dollars per win share computation. Then dividing slot value salary by this number, we were able to get an expected win shares per player value.

We then examined and compared this against their actual win shares for the first 3 seasons of their career. The number 3 was chosen because it is the guaranteed amount of years on a rookie contract, demonstrating the commitment that made towards a selected player. A fourth option can be picked up by the team at a stipulated fixed increase in percentage. However, for the purpose of this paper was not considered as it is not a guaranteed salary at the time that the picks are made.

Results/Discussion:

Included in the Appendix are the results of the experiment. Each draft evaluated (2012,2013,2014) provides insight into a variety of biases and reasons for outliers. Aside from the biases of age, small school and international, we can also see a common reason

for a high surplus sum score to be injury concern and simply outperforming draft position to become the best player in the NBA draft.

Surplus Sum Ranking (2014 NBA Draft):

1. Joel Embiid (11.19)
2. Rodney Hood (9.17)
3. Dario Saric (8.36)
4. Bogdan Bogdanovic (7.29)
5. Gary Harris (5.98)
6. Elfrid Payton (5.86)

We can see that Rodney Hood and Elfrid Payton both fell victim to the age bias, with Elfrid Payton also falling victim to the Small School Bias as well. Meanwhile, Dario Saric and Bogdan Bogdanovic were both individuals who fell into the international bias. Joel Embiid fell in the draft due to injury concerns but along with Gary Harris were also just simply examples of overperforming draft prospects.

Surplus Sum Ranking (2013 NBA Draft):

1. Rudy Gobert (14.48)
2. Mason Plumlee (13.64)
3. Giannis (11.8)
4. Gorgui Deng (10.96)
5. Steven Adams (10.35)

Aside from Mason Plumlee, the remaining 4 members of the top 5 in surplus sum ranking for the NBA Draft were subject to the International Bias. Rudy Gobert and

Giannis both played in leagues professionally internationally prior to entering the NBA Draft. Meanwhile, Deng and Steven Adams were late additions to the NBA pipeline, only playing 1 year of high school basketball and 1 year of college basketball each. Mason Plumlee was subject to the age bias, having played 4 years in college. His achievements were discounted on a larger scale than what was shown to be merited based on his performance in the NBA.

Surplus Sum Ranking (2012 NBA Draft):

1. Anthony Davis (22.48)
2. Damian Lillard (21.22)
3. Andre Drummond (18.43)
4. Terrence Jones (8.69)
5. Tyler Zeller (8.66)

Damian Lillard and Tyler Zeller were both 4 year college players, falling into the age bias. However, this draft was largely an example of players overachieving their draft position. Davis was the first overall pick and was an example of a successful first overall pick blossoming into a superstar. Drummond and Jones were under drafted as both were considered to be poor fits in terms of their translation to the NBA style of play, which turned out to be untrue.

Limitations and Future Work:

Within the work, there is a great deal of limitations as well as room for future work. In this paper, there were 3 main biases focused upon. However, these are not the only biases present during decision-making in the NBA Draft. Any criteria upon which

teams will look favorably such as height, weight or other physical characteristics will result in biases being held against those who lack the aforementioned traits. These biases were not addressed in the scope of this research paper as the paper attempted to discuss biases regarding the players' background rather than physical characteristics.

Furthermore, there was a limited set of data used during the development of this paper as only 3 drafts were considered. In future expansion upon this research, greater data sets could be used to gain further insight into biases regarding the decision-making. The limited sample size was used in this paper because drafting trends take place over the course of only a few years as the macro-environment drastically changes the optimal player development model. Historical examples of this include but are not limited to: the implementation of the post graduate year of experience and the implementation of 2-way contracts with the G-League.

Finally, there is an emphasis placed on Win Shares as the optimal statistic to measure the success of a player's career due to its measurement of contribution to team success. However, there exist other advanced statistics which may bear the ability to measure biases in drafting under different assumptions.

Chapter 6: Conclusion

The effect of the biases presented in the above argument is largely that there is under-representation during the consideration and scouting periods of NBA front offices. Front Offices are limited in both time and resources. Consequently, they are able to scout a limited number of players and miss out on a number of suitable candidates due to pre-conceived biases regarding the transition of various playstyles to the NBA. Barring only sports, overlooking candidates from non-traditional backgrounds is a common issue when it comes to numerous situations of selection amongst the masses. For example, this is often seen in instances of college admissions or entry-level employment where accomplishments are similar and must be contextualized based on the applicant background.

Normally teams evaluate players through pre-draft workouts where teams are able to invite a small number of players for individual evaluation as well as through invitations to the NBA Draft Combine where the NBA invites a group of draft eligible players for a broader evaluation in front of all 30 teams.

A proposed solution in those situations is affirmative action or quota driven hiring. In the context of basketball drafting, this could be reflected in a required offering of a certain number of pre-draft workouts and combine invitations to players who fall under the 3 discussed biases of being an International Prospect, an Upperclassmen Prospect, and a Small School Prospect. Consequently, these players would receive an equal and fair chance at being evaluated by professional teams.

The two major risks when discussing picking players is the potential act of missing out on a star player as well as potentially landing on a bust. Both actions are compounded by the presence of the biases discussed in this paper. Star players who fall under any of the 3 major biases can be more easily missed out on while those players who fulfill the opposite of the proposed bias prototypes (Underclassmen, Blue Blood and Domestic Player) will tend to go higher. By identifying and reflecting upon the common biases present in the drafting process, these two major risks can be drastically reduced by creating a clearer view of the decision-making process.

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Appendix A (2012 NBA Draft)

Expected Win Shares

Pick Number	Year 1	Year 2	Year 3
1	2.62	2.72	2.69
2	2.34	2.43	2.40
3	2.10	2.18	2.16
4	1.89	1.97	1.95
5	1.72	1.78	1.76
6	1.56	1.62	1.60
7	1.42	1.48	1.46
8	1.30	1.35	1.34
9	1.20	1.24	1.23
10	1.14	1.18	1.17
11	1.08	1.12	1.11
12	1.03	1.07	1.05
13	0.98	1.01	1.00
14	0.93	0.96	0.95
15	0.88	0.91	0.90
16	0.84	0.87	0.86
17	0.79	0.83	0.82
18	0.76	0.78	0.78
19	0.72	0.75	0.74
20	0.69	0.72	0.71
21	0.66	0.69	0.68
22	0.64	0.66	0.65
23	0.61	0.64	0.63
24	0.59	0.61	0.60
25	0.56	0.59	0.58
26	0.55	0.57	0.56
27	0.53	0.55	0.54
28	0.53	0.55	0.54
29	0.52	0.54	0.54
30	0.52	0.54	0.53

Actual Win Shares

Pick Number	Player Name	Year 1	Year 2	Year 3
1	Anthony Davis	6.1	10.4	14
2	Michael Kidd Gilchrist	2.1	3.1	3.8
3	Bradley Beal	3	4	3.7
4	Dion Waiters	0.9	1.6	1.1
5	Thomas Robinson	-0.1	1.6	1.5
6	Damian Lillard	5.8	9.6	10.6
7	Harrison Barnes	2.8	3.2	6.7
8	Terrence Ross	0.9	4.2	2.4
9	Andre Drummond	4.5	9.9	7.7
10	Austin Rivers	-1.1	0.6	1.5
11	Meyers Leonard	2.4	0.6	2.8
12	Jeremy Lamb	0.2	3.3	1.6
13	Kendall Marshall	-0.2	0.9	0.8
14	John Henson	1.9	3.3	3.6
15	Maurice Harkless	2.4	2.8	0.3
16	Royce White			
17	Tyler Zeller	2	2.6	6.5
18	Terrence Jones	0.7	7.3	3
19	Andrew Nicholson	1.7	0.6	0.1
20	Evan Fournier	1	1.4	2.1
21	Jared Sullinger	2.7	3.9	4
22	Fab Melo			
23	John Jenkins	1.7	-0.1	0.9
24	Jared Cunningham	0	0.1	0
25	Tony Wroten	0.1	-0.9	0.3
26	Miles Plumlee	0	4	2.6
27	Arnett Moultrie	1.7	0	
28	Perry Jones	0	1.5	0.2
29	Marquis Teague	-0.3	-0.5	-0.1
30	Maurice Harkless	1.5	1.7	2.7

Win Share Difference

Pick Number	Player Name	Year 1	Year 2	Year 3	Surplus Sum
1	Anthony Davis	3.48	7.68	11.31	22.48
2	Michael Kidd Gilchrist	-0.24	0.67	1.40	1.83
3	Bradley Beal	0.90	1.82	1.54	4.26
4	Dion Waiters	-0.99	-0.37	-0.85	-2.21
5	Thomas Robinson	-1.82	-0.18	-0.26	-2.26
6	Damian Lillard	4.24	7.98	9.00	21.22
7	Harrison Barnes	1.38	1.72	5.24	8.34
8	Terrence Ross	-0.40	2.85	1.06	3.51
9	Andre Drummond	3.30	8.66	6.47	18.43
10	Austin Rivers	-2.24	-0.58	0.33	-2.49
11	Meyers Leonard	1.32	-0.52	1.69	2.49
12	Jeremy Lamb	-0.83	2.23	0.55	1.95
13	Kendall Marshall	-1.18	-0.11	-0.20	-1.49
14	John Henson	0.97	2.34	2.65	5.96
15	Maurice Harkless	1.52	1.89	-0.60	2.80
16	Royce White				0.00
17	Tyler Zeller	1.21	1.77	5.68	8.66
18	Terrence Jones	-0.06	6.52	2.22	8.69
19	Andrew Nicholson	0.98	-0.15	-0.64	0.19
20	Evan Fournier	0.31	0.68	1.39	2.38
21	Jared Sullinger	2.04	3.21	3.32	8.56
22	Fab Melo				0.00
23	John Jenkins	1.09	-0.74	0.27	0.62
24	Jared Cunningham	-0.59	-0.51	-0.60	-1.70
25	Tony Wroten	-0.46	-1.49	-0.28	-2.23
26	Miles Plumlee	-0.55	3.43	2.04	4.93
27	Arnett Moultrie	1.17	-0.55		0.62
28	Perry Jones	-0.53	0.95	-0.34	0.09
29	Marquis Teague	-0.82	-1.04	-0.64	-2.50
30	Maurice Harkless	0.98	1.16	2.17	4.31

Appendix B (2013 NBA Draft)

Expected Win Shares

Pick Number	Year 1	Year 2	Year 3
1	2.69	2.66	2.66
2	2.41	2.38	2.38
3	2.16	2.14	2.14
4	1.95	1.93	1.93
5	1.76	1.75	1.75
6	1.60	1.59	1.59
7	1.46	1.45	1.45
8	1.34	1.33	1.33
9	1.23	1.22	1.22
10	1.17	1.16	1.16
11	1.11	1.10	1.10
12	1.06	1.05	1.05
13	1.00	0.99	0.99
14	0.95	0.94	0.94
15	0.91	0.90	0.90
16	0.86	0.85	0.85
17	0.82	0.81	0.81
18	0.78	0.77	0.77
19	0.74	0.73	0.73
20	0.71	0.71	0.71
21	0.68	0.68	0.68
22	0.66	0.65	0.65
23	0.63	0.62	0.62
24	0.60	0.60	0.60
25	0.58	0.57	0.58
26	0.56	0.56	0.56
27	0.55	0.54	0.54
28	0.54	0.54	0.54
29	0.54	0.53	0.53
30	0.53	0.53	0.53

Actual Win Shares

Pick Number	Player Name	Year 1	Year 2	Year 3
1	Anthony Benett	-0.4	0.3	0.1
2	Victor Oladipo	1.3	3.5	4.9
3	Otto Porter Jr.	0	2.7	5.6
4	Cody Zeller	2.6	3.8	6.3
5	Alex Len	0.2	3.4	1.3
6	Nerlens Noel *	4	3	4
7	Ben McLemore	0.8	2.5	0.3
8	Kentavious Caldwell-Pope	1.8	2.8	5.3
9	Trey Burke	0.9	2.4	2.1
10	CJ McCollum	0.2	1.8	6
11	Michael Carter-Williams	1.3	0.8	1.2
12	Steven Adams	2.9	4.1	6.5
13	Kelly Olynyk	2.9	3.6	4.1
14	Shabazz Muhammad	0.3	2	2.7
15	Giannis Antetokounmpo	1.2	6.2	7.1
16	Lucas Nogueira	0	0.7	3.7
17	Dennis Schroder	-0.7	2.5	2.2
18	Shane Larkin	-0.1	1.7	1.4
19	Sergey Karasev	-0.1	0.7	0.3
20	Tony Snell	1.6	2.4	0.4
21	Gorgui Deng	2.2	4.9	5.9
22	Mason Plumlee	4.7	4.8	6.1
23	Solomon Hill	0.4	3.5	2.1
24	Tim Hardaway Jr.	3.1	0.8	1.9
25	Reggie Bullock	0.2	0.1	1.2
26	Andre Roberson	0.8	2.1	3.4
27	Rudy Gobert	0.4	9.3	6.4
28	Livio Jean-Charles			
29	Archie Goodwin	0.2	0.2	0.1
30	Nemanja Nedovic	-0.4		

Win Share Difference

Pick Number	Player Name	Year 1	Year 2	Year 3	Surplus Sum
1	Anthony Benett	-3.09	-2.36	-2.56	-8.02
2	Victor Oladipo	-1.11	1.12	2.52	2.53
3	Otto Porter Jr.	-2.16	0.56	3.46	1.86
4	Cody Zeller	0.65	1.87	4.37	6.89
5	Alex Len	-1.56	1.65	-0.45	-0.36
6	Nerlens Noel *	2.40	1.41	2.41	6.22
7	Ben McLemore	-0.66	1.05	-1.15	-0.76
8	Kentavious Caldwell-Pope	0.46	1.47	3.97	5.90
9	Trey Burke	-0.33	1.18	0.88	1.73
10	CJ McCollum	-0.97	0.64	4.84	4.51
11	Michael Carter-Williams	0.19	-0.30	0.10	-0.01
12	Steven Adams	1.84	3.05	5.45	10.35
13	Kelly Olynyk	1.90	2.61	3.11	7.61
14	Shabazz Muhammad	-0.65	1.06	1.76	2.16
15	Giannis Antetokounmpo	0.29	5.30	6.20	11.80
16	Lucas Nogueira	-0.86	-0.15	2.85	1.84
17	Dennis Schroder	-1.52	1.69	1.39	1.56
18	Shane Larkin	-0.88	0.93	0.63	0.69
19	Sergey Karasev	-0.84	-0.03	-0.43	-1.31
20	Tony Snell	0.89	1.69	-0.31	2.28
21	Gorgui Deng	1.52	4.22	5.22	10.96
22	Mason Plumlee	4.04	4.15	5.45	13.64
23	Solomon Hill	-0.23	2.88	1.48	4.12
24	Tim Hardaway Jr.	2.50	0.20	1.30	4.00
25	Reggie Bullock	-0.38	-0.47	0.63	-0.23
26	Andre Roberson	0.24	1.54	2.84	4.63
27	Rudy Gobert	-0.15	8.76	5.86	14.48
28	Livio Jean-Charles		-0.54	-0.54	-1.07
29	Archie Goodwin	-0.34	-0.33	-0.43	-1.10
30	Nemanja Nedovic	-0.93	-0.53	-0.53	-1.99

Appendix C (2014 NBA Draft)

Expected Win Shares

Pick Number	Year 1	Year 2	Year 3
1	2.55	2.42	2.01
2	2.28	2.17	1.79
3	2.05	1.95	1.61
4	1.85	1.75	1.45
5	1.67	1.59	1.32
6	1.52	1.44	1.19
7	1.39	1.32	1.09
8	1.27	1.21	1.00
9	1.17	1.11	0.92
10	1.11	1.05	0.87
11	1.05	1.00	0.83
12	1.00	0.95	0.79
13	0.95	0.90	0.75
14	0.90	0.86	0.71
15	0.86	0.82	0.68
16	0.82	0.77	0.64
17	0.77	0.74	0.61
18	0.74	0.70	0.58
19	0.70	0.67	0.55
20	0.67	0.64	0.53
21	0.65	0.62	0.51
22	0.62	0.59	0.49
23	0.60	0.57	0.47
24	0.57	0.54	0.45
25	0.55	0.52	0.43
26	0.53	0.51	0.42
27	0.52	0.49	0.41
28	0.51	0.49	0.40
29	0.51	0.48	0.40
30	0.51	0.48	0.40

Actual Win Shares

Pick Number	Player Name	Year 1	Year 2	Year 3
1	Andrew Wiggins	2.1	4.1	4.2
2	Jabari Parker	1.3	3.6	4
3	Joel Embiid	1.9	6.2	8.7
4	Aaron Gordon	1	5.4	3.7
5	Dante Exum	-0.1	1.2	0.7
6	Marcus Smart	2.9	2.9	3.2
7	Julius Randle	-0.1	1.6	3.5
8	Nik Stauskus	0.5	0.5	1.4
9	Noah Vonleh	0.5	1.2	1.8
10	Elfrid Payton	2.3	2.2	4.4
11	Doug McDermott	0	2.8	2.6
12	Dario Saric	1	6.6	3.5
13	Zach Lavine	-0.7	2.6	3
14	TJ Warren	1.1	2.2	4.1
15	Adreian Payne	-0.5	-0.5	0.2
16	Jusuf Nurkic	1.6	0.4	2
17	James Young	0.3	0.1	0.3
18	Tyler Ennis	-0.3	0.4	0.4
19	Gary Harris	-0.7	4	4.6
20	Bruno Caboclo	-0.1	-0.3	0.1
21	Mitch McGary	1.3	0	
22	Jordan Adams	0.4	0	
23	Rodney Hood	2.2	6	2.6
24	Shabazz Napier	0.50	0.10	0.20
25	Clint Capela	0	4.4	2.9
26	PJ Hairston	0.3	0.6	
27	Bogdan Bogdanovic	2.9	2.7	3.1
28	CJ Wilcox	0	0.3	-0.2
29	Josh Huertis	0	0.2	0.5
30	Kyle Anderson	0.3	3.5	2.7

Win Share Difference

Pick	Player Name	Year 1	Year 2	Year 3	Surplus Sum
1	Andrew Wiggins	-0.45	1.68	2.19	3.42
2	Jabari Parker	-0.98	1.43	2.21	2.66
3	Joel Embiid	-0.15	4.25	7.09	11.19
4	Aaron Gordon	-0.85	3.65	2.25	5.05
5	Dante Exum	-1.77	-0.39	-0.62	-2.78
6	Marcus Smart	1.38	1.46	2.01	4.84
7	Julius Randle	-1.49	0.28	2.41	1.20
8	Nik Stauskus	-0.77	-0.71	0.40	-1.08
9	Noah Vonleh	-0.67	0.09	0.88	0.30
10	Elfrid Payton	1.19	1.15	3.53	5.86
11	Doug McDermott	-1.05	1.80	1.77	2.52
12	Dario Saric	0.00	5.65	2.71	8.36
13	Zach Lavine	-1.65	1.70	2.25	2.30
14	TJ Warren	0.20	1.34	3.39	4.93
15	Adreian Payne	-1.36	-1.32	-0.48	-3.15
16	Jusuf Nurkic	0.78	-0.37	1.36	1.77
17	James Young	-0.47	-0.64	-0.31	-1.42
18	Tyler Ennis	-1.04	-0.30	-0.18	-1.51
19	Gary Harris	-1.40	3.33	4.05	5.98
20	Bruno Caboclo	-0.77	-0.94	-0.43	-2.15
21	Mitch McGary	0.65	-0.62		0.04
22	Jordan Adams	-0.22	-0.59		-0.81
23	Rodney Hood	1.60	5.43	2.13	9.17
24	Shabazz Napier	-0.07	-0.44	-0.25	-0.77
25	Clint Capela	-0.55	3.88	2.47	5.79
26	PJ Hairston	-0.23	0.09		-0.14
27	Bogdan Bogdanovic	2.38	2.21	2.69	7.29
28	CJ Wilcox	-0.51	-0.19	-0.60	-1.31
29	Josh Huertis	-0.51	-0.28	0.10	-0.69
30	Kyle Anderson	-0.21	3.02	2.30	5.12

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