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Marginal Revenue Product of Four-Year College Basketball Players

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Abstract

In this paper, I calculate the marginal revenue product of 30 four-year college basketball players in an attempt to add to the debate surrounding the payment of college athletes. I compare the MRP of each player to tuition costs to determine their lost earnings. Previous studies have provided evidence that college athletes make more money for their schools than they are being compensated for. My results are consistent with this. My model estimates that on average these 30 college basketball players are generating $2,059,970 in revenue over four seasons and their lost earnings are on average $1,975,918. Additional analysis shows that 17 out of the 30 basketball players will be compensated for their losses experienced in college in 3 seasons or less in the NBA.

1 Introduction

The goal of this paper is to add to the discussion around the payment of college athletes by calculating the marginal revenue product of four-year college basketball players. College athletes are and always have been considered amateurs by the NCAA and their schools. This may make sense at a small Division III college but when looking at big time Division I basketball and football it is easy to see the similarities these players have to professionals. The hours that they put into training, practicing and traveling are comparable to a full-time job. The issue that many people have with this is the fact that these individuals are supposed to be students first and athletes second. As the lives of these student athletes come more into the spotlight, one question continues to be asked. Should college athletes be paid?

My paper will not necessarily attempt to answer this question one-way or the other. Instead, it will provide an estimate of the marginal revenue product of Division I college basketball players. Assuming perfect competition, a marginal revenue product should be equivalent to any workers wages. But in the market for college athletes, this is not always the case. College athletes do not get officially paid by their schools or the NCAA to participate in their sport. Every year there are scandals involving under-the-table payments for these athletes but they do not receive any monetary compensation directly from the school besides an opportunity to attend the university or college. Many athletes do receive scholarships and grants in aid but this amount is often not equivalent to the amount of money the athlete brings in for the school.

My research focuses on calculating the marginal revenue product of four-year college basketball players. For some sports, playing all four years is considered the norm. This is especially true at Division III schools where players are usually not competing for a chance to play professionally. However, in Division I college basketball many talented athletes do not finish out their eligibility. I was interested in the amount of money these athletes specifically were bringing in for their school since they chose to pass up any opportunities to go to the NBA earlier in the careers where they would have been paid a salary. My results found that on average these players were producing MRP's of $2,059,970 for all four seasons and $514,992 per season. Before continuing, it is important to note that these estimates are not representative of all college basketball players because these athletes are differentiated by the fact that they played all four years in college. The most talented college basketball players are more likely to only play for a year or two before leaving for the NBA. Therefore, the estimates of MRP in this paper may be lower than the average college basketball player because they are not necessarily star players.

Section two of this paper reviews previous literature written on the topic of the payment of college athletes. Section three presents the methodology and data collection process. Section four will present the results of my regressions and calculations of marginal revenue product. Section five will discuss the implications of the results. Subtracting the tuition from the marginal revenue products of the players will give an estimate of lost earnings for their four years at college. Comparing the player's marginal revenue product to NBA salaries will determine if former college athletes are earning salaries that make up for the money lost in college.

2 Literature Review

The payment of college athletes is a highly discussed and debated topic. It is an extremely relevant debate, as college athletics continues to grow in popularity and size. A portion of the literature focuses on calculating the marginal revenue product of college athletes in an effort to show that they are highly underpaid. Additional literature is less empirically based and focuses more on the reasons why college athletes should or should not be paid. The first section of the literature review will provide a background of how the NCAA operates as well as various views on the issue. The second section will look at papers that calculate the marginal revenue product of athletes and how estimates of MRP relate to college athletics.

2.1 The NCAA

Even though Sanderson and Siegfried (2015) did not write the first paper on the topic of paying college athletes, their work provides a necessary background of the NCAA before moving forward. The NCAA is a well-known and powerful institution in the United States. What many people might not know, however, is how the organization first formed and became the powerhouse it is today. The NCAA originally formed as the Intercollegiate Athletic Association of the United States (IAAUS) after Theodore Roosevelt voiced his concern over the large number of football related injuries and called for rule changes (Sanderson and Siegfried, 2015). Put into place after World War II, the "Sanity Code" limited compensation for players and set limits on recruitment costs (Sanderson and Siegfried, 2015). This was the organization's first attempt at restricting the wages of college athletes and the basis for the current rules regarding compensating athletes today. On the other hand, the wages of coaches are extremely high. Football head coach at the University of Alabama, Nick Saban, received a salary of $7,087,481 for the year 2015 (Goodbread, 2015). Large amounts of money are also spent on facilities such as stadiums and locker rooms in order to attract players of the most elite level of talent.

According to Sanderson and Siegfried (2015) one of the main reasons the NCAA has been able to become so lucrative is due to television broadcast rights. Tournaments such as March Madness, provide schools with substantial revenues largely due to the broadcasting rights. Many schools today, rely on television revenues for a huge portion of their athletic department income. Even with large revenue streams, Sanderson and Siegfried (2015) point out that some programs are still operating at a loss. In fact, only 20 out of the 126 Football Bowl Subdivision universities earned a surplus on athletics in 2013 (Fulks,2014). It is interesting that even though these athletic departments are partially receiving free labor in the form of the collegiate athletes, expenses are still outweighing their revenues. This may be due to the large amount of money spent on coach's salaries and facilities in the hopes of creating a successful program. This brings in the question, why do universities choose to fund athletics so heavily? Reasons provided by Sanderson and Siegfried (2015) include the belief that athletic success may increase private donations as well as the number of applications to the school. The immense power that the NCAA holds today could not have been predicted at the time of the organization's creation. Articles such as Sanderson and Siegfried (2015) discuss the issues that come with the NCAA's control over athletes and possible outcomes of paying the players.

One problem with the NCAA's power is the fact that universities essentially have control over the athletes' lives. Elite student-athletes have demanding schedules of practice, class and schoolwork. The type of schedule these athletes follow would most likely not be allowed if there was any protection in the form of labor laws (Sanderson and Siegfried, 2015). This may be a reason why the NCAA is reluctant to pay athletes; they would lose a portion of their control. Sanderson and Siegfried (2015) believe the result of paying athletes would be a competitive wage for the players and a reduced surplus for the college athletics departments. Sanderson and Siegfried do not offer a direct solution to the unfavorable sentiment some athletes feel towards the NCAA regarding compensation. What they are certain of is that college athletes are not being paid their market value. Although they do not contribute any empirical work, Sanderson and Siegfried (2015) provide a good background into the issue at hand.

McKenzie and Sullivan (1987), was an earlier paper on the topic that does not believe that the NCAA is exploiting athletes. Instead they argue that the actions of the NCAA are completely necessary in order to keep the business running efficiently. One of McKenzie and Sullivan's first arguments is that there are no legal barriers to the entry of a competing athletic conference into the athletic labor markets. They believe that if the athletes were exploited, schools would leave the NCAA. However, it would not be in the best interest for colleges who are profiting from the actions of the NCAA to leave the organization for a competing league. It seems unlikely that another athletic conference would be able to successfully compete against the NCAA.

McKenzie and Sullivan (1987) propose the idea that any rules that the NCAA has in place are a contract among participants of a joint venture rather than the actions of a cartel. They also make the argument that the expected pay of college athletes is greater when their future professional employment is taken into consideration. However, even McKenzie and Sullivan admit that not many college athletes will become professional players. They argue that those who decide to finish their college eligibility are suggesting that college is providing them with valuable training and media exposure that they would not have received otherwise. The result of this is an increase in expected future income that will compensate for any losses in college (McKenzie and Sullivan, 1987). This argument is unfounded as there are certainly many talented college athletes who do not make it to the professional level even with the extra training and media exposure. Additionally, an athlete's career can be cut short by an injury making it impossible to know if a college athlete will have the chance to play professionally. McKenzie and Sullivan (1987) provide arguments against the payment of college athletes and were among the first to contribute to the topic. However, many papers written after would not support their arguments.

Kahn (2007) also discusses the cartel behavior of the NCAA and highlights the most important way that the NCAA restricts competition is by placing restrictions on the payments to players. Before the 1950s, athletes could not receive scholarships based only on athletic abilities and instead schools had to consider financial need as well (Kahn, 2007). After many schools threatened to leave the NCAA, they changed their rules and now athletes were able to receive an athletic scholarship that covered tuition (Kahn, 2007). While this can be considered paying the athletes to participate in intercollegiate athletics, the amount they are receiving does not add up to the amount elite athletes are making for the schools, as the papers in the next section will show. Kahn does not necessarily take one point of view or the other on the issue but his work does provide ideas for consideration when discussing the payment of college athletes.

According to Kahn, many athletes receive the opportunity to attend schools they might not have been able to otherwise. Similar to McKenzie and Sullivan (1987), Kahn discusses the fact that these schools can provide an athlete with elite training and coaching and high media exposure, which can increase future earnings. Kahn also brings up the value our society places on amateurism in college sports. He asks the question, if college athletes were employees and not amateurs, would college sports still have the same appeal to fans? If payments were made to college athletes, this competition for their labor may seem wasteful to society (Kahn, 2007). The large amount of money that would be spent on paying athletes could arguably go to other university activities. Kahn also argues that if the labor supply curves of college athletes are perfectly inelastic, no efficiency loss will occur when their pay is restricted. Additionally, he claims that if playing a college sport is the athlete’s best use of their time by a large margin, then this condition would hold. When athletes such as college basketball players seek employment at the professional level, their labor supply curve will become more elastic (Kahn, 2007). Kahn believes this can be a problem for fans that care about absolute quality since lowered compensation for college athletes can lead to a lower playing quality.

The previous papers provide ideas that should be considered when discussing the payment of college athletes. Even if calculations of marginal revenue product show that college athletes are underpaid there would still be difficulty in determining how exactly to distribute payments to these athletes. The discussion continues to grow and my paper will aim to add to the topic by analyzing the compensation of college basketball players compared to their future NBA salaries.

2.2 Marginal Revenue Product and Athletes

This section will examine papers that attempt various ways to calculate the marginal revenue product of athletes. Marginal revenue product is the increase in revenue based on the addition of one extra unit of labor. Under the assumption of perfect competition, a marginal revenue product should be equivalent to any workers wages. A firm that is purchasing labor is at its optimal amount of labor when MRP=W. Scully (1974) began the work on calculating the marginal revenue product of athletes by doing so for Major League Baseball players. Scully argues that an individual player's ability contributes to team performance and therefore to winning games, which will raise attendance and TV or broadcast revenues. Scully (1974) estimates the marginal revenue product with a two-equation model. The first equation Scully uses is similar to a production function, which relates the teams output (win-loss percentage) to team performance variables.

$$PCTWIN_t = 37.24 + .92TSA_t + .90TSW_t - 38.57\ NL + 43.78CONT_t - 75.64OUT_t$$

Scully (1974) uses team slugging average (TSA) and team strikeout-to-walk ratio (TSW) for team performance variables. Slugging average is a measure of hitter performance and strikeout-to-walk ratio is used to measure the performance of a pitcher. A number of dummy variables are also included to take into consideration games when the TSA and TSW will not have a large effect on the outcome, such as games won by one run (Scully, 1974). The second equation estimates the revenue of a team determined by the team's win loss percentage as well as a number of dummy variables.

$$REVENUE = -1{,}735{,}890 + 10{,}330PCTWIN_t + 494{,}585SMSA_{70} + 512MARGA$$
$$+ 580{,}913NL - 762{,}248STD_t - \%8,523BBPCT_t$$

SMSA is the size of the Standard Metropolitan Statistical Area. MARGA represents the varying degree of fan interest. NL takes into account the higher quality of play in the National League. STD represents the quality of the stadium and facilities. BBPCT is the percentage of African American players on a team (Scully, 1974).

From these equations Scully was able to determine:

MRP hitters = .92 (pctwin) x $10,330 (revenue)

= $9,504 per point TSA

MRP pitchers = .90 x $10,330

= $9,297 per 1/100 point TSW

These results show that with every per point increase in TSA, there will be a $9,504 increase in revenue and with every 1/100 point increase in TSW, there will be a $9,297 increase in revenue. Although Scully's work does not focus on college athletes, it still provided economists with a base to work from when determining the marginal revenue product of a player.

Brown (1993) builds on the work of Scully and provides an estimate of how much money was being produced by Division I football players by calculating their marginal revenue product. The main purpose of his work was to show that college athletes were being undercompensated. Brown states that the difference between the individual player's marginal revenue product and the maximum payments allowed by the NCAA, is captured by the school and can be viewed as lost earnings. Since these athletes are only being compensated an amount equal to the value of a scholarship plus room and board and book allowances, the lost earnings can end up being substantial (Brown, 1993). The marginal revenue products of these athletes are estimated by regressing the team's revenue on the number of the players that end up being drafted into the NFL (Brown, 1993). Brown uses a two-stage least squares estimation in order to account for the variety of factors that influence recruitment of players. Brown's findings estimate the marginal revenue product of a college football player to be $538,760 in one season. Based on these findings, players are losing potential earnings of up to $2 million in a four-year career.

Brown (2012) seeks to discredit the argument that many successful and talented college football players will go on to make salaries that will compensate for any exploitation experienced during their college careers. It could be argued that college athletes attending top schools are provided with training and coaching that will allow them to gain exposure from professional teams and eventually receive higher salaries than they would have otherwise. However, Brown (2012) finds that between 33 and 38 percent of the sample of college football players he used will earn incomes in the NFL that compensate for the potential earnings in college. Brown comes to this conclusion based on the estimation provided by the NFL Players Association that player careers average 3.8 years and on the fact that NFL reports that a player who makes an opening day roster can expect an average career exceeding 6 years. Additionally, Brown admits that there are a handful of players that will earn large net surpluses but most can expect to receive a modest amount of money. Although Brown provides an intriguing statistic, using the average career length to make the estimation has its limitations. There will always be players who have longer careers and therefore make larger salaries. Brown's work was interested in estimating the marginal revenue product of college football players and then looking at these player's future earnings in the NFL to see how these numbers match up. He uses the marginal revenue products calculated from his previous work in Brown (2010). I will be doing a similar analysis looking at college basketball players.

Another attempt to estimate the marginal revenue product of college football players was done by Hunsberger and Gitter (2015). Their work is similar to Brown's but is differentiated by their focus on quarterbacks and even more specifically elite quarterbacks. In order to determine "elite" status, high school prospect rankings and QBR ratings were looked at (Hunsberger and Gitter, 2015). Hunsberger and Gitter (2015) determined that when a QBR of 1 standard deviation above the mean is used, signifying elite status, the marginal revenue product estimate is $2.3 million dollars. Their findings are significant because they discuss the difference in marginal revenue product when comparing an elite player to an average player. It is important to note that this high MRP is only applicable to the elite quarterbacks and will not apply to the average college football player. The differences in the MRP of two college athletes makes it difficult determine if all college athletes deserve to get paid or just the individuals whose marginal revenue products exceed the amount they are compensated. The process of determining which college athletes should be paid and how much, would be complicated and a number of considerations would have to be taken into account which is one reason why the topic is so highly debated. Hunsberger and Gitter (2015) argue that marginal revenue product of these elite athletes may even be understated due to the other benefits the institution receives as a result of athletic success that may not be accounted for. For instance, if a team has a successful season, there is the possibility of an increase in interest of the school and therefore could be a subsequent increase in applicants (Hunsberger and Gitter, 2015). Alumni donations also have the possibility of increasing along with athletic success (Hunsberger and Gitter, 2015). A problem with these assumptions is that it is extremely difficult to measure the direct relationship between athletic success and the number of applications or the amount of alumni donations.

Lane et al. (2012) focuses on basketball rather than football in an attempt to show that college athletes are under compensated. Their research was aiming to answer the question, are all men's college basketball players exploited or is it just the elite players? To determine this they calculate the marginal revenue product of the athletes using methodology similar to Scully (1974). The first step in their process was to model the team's win-loss percentage as a function of team performance and the contribution of the coach. Lane et al. (2012) use team performance statistics such as: blocks, steals, rebounds, three-point shots per game, and the percentage of goals and free throws made. To incorporate the contribution of the head coach, Lane et al. (2012) add a dummy variable indicating there was: a change in head coach from the previous year, a dummy variable indicating that the coach was ranked as coach of the year and lastly, a continuous variable indicating the coaches' Division I win-loss record. The next step in Lane et al. (2012), is modeling the team's revenue as a function of team performance and demand. Lastly, a player's MRP is the product of his contribution to team performance, multiplied by the effect team performance has on the team's win-loss percentage. Lane et al. (2012) shows that 60% of college basketball players have a marginal revenue product greater than the amount they are being compensated. My paper will use similar methodology as Lane, Nagel and Netz (2012) but will add a variable for the strength of a team's schedule.

There has been a considerable amount of work focusing on the marginal revenue product of athletes. It has become a way to determine what a player should be receiving in compensation for their participation in athletics. Considering the calculations of marginal revenue products for players helps support those with the view that college athletes should be paid. When the difference between what the athletes could be earning is compared to what they are compensated, it is hard to view the NCAA’s actions as fair. Many proponents for not paying college athletes use the argument of future earnings to justify their opinion. The methodology in this paper will focus on calculating the marginal revenue product for college basketball players. The discussion section of the paper will look at NBA salaries for the thirty players to see if their earnings compensate for the exploitation experiences in college. The previously mentioned literature provided the background and empirical work necessary to build on and add to the debate surrounding the payment of college athletes.

3 Methodology

In this section I will first discuss my data collection process. Next I will present the equations used and describe the variables in the model.

3.1 Data Collection

I collected a majority of my data from Basketball-Reference.com. This online database collects and organizes basketball statistics for individual performance as well as team performance. Measures of win-loss percentage were also found on this website, for both the individual teams and the coaches. Revenue data for each team was collected from Data Planet, an online statistical database. The data includes performance statistics for thirty college basketball players, all of who played for four seasons at their respective schools. I chose to focus on four-year players because I assumed this would lead to a larger MRP since they played for the team for as long as they were eligible. However, it is possible that these players remained in college for all four years because they were not talented enough to be drafted into the NBA after only one or two years, which could lead to lower marginal revenue products. Since NBA players that were a part of their college program for four years are rare, I was interested in determining their worth to the team. There are a total of twenty-seven Division I teams since a few players that were looked at were teammates. The overlaps were omitted so that there are a total of 107 sets of performance statistics by team and season. 2004-2005 is the earliest season in the set and 2011-2012 is the latest season.

3.2 Calculating Marginal Revenue Product

The methodology in this paper was largely based on the work of Lane et al. (2012). The calculation of the athletes' marginal revenue product was done in a three-step process. In the first step, Lane et al. regresses the teams win-loss percentage on measures of team performance and other variables that impact the team's likelihood of winning. In the second step, they regress the team's total revenues on the team's win-loss percentage and other factors that may influence revenue. The last step in Lane et al. (2012) is to calculate the player's MRP as the product of the player's contribution to team performance, multiplied by the effect team performance has on the team's record, multiplied by the effect an increase in the team's win-loss percentage has on revenue. My methodology will follow these three steps but with slight modifications that will be addressed in each step.

3.3 Win-Loss Regression

The first step aims to find the effect team performance and other variables have on the win-loss percentage. The model for win-loss is as follows,

$$win - loss\% = \beta_1 TP + \beta_2 C + \beta_3 SOS + \varepsilon$$

Win-loss is a function of team performance variables (TP), the contribution of the coach (C) and the team's strength of schedule (SOS).

Similar to Lane et al. I used both offensive and defensive team performance variables. They use the number of blocks, steals, rebounds and three point shots and the percentage of field goals and free throws made. I used all of these statistics as measures of team performance and also added in turnovers. The first mentioned variables would be expected to have a positive coefficient. Meaning that with an increase in any of those statistics there would be an expected increase in win-loss percentage. Turnovers would be expected to have a negative coefficient; the more turnovers, the lower the expected win-loss percentage would be.

To account for the contribution of the coach, I used a dummy variable to indicate whether or not the coach is considered a "winningest coach" by the NCAA; 1 if the coach is a "winningest" coach and 0 if they were not. The variable indicates that the coach has been coaching for more than 5 years and has a win-loss record of .600 or higher. This variable was also used in Lane et al. and allows the experience of the coach to be considered as having an effect on a team's win-loss record. If the coach has more experience and a successful record it is expected to have a positive effect on the team's win-loss percentage.

Lane et al. used the average rank index of opponents to account for the strength of opposition. I decided to instead use the strength of schedule rank that was available on Basketball-Reference.com. The measure of strength of schedule is more intuitive than the average rank index. It simply means that a team with a higher strength of schedule is playing tougher teams.[1] A negative coefficient is expected because the harder a team's schedule is, the lower the expected win-loss percentage is.

The variable of interest in this equation is shooting percentage. The effect that shooting percentage has on a team's win-loss percentage will be used in step three to calculate the individual player's marginal revenue product.

3.4 Revenue Regression

The next step in Lane et al. was to model revenue as a function of team performance and other determinants of revenue. My model does the same but has slight variations in the variables. Therefore, the model is as follows,

$$rev = \alpha_1 win - loss\% + \alpha_2 Arena + \alpha_3 Nike + \alpha_4 Conf + \alpha_5 SOS + \varepsilon$$

In this case, team performance is represented as win-loss percentage. This is expected to have a positive coefficient; the higher a team's win-loss percentage, the more revenue is expected. *Arena* represents the arena capacity of the team's home stadium. A bigger arena capacity would be expected to bring in more gate receipts and therefore generate larger revenue. *Nike* represents whether or not Nike sponsors the team. A dummy variable was used to take this sponsorship into account, 1 if the team was sponsored by Nike and 0 if the team was not. According to Lane et al. schools that are sponsored by Nike have more access to the top recruits because of various sponsorship deals and All-American Camps. They argue that the schools ability to recruit the most talented players should increase demand by fans and increase revenue. Lane et al. also chose to include *Conference* in the revenue equation but my reasoning for doing so was different. I include a dummy variable for conference indicating whether or not a team is in a top 5

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[1] Instead of using the strength of schedule measurement, the rank of the teams SOS was subtracted from 334(the average number of teams in Division I basketball). For example, if the team's strength of schedule was ranked as the 3rd hardest schedule, there measurement for SOS in this paper would be 334-3= 331.

conference for basketball; 1 if the team was in a top 5 conference, 0 if they were not. Teams in top conferences have higher demand by fans and therefore higher revenue. Similarly, I added the same strength of schedule measure from step one because teams with harder opponents may attract more fans due to the exciting nature of the game. The higher the strength of schedule, the more fans that will buy tickets and therefore there will be an increase in revenues.

3.5 Marginal Revenue Product

The last step is to calculate the marginal revenue product for the players. Lane et al. do this by multiplying the product of a player's contribution to team performance by the effect team performance has on the team's win-loss percentage, multiplied by the effect that the increase in a team's win-loss percentage has on revenues. In order to find the player's contribution to team performance, Lane et al. multiplies each player's performance statistics by his weight in the team. They calculate the player's weight in the team by finding the ratio between the player's performance statistic and the team's performance statistic. The effect team performance has on the team's win-loss percentage is given by the coefficients in the win-loss regression. The effect that an increase in the team's win-loss percentage has on revenues is given by the coefficients in the revenue equation.

4 Results

This section will present the results of both regressions and highlight what coefficients are used to calculate the marginal revenue product for the individual athletes.

4.1 Win-Loss Regression

The coefficients from the win-loss regression are shown in Table 1. The regression shows that shooting percentage has a significant effect on win-loss percentage. A one-unit increase in percentage goals made will cause the win-loss percentage to increase by 2.57%. Total rebounds, turnovers, the contribution of the coach and the number of three points made are also significant. A one-unit increase in rebounds will cause a .0004249% increase in win-loss percentage. As expected, turnovers will have a negative impact on the team's win-loss percentage. An increase in turnovers will lead to a decrease in a team's win-loss percentage of -.0005569. According to the results, strength of schedule is not significant and is positive and not negative as expected. As mentioned previously, I will focus on shooting percentage as the team performance statistic that determines the win-loss percentage and will use the coefficient to later calculate the marginal revenue product of the individual athletes.

4.2 Revenue Regression

The revenue regression shows that win-loss percentage has a significant effect on revenue. As expected, all variables have a positive coefficient meaning an increase in any variable will lead to an increase in revenue. Coefficients are shown in Table 2. To determine the MRP of the athletes the following equation was used.

$$MRP = (PIPS * weight) * SP * WinLoss$$

PIPS represents the players individual performance statistic of shooting percentage. This was then multiplied by the *weight* the player has in the team, which was found by the ratio of the player's performance statistic to the team's performance statistic. *SP* represents the coefficient for shooting percentage that was found in the win-loss equation. *WinLoss* represents the coefficient for win-loss percentage that was found in the revenue regression.

My results showed that on average these four-year college basketball players produce $2,059,970 in revenues for their schools. This means that per season, they are producing $514,992. Since my equation focused on the player's contribution to the team based on shooting alone, these estimates may not be completely accurate for all players. For example, a point guard may excel in shooting while a center may add value to their team based on their rebounds or simply their size. Table 3 gives a summary of the results based on all four years the players spent with the college program. Table 4 gives a summary of the marginal revenue products per season.

The largest marginal revenue product belongs to Kenneth Faried from Morehead State. In regards to shooting his weight in the team was 0.24. This means that Faried made almost 25% of the team's field goals. His shooting percentage was also on the higher side, at 0.569. Because of the focus on shooting, Faried is perceived as having a larger effect on the performance of his team than someone who does not have as much weight in his team based on that specific statistic. The lowest marginal revenue product belongs to Da'Sean Butler who played for West Virginia. At 0.055, his weight in the team based on shooting was significantly smaller than Faried. Additionally, his shooting percentage was also lower at 0.448. Butler's low weight in the team hinders his contribution to the team's win-loss percentage and therefore his contribution to revenue. Table 5 shows the top five marginal revenue products based on shooting percentage.

5 Discussion

This section aims to use the calculations from the results section to add to the discussion surrounding the payment of college athletes. It will first highlight possible reasons that the marginal revenue products of these athletes were underestimated. While the overall purpose of the paper is not affected by this underestimation it is still important and should be made apparent. Next, it will look at the average cost of tuition for both public and private schools during the relevant years. This allows an estimate of how much money these athletes are losing during their college careers to be calculated. Next, NBA starting salaries for these players will also be looked at. This is important to discuss because an argument against paying college athletes is that they will earn salaries in professional leagues that will make up for any exploitation during college. This comparison was done in Brown (2012) for college football players and it was found that only 33-38% of the athletes made salaries in the NFL that compensated for the money lost during college. Next, the section will discuss the value of the education these student athletes are receiving. Lastly, I will introduce possible ideas for reform that have been proposed for college athletics.

5.1 Possible Reasons for Underestimation

Lane et al. calculated the marginal revenue product of certain high profile players to be equivalent to $1.75 million per season. The largest value per season in this case is $895,358. There are a number of explanations for this discrepancy. One reason could be because of the focus only on shooting as a determinant of individual performance in this paper. While shooting is undeniably important to a team's performance, (the more points scored, the more likely the team is to win) there are a number of other performance statistics that are significantly important. Focusing on just one statistic limits the accuracy of a player's impact on his team's performance. To investigate further into this, I decided to calculate the marginal revenue product based on a statistic other than shooting percentage. For the thirty basketball players, I calculated marginal revenue product the same as was done previously but based on their total rebounds instead of shooting percentage. My findings were that using this statistic actually lowered the players MRP. For example using shooting percentage, Draymond Green has a marginal revenue product of $1,790,297. Using total rebounds he has a marginal revenue product of $934,658. The highest marginal revenue product based on total rebounds belonged to Kenneth Faried and was $2,430,475. The lowest marginal revenue product was $82,873.42 and belonged to Andy Rautins. Table 6 shows the top five marginal revenue products based on rebounds. The table shows that different players will be in the top five estimates of marginal revenue product depending on what statistic is used. These estimates of MRP are likely lower because as found in the win-loss regression, shooting percentage has more of an impact on win-loss percentage than rebounds do. The most accurate measure of MRP for these basketball players would be found if the equation for MRP could be calculated by combining multiple performance statistics instead of just one.

The simplicity of my model compared to previous equations for calculating marginal revenue product may also be a reason for underestimation. To be able to calculate MRP efficiently I left out certain variables that were included in Lane et al. A variable that they included was the number of televised games. They found that televised games had a positive effect on revenue. However, this data was difficult to find for every season for every team. They also included the size of their opponents' arena in the revenue equation. This was also difficult to find for every team over all four seasons.

Another reason that the marginal revenue products of these athletes may be underestimated in both this paper and others is because the impact that a successful athletic program has on number of new applicants to the school cannot be considered. It could be argued that having a nationally recognized basketball team may attract potential students to the school, therefore adding potential revenue. However, this is extremely difficult to measure and cannot be taken into account when determining how much money these athletes bring into the school. Another argument is that successful college athletic teams increase private donations. This is also hard to include in the measurement of the players marginal revenue products because it is difficult to measure the direct correlation between the success of a team and the number of private donations.

5.2 College Tuitions

It is often stated that although college athletes are not being paid directly by the school, they are still receiving money in the form of scholarships and room and board. However, this amount of money does not tend to add up to the marginal revenue products of the athletes. I collected data from the National Center for Educational Statistics on the average public and private school tuition for the years 2004-2012. I then took an average of these years' tuitions to find an average that was relevant for the years that these student-athletes were attending school. Based on this data, the average public school tuition was $13,969. The average private school tuition was $30,224. These numbers are also taking into account room and board.

Based on the calculations of marginal revenue product for these athletes and the average cost of tuition plus room and board, I was interested in seeing how much money they were losing by choosing to stay for all four years of their eligibility. To do this I subtracted the average tuition, depending on whether the school was public or private, from the per season marginal revenue product for each player. This gave an estimate of the amount of money lost per season. I then multiplied this number by four to account for every season the athlete played at the school. The results can be found in Table 7. The average amount of money lost for these thirty players over their college careers was $1,975,918. The size of this number explains why some people argue for the payment of college athletes. It also explains why many basketball players do not choose to stay through their full eligibility and instead enter the NBA draft. Students that used basketball as a way to get into college and follow this path to the NBA have very little incentive to stay and play all four years. This is especially true for low-income students who would benefit greatly from having an NBA salary. For some athletes, going to the NBA might be an opportunity to provide for their family and the importance of education may be overlooked.

When college athletes are only getting paid equivalent to the amount of a scholarship and room and board they have little incentive to stay and instead choose to go to the draft. In fact, this year Kentucky Head Coach John Calipari announced that all draft-eligible players on his team will be entering the 2016 draft (Sports Illustrated). It could be argued that this is potentially harmful to the business of the NCAA. If all talented players are entering the draft this may lower the level of talent in college basketball and decrease the value of their product.

Based on the estimates of marginal revenue product and the average tuitions of both private and public schools, the thirty basketball players in this paper are losing on average $1,975,918. While, this number might seem large it could be underestimated for some players. However, the implications are clear. Players that choose to finish out their college careers are losing out on close to $2 million dollars. When the numbers are examined, the decision to go to the NBA seems like the obvious choice for successful college basketball players. This raises a lot of questions for the NCAA, basketball fans and players. Should the NCAA do something to incentivize players to stay? What would make it worth it for college basketball players to not enter the draft? Should the players be paid equivalent to their marginal revenue product or should it be a fixed salary? It seems likely that there will be an eventual change in college athletics but until an idea is proposed that appeases the NCAA, schools and the players, the debate on the payment of college athletes will continue.

5.3 NBA Salaries

Another topic of discussion regarding the payment of college athletes is the future earnings of the players. Some people argue that their future earnings offset any exploitation an athlete may experience in college. This seems like a reasonable argument when the average basketball player will make over $24.7 million in their career. To investigate this claim I decided to look at the salaries for the first three years of the thirty basketball player's NBA careers. I collected the salary and draft data from Spotrac, an online database that makes NBA, NFL, MLB, NHL and MLS salaries available.

Damian Lillard played for Weber State from 2008-2012 and his calculated marginal revenue product was $2,190,505 for the four years of his college career. After subtracting the average cost of tuition and room and board for a public school, his lost earnings are estimated to be $2,134,629. He was drafted in the first round and was the sixth pick for the Portland Trailblazers. His salary for his first year of his NBA career was $3,065,040. Damian Lillard is an example of a player who reaches the NBA and is compensated for any loss he may have experienced by choosing to attend college for four years. Even with the chance that his marginal revenue product was under estimated in college, Lillard's earnings in the NBA have compensated for his time spent in college. After the 2015-2016 season, Lillard's total career earnings equal $13,845,166. Looking at a player like Lillard, it is easy to see why some people resent the idea of paying college athletes. However, it is important to remember that not all college athletes will go on to play in professional leagues, in fact many will not. It is easy for society to be fixated on the extremely high salaries of some professional athletes. It is not as easy to consider those that dedicate their college careers to a sport only to not make it professionally.

All of the players used in this paper did end up making it to the NBA. However, some were more successful than others. Jarvis Varnado played for Mississippi State from 2006-2010. His estimated marginal revenue product is $2,279,521 over his career. After subtracting the average cost of tuition and room and board for a public school, his lost earnings are estimated to be $2,223,645. Varnado was drafted in second round and was the forty-first pick for the Miami Heat. Varnado's professional career quickly became complicated. He traveled from team to team, including some teams abroad. Looking solely at the money he earned in the NBA, Varnado's earnings total to only $657,097. Varnado is an example of a player who did not have much success in the NBA. The argument regarding future earnings would be hard to make in his case.

There are other players who do not make up the lost earnings right away but end up having a solid NBA career that over the course of a few seasons compensates for their college years. Chandler Parsons played for the University of Florida from 2007-2011. His calculated marginal revenue product for his college career is $1,687,490. His lost earnings were estimated to be $1,631,614. Parsons was drafted by the Houston Rockets in the second round and was the 48th pick overall. His starting salary was $684,146. Unlike Damian Lillard, Parsons did not earn a salary in the NBA that immediately compensated for his lost earnings in college. However, in his second season in the NBA his salary was $888,250 and by his third season his salary was $926,500. Parsons increasing salary allowed him to make up for any lost earnings during his third season in the NBA.

It is important to note that the players mentioned here might not be accurate representations of NBA players as a whole. As discussed before, many college basketball players will leave their respective schools after only one or two years to play in the NBA. These individuals are players who are expecting to have successful basketball careers. The players who choose to stay in college for all four years might do so because they are not expecting to be as successful and want to spend more time developing themselves as players. Athletes who enter into the draft early are usually more talented and therefore receive higher salaries. Since this paper only looks at four-year college athletes, their salaries might be significantly lower.

Overall, the argument that college athletes do not need to be paid for their participation in college sports because of the size of their future earnings has more support when looking at basketball than football. Brown (2012) looked at the earnings of NFL players and found that many did not have salaries that compensated for exploitation in college. Based on the data I collected, 17 out of the 30 players made salaries that compensated for their lost earnings in three seasons or less. This difference between the two sports leagues is likely due to the fact that the average NFL salary is $1.9 million a year while the average NBA salary is $5.15 million a year.

5.4 The Value of Education

Another argument against the payment of college athletes is that they are being compensated with an education, which is priceless. However, this argument has little validity. More and more scandals involving the academics of student-athletes have been surfacing. There are instances of cheating and academic fraud, where tutors or other students are doing the work for the athletes. In the PBS documentary, *Big Time Losers*, a former college basketball player admits he was told to switch his major to “special studies” so that he would be able to graduate. His courses included little to no academic classes and instead including activities like swimming. While the value of a college education may be priceless, a majority of these athletes are not actually receiving an education. The players who do not end up making it professionally, leave their college careers with no earned money and frequently, a low-level of education as well.

5.5 Ideas for the Future

The debate on college athletics does not seem like it will be resolved any time soon. The NCAA strives to maintain the amateur status of college athletes and is hesitant to consider them employees of the schools. Individuals against the payment of college athletes argue that making them employees of the school would take away from the appeal of college athletics. If athletes were no longer playing for the love of the game, would fans still be attracted? An interesting comparison regarding the amateurism of athletes can be made between Olympic athletes and college athletes.

Originally, only amateur athletes were allowed to compete in the Olympic games and professional athletes were strictly forbidden to participate. In fact, there were cases of athletes being stripped of their medals because it was found out that they had competed professionally or even semi-professionally (Greene, 2012). President of the International Olympic Committee, Avery Brundage believed in maintaining the “amateur code” and wanted to prevent the Olympics from being used by individuals, organizations or nations to make money (Greene, 2012). Today, an Olympic game free of professional athletes, sponsorships and advertisements seems unimaginable. The fact that Olympic athletes are now professional athletes does not seem to take away from the appeal of the games. The Olympics provides some support that the appeal of college sports might not be tainted by the payment of these athletes.

A common comparison is one between athletes and musicians. A musician who participates in a college music organization can be paid for performances outside of school. Additionally, an artist in college can sell their work if they please. If an individual is undeniably good at something why should they not be paid for it? College athletes, however, are not allowed to earn any money for their image or participation in a sport.

How do we as a society go about fixing this situation? Various ideas have been proposed but little has yet to be changed. The following ideas from a CBS Sports article titled, “NCAA critics offer ways to pay college players”, provides insight into the topic. One idea, proposed by Ken Feinberg a board member of the Former College Athletics Association, would be to pay former but not current athletes for the time they appeared on television or athletes that were secured by the NCAA for video games, T-shirts or any item sold to benefit the revenue sources of the NCAA. Feinberg says the amount of money distributed would be based on formulas created by the FCAA. Feinberg also believes that athletes at different schools would most likely earn different amounts of money. However, he does not believe it would be fair to pay athletes on the same team different amounts of money. This would likely lead to a lot of dispute within certain teams. A talented quarterback of a successful Division IA football team would likely feel entitled to a larger amount of money than a lineman.

Jeffrey Kessler, sports attorney, wants there to be no limit on the amount of financial aid a student-athlete can receive. He essentially wants there to be a free market in which schools can outbid each other for the most talented players. Kessler believes that the NCAA's use of the word amateurs to describe college athletes is inaccurate. His point of view is that the money in college sports has gotten so big that arguing that college athletes are amateurs is completely unfounded.

Ramogi Huma, a players union organizer and a former UCLA football player thinks the NCAA should adapt a model similar to the Olympics, where individuals could receive money from activities such as endorsements or autograph signing. He also proposes the idea that some of this money could be put into a trust fund to increase graduation and retention rates. The idea of college athletes receiving money for endorsements would allow them to earn money for their image and not necessarily require the NCAA or the schools to pay them directly.

The last suggestion in the article was made by ESPN analyst Jay Bilas. In his opinion, athletes should be paid through the Olympic model mentioned above and by their schools if that specific school chooses to do so. Bilas believes college athletics should be recognized for what they are, professional sports. It is likely that in the future a combination of these ideas will be implemented in college athletics.

6 Conclusion

My results suggest that the thirty college basketball players earned on average $2,059,970 in revenue for their schools. Future research on this topic should find ways to incorporate multiple player statistics into the measurement of marginal revenue product. My estimates of MRP were limited by the fact that the calculations were only based on one measurement. To fix this issue, a matrix combining two or more player statistics should be used. While the MRP's may be underestimated for a number of reasons, it is still large enough to question the “amateur” status of these athletes. Athletes are being compensated in the form of scholarships but this amount is not equivalent to a number of their marginal revenue products. Further analysis shows that the lost earnings of these players were on average $1,975,918. These numbers show that college basketball players have little incentive to stay at school if they are good enough to be drafted to the NBA. Lastly, the analysis shows that 17 out of the 30 players in the study ended up being compensated for the money they lost out on in college in three seasons or less in the NBA. These results may support people’s claims that college athletes should not be paid because of their potential future earnings. However, it is still important to note that not all college basketball players who contributed money to their school will make it to the NBA. It is estimated that only about 1% of college basketball players make it to the NBA. When determining whether or not college athletes should be paid it is important to consider all of the players and not just ones who make it to the professional leagues. The players who do not make it to the NBA or NFL for example are actually more representative of college athletes than the ones who do go on to have a professional career. The debate regarding the payment of college athletes continues to grab the attention of athletes, fans and administrators and the ideas of possible ways to compensate athletes beyond scholarships will likely keep expanding.

Appendix

Player	Career	School	Conf	FG	FGA	FG%	3P	FT%	TRB	STL	BLK	TOV
Damian Lillard	’08-‘12	Weber State	Big Sky	584	1310	0.446	246	0.867	444	129	19	246
Danny Green	’05-09	UNC	ACC	491	1079	0.455	184	0.845	590	160	154	137
Chandler Parsons	’07-‘11	Florida	SEC	527	1105	0.477	153	0.611	859	129	42	234
Draymond Green	’08-‘12	Michigan State	Big Ten	543	1163	0.467	91	0.687	1096	180	116	277
Roy Hibbert	’04-‘08	Georgetown	Big East	573	950	0.603	3	0.687	808	55	259	57
Kenneth Faried	’07-‘11	Morehead State	OVC	783	1376	0.565	3	0.582	1673	228	241	304
Tyler Hansbrough	'05-'09	UNC	ACC	939	1752	0.536	12	0.791	1219	180	66	146
Darren Collison	'05-'09	UCLA	PAC-10	560	1171	0.478	163	0.85	320	231	13	161
Quincy Acy	’08-12	Baylor	Big 12	503	835	0.602	3	0.708	828	102	177	214
Lavoy Allen	’07-‘11	Temple	A-10	592	1109	0.534	19	0.671	1147	72	213	189
Damion James	’06-‘10	Texas	Big 12	705	1473	0.479	103	0.63	1318	163	163	207
Quincy Pondexter	’06-‘10	Washington	Pac-10	652	1297	0.503	54	0.768	757	107	45	193
Lazar Hayward	’06-‘10	Marquette	Big East	667	1476	0.452	169	0.789	910	158	43	195
Dexter Pittman	’06-‘10	Texas	Big 12	337	541	0.623	0	0.601	529	33	124	132
Andy Rautins	’05-‘10	Syracuse	Big East	360	908	0.396	282	0.763	327	172	22	171
Landry Fields	’06-‘10	Stanford	Pac-10	499	1078	0.463	103	0.676	647	111	54	173
Jarvis Varnado	’06-‘10	Mississippi State	SEC	548	930	0.589	1	0.595	1096	76	564	172
Da’Sean Butler	’06-‘10	West Virginia	Big East	741	1654	0.448	205	0.732	800	154	35	206
Luke Harangody	’06-‘10	Notre Dame	Big East	936	1968	0.476	42	0.782	1222	99	95	192
Stanley Robinson	’06-‘10	UConn	Big East	488	1007	0.485	74	0.646	776	74	130	168
Dwayne Collins	’06-‘10	Miami (FL)	ACC	463	820	0.565	0	0.563	879	86	93	176
Hamady N’Diaye	’06-‘10	Rutgers	Big East	267	495	0.539	0	0.582	681	47	358	144
Jimmer Fredette	’07-‘11	BYU	MWC	838	1843	0.455	296	0.882	367	167	12	359
Nolan Smith	’07-‘11	Duke	ACC	668	1491	0.448	166	0.8	398	142	19	292
Marshon Brooks	’07-‘11	Providence	Big East	587	1265	0.464	158	0.739	486	129	81	207
Justin Harper	’07-‘11	Richmond	A-10	537	1111	0.483	179	0.711	651	76	113	172
Kyle Singler	’07-‘11	Duke	ACC	814	1879	0.433	267	0.773	1015	168	107	316
Jon Leuer	’07-‘11	Wisconsin	Big Ten	518	1074	0.482	100	0.723	551	51	85	142
Tyler Zeller	’08-‘12	UNC	ACC	548	1010	0.543	0	0.775	788	78	130	165
Jeremy Lin	’06-‘10	Harvard	Ivy	506	1052	0.481	108	0.773	494	225	70	280

Table 1: Win-Loss Percentage Regression Results Dependent Variable: Team's Annual Win-Loss Percentage	
	Estimated Coefficients
Percentage Goals Made	2.57*** (.467)
Percentage Free Throws Made	.0002639 (.000208)
Three Points Made	.6201082** (.259)
Blocks	-.0000456 (.000194)
Steals	.0002364 (.000232)
Rebounds	.0004249*** (.0000725)
Turnovers	-.0005569*** (.002101)
Coach	.0428933** (.0209)
Strength of Schedule	9.94e-06 (.000148)
Adjusted R-squared Number of Observations *** significant at the 1% level **significant at the 5% level	.64 107

Table 2: Revenue Regression Results
Dependent Variable: Team's Annual Revenues

	Estimated Coefficients
Win-Loss Percentage ***	10,200,000 (3131706)
Nike ***	2482847 (883008)
Arena Capacity **	116.42 (53.1078)
Conference ***	3529986 (1289718)
Strength of Schedule **	18591.83 (9343.51)
Adjusted R-Squared Number of Observations *** significant at the 1% level **significant at the 5% level	.52 107

Table 3: Summary of Marginal Revenue Product (4 Seasons)					
Mean	Median	Standard Deviation	Min.	Max.	# of Obs.
$2,059,970	$2,053,744	$607,978	$654,535	$3,581,430	30

Table 4: Summary of Marginal Revenue Product (Per Season)					
Mean	Median	Standard Deviation	Min.	Max.	# of Obs.
$514,992	$513,436	$151,995	$163,634	$895,358	30

Table 5:Top 5 Marginal Revenue Products Based on Shooting Percentage	
Player	Marginal Revenue Product
Kenneth Faried	$3,581,430
Luke Harangody	$3,165,975
Tyler Hansbrough	$2,928,660
Roy Hibbert	$2,746,342
Jimmer Fredette	$2,590,084

Table 6:Top 5 Marginal Revenue Products Based on Total Rebounds	
Player	Marginal Revenue Product
Kenneth Faried	$2,430,475
Damion James	$1,338,904
Luke Harangody	$1,231,797
Lavoy Allen	$1,174,422
Tyler Hansbrough	$1,174,422

Table 7: Potential lost earnings					
Mean	Median	Std. Deviation	Min.	Max.	# of Obs.
$1,975,918	$1,932,848	$603,778	$598,659	$3,525,554	30

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