The Economic Value of an Extra Year in College
to an Elite Basketball Player

An Honors Thesis (HONRS 499)

by

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ABSTRACT

In this study, the plan is to investigate some facets of the debate between attending college and entering the National Basketball Association for elite basketball players. Using the data from ten years of draft classes of the NBA, support is found that college basketball players are more successful in their initial year of professional basketball than those who are not. However, support is also found that there is convergence in the data seven years after finishing high school for these same players. The implications of this study for college coaches, players, and professional coaches/commissioners, are discussed, along with some suggested strategies.
ACKNOWLEDGEMENTS

I would like to thank Dr. Spector for advising me through this project. His help was crucial to the idea of this project and helping me develop an appropriate test for this idea. I know it sounds counterintuitive, but his arguing with me about the sports-related topics was helpful in creating an accurate model and discussion of this model. I would also like to thank my sports-heavy roommates who are simply fans of the game and very opinionated. Also, I would like to thank Dr. Liu for his help in class learning about regression models and the tests for their accuracy.
INTRODUCTION

In the National Basketball Association (NBA) some might suggest there is a growing problem with regards to the leap from college basketball to professional basketball. Currently, players are trying to minimize their years in college with the hope of getting a big signing bonus from their first NBA check. The problem is that without any motivation to do so, the players in the NBA will not learn any of the many other important things that all attendees learn in college. The NBA has attempted to avoid this by establishing a rule requiring that players go to at least one year of college, but since they have no jurisdiction on the grade point average of players, they are only required to get minimal grades to stay on their college team. For example, players can get a 0.00 grade point average their second semester of their year in college and still be eligible to play that second semester.

The basis for the problem about college players minimizing their years in college is one that is completely human. These college players are faced with a difficult problem of whether or not to stay in college or go to the NBA. They are influenced by their parents, coaches, peers, etc., and there are often very conflicting views. Some say that the intangibles of college are more important, but others argue that the salary earned in just one or two years of professional basketball is enough to live on for the rest of their life. This problem could be addressed by considering going to college as an internship for a basketball career, and going straight to the NBA as on-the-job training. When we are growing up, we are always shown statistics about how going to college will increase our lifelong salary by millions of dollars. However, if there were no degree requirements for certain professions, one might say that on-the-job training might be just as efficient in the long run.

For example, if you are attending college for construction management, you would attend four years and then get a job in your field. If there were no degree restrictions, however, you may opt to go straight to your job, and just learn as you go. Although the person who does on-the-job training may start off significantly behind the person who went to college, one would think they would learn the job
and approach the job level or an even higher level than that of the college graduate. The point that
many people make is that there are things you learn in college (intangibles, maturity, etc.) that make it
so that they will always be superior to people who did not go to college.

When we apply this idea to basketball, one can examine whether in their first year, people who
do not attend college are behind those who did, but in the long run they approach similar levels of play.
According to a basketball "traditionalist" idea, it is found that there is definitely a higher success level in
the first year for college basketball players transferring to the NBA, and also to find that in the long run,
those who attend college are better off than those who do not. It is this hypothesis that this thesis
seeks to examine.

REVIEW OF LITERATURE

While the literature in this area is not very plentiful, three articles provide the background for
the model being estimated in this thesis. Sports statistics and arguments are plentiful, but often their
arguments are not presented in a traditional professional format.

Hatch and Dyer

No one would argue with the fact that someone who goes to college should be more proficient
in some field over someone who has not had experience in any way. However, the question of this
thesis is more directed at whether or not this advantage is sustainable long-term. When we look at this
issue on a larger scale, the article from Hatch and Dyer, "Human Capital and Learning as a Source of
Sustainable Competitive Advantage," creates a model about how firms should invest in human capital
because it creates speedier on-the-job training than on-the-job training with less human capital.
The model that they use is tested on data collected from a chain of semiconductor manufacturers. Of course, the idea behind the data is in a different industry, but it does provide similar results to the model in this thesis. The test model’s dependent variable is accuracy of die cut on the semiconductors, or basically success at their job. The independent variables are dummy variables based on what training they have attained during their experience on the job and their learning-by-doing and human capital variable, based on education. They found that adding the human capital variable added accuracy to the model, raising the R-Squared, and showing that human capital can predict success as a sustainable competitive advantage. This study examines whether the results from the NBA match those of Hatch and Dyer.

Staw and Hoang

Coaches in the NBA are not economists; as a matter of fact, most of the time one might not expect an economist to work in a professional sports organization. In the article, “Sunk Costs in the NBA: Why Draft Order Affects Playing Time and Survival in Professional Basketball,” the authors address the economic idea of sunk cost and how it applies to the NBA. Sunk cost refers to the cost that has already been paid for something that should not affect any further decisions about future cash flows, e.g. whether or not to continue building a tower even if the first part of the construction process was over budget. In other words, firms often make the mistake of trying to recoup their investment and this can make their losses actually increase.

As it applies to the NBA, the argument that the authors present is that coaches do not see a player’s salaries as a sunk cost, and let these salaries affect their decisions based on playing time. The model that they present in their article is

\[
MINUTES = b_0 + b_1 \text{Scoring} + b_2 \text{Toughness} + b_3 \text{Quickness} + b_4 \text{Injury} + b_5 \text{Trade} + b_6 \text{Win} + b_7 \text{DraftNumber} + b_8 \text{Forward/Center}
\]
In their model, they use points per minute as the “scoring” variable, rebounds and blocks as “toughness,” and steals and assists as “quickness.” They used the previous year’s statistics for those three performance variables to avoid the performance bias in the “minutes” variable. They find injury, trade, and Forward/Center variables are dummy variables that they believe to be predictive with respect to minutes. Wins that year was also found to be relevant in playing time because it is more difficult to get more playing time on teams that are more successful. By examining players’ minutes over time, they determined that after the effect of the sunk cost of the initial salary from getting such a high pick in the draft wears off, the number of minutes affected by pick in the draft decreases significantly.

This model forms part of the basis for the model presented in this thesis. Things were taken from this model, but there were slight changes that had to be made. While using the statistical variables may be important, there are lots of intangibles and little minor “hustle” plays that cause coaches to play certain players more than others. Also, rather than qualifying the idea of what an injury is, i.e. rolling an ankle vs. breaking an arm, one would think that if you were to look at minutes per game, you would avoid the effect of games that people do not play in due to injury.

Berman, Down, and Hill

In determining the variance between players who have attended college and those who have not might lie in the intangibles that come with attending a university. The reason these are called intangibles, by the definition of the word is that they have no physical existence, and they cannot be quantified exactly. One method of trying to put values on those intangibles is shown in the article, “Tacit Knowledge as a Source of Competitive Advantage in the National Basketball Association.” This article attempts to quantify the intangibles by creating the following model:

\[
\text{Wins} = b_0 + b_1 \text{EXP} + b_2 \text{EXP}^2 + b_3 \text{AVGDP} + b_4 \text{AVGAGE} + b_5 \text{CEXP} + b_6 \text{CE} \times \text{EXP} \\
+ b_7 \text{SDEXP} + b_8 \text{SDAGE} + b_9 \text{SDDP} + u
\]
In this model, the authors try to correlate experience in the league, average age, average draft pick, experience with the team, their coach’s experience, and their standard deviations, with wins by that team (EXP-Experience, AVGD-Average Draft Pick, AVGA-Average Player Age, CEXP-Coach’s Experience, CE*EXP-Coach’s Experience times Player’s experience, and their standard deviations). These variables attempt to show that experience from both players and coaches leads to tacit knowledge, an intangible that could show success in terms of wins on the court. They also modeled their independent variables with assists and wins as the dependent variable, and found that in both models, experience proved to be statistically significant and have a positive coefficient with the success variables.

This model indicates further variables that might be considered when examining this thesis’ hypothesis. One must think about what years to choose when the data is examined, as well as considering age and wins. The article models wins as a measure of team quality, which is necessary when looking at draft picks, as players who play on better teams should get less playing time than players on worse teams. The thought about age as a measure of maturity level as opposed to years in college was also useful when constructing my model. Age should generally be correlated with years in college, but may be skewed due to foreign players and the varying ages of college students. The article does conclude in the end that there is a competitive advantage that lies in having tacit knowledge from experience.
MODEL AND METHODOLOGY

Models

Two models must be created to appropriately analyze the problems to be examined. The first model looks at the players' first year in the NBA from the 1996-2005 draft classes. This model determines whether people who attend college start off their career at a level above people who did not attend college.

\[ MPG = b_0 + b_1 \text{COLLEGEYRS} + b_2 \text{AGE} + b_3 \text{FOREIGN} + b_4 \text{PREVWINS} + b_5 \text{WINS} + b_6 \text{PICK} + b_7 \text{YEAR} + b_8 \text{CENTER} + b_9 \text{GUARD} + u \]

The second model is seven years after most players' high school senior year. If one were to take their career seven years out without college or three years out with graduating college, one can determine whether, at this point, would think that at this point their career numbers will converge. The point of this model is to determine whether those who attend college are better off than those who went directly to the NBA. If there is seen to be a significance with a positive coefficient for college years, this would show that even at this mark in the future, those who have attended college are better off in the long run than those who did on-the-job training and went straight to the NBA.

\[ MPG7 = b_0 + b_1 \text{COLLEGEYRS} + b_2 \text{AGE7} + b_3 \text{FOREIGN} + b_4 \text{PREVWINS7} + b_5 \text{WINS7} + b_6 \text{PICK} + b_7 \text{YEAR} + b_8 \text{CENTER} + b_9 \text{GUARD} + u \]

Independent Variables for The Above Models

COLLEGEYRS- Years spent in college
AGE- Player's age at date of draft
AGE7- Player's age seven years after their senior year of high school
FOREIGN- Whether the player was born in another country
PREVWINS- Wins in the season prior to the season the player joins the team

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\(^1\) The difficulties with any intense analysis in sports are that there are always many opinions as to how to estimate these factors, there are always exceptions because of the large amount of players, and there is a lot of human error being that one is dealing with the decisions of people that are refereed by people. These three difficulties will make the model questionable among sports fans, just as almost every model is criticized.
PREVWINS7-Wins in the season prior to the season seven years after a player’s senior year of high school
WINS-Wins in the season the player joins a team
WINS7-Wins in the season seven years after a player’s senior year of high school
PICK-Draft pick number of the player
YEAR-What year the players were drafted
CENTER-Whether the player’s primary position was “Center” or not
GUARD-Whether or not the player’s primary position was “Guard”

The independent variables in both models are the same, except that in the second model many of the variables needed to be for a few years later, be it seven for those who did not attend college, six for those who went one year of college, et al. The variable for attending college is currently represented as years in college as if it were a linear function, but subsequent tests will be done to test college as a dummy variable and as several dummy variables to test if there is an optimal number of years in college. The first test to be performed however is whether or not one can include both age and college years and wins and previous wins, as one must avoid multicollinearity in the variables. One would think that these two pairs of variables would be highly correlated, but with the effect of players coming from abroad and the variation in team performances with changes in the off-season, this might not necessarily be true in the model.

The dummy variables in the model are “foreign,” “center,” and “guard” with the base case being American-born players for the “foreign” variable and the “forward” players for the position variables. All of these variables were included in order to hopefully increase the R-Squared of the test and to weed out the effects of playing one position over another or being from another country. It would be best to test dummy variables on each of the five separate positions on the court, but there are too many players that play two positions to organize the test this way. The coefficient of the foreign variable will most likely be positive as the players coming from abroad often have no college experience, but have experience in playing the game in leagues in their country.

The linear variables, prevwins, wins, pick, and year are variables that will most likely be relevant in the regression. The variables previous wins and wins are relevant because a player playing on a
better team or a worse team would greatly affect their playing time. Both variables must be included because playing time at the beginning of a season is affected by the previous season, but at the end of a season, playing time decisions are made based on whether the team is winning that year. The variable of pick is included because, as noted in the Staw and Hoang article, teams often do not respect the economic principle of sunk cost and simply play players because they were their first round pick, regardless of skill. The variable, “year,” was also included just to see if there was a time trend that showed whether minutes played by recent graduates changed in any way over time.

**Dependent Variables**

The dependent variable of minutes per game is an interesting one, that partially is derived from others’ models, but with the twist of including the “per game” factor. This has one positive effect and one negative effect. Making the statistic “per game” allows for us to not qualify what an injury is by making it only include games they played in, but it unfortunately makes it so that if a player were to play twenty minutes in just one game, their statistic would be inflated compared to players who play ten minutes in every game in a season.

The economical choice would be to assume efficient markets and analyze salary over a career as a measure of success. However, since there is no one who can perfectly predict what value a player will provide to a team in the future, and the players often desire longer contracts than necessary, this might not be the best measure. One issue with using salary as a dependent variable is that if one were to correlate draft pick with salary, the correlation would be so high that any other variable would most likely be irrelevant. First year salary is almost solely determined by draft pick and provides little information as to the success of a player. Also, in order to analyze salary over a career one would have to go back to the oldest player to retire last year, then look at the draft classes prior to this. That player
was Shaquille O'Neal, meaning one would have to analyze the drafts in the 80's, which would not give us relevant data for today's style of play and draft.

**Hypotheses**

Per the first model, one would think that those players who attended college would benefit from it in terms of success on the court. One would assume this is so, as otherwise it would not make much sense to attend college for any reason. If a player did not become better by attending college, they would be wasting every year they attended by not attaining an NBA salary, even if it was just the league minimum. This is just with the assumption of being successful enough to be drafted. Also, this has not even considered the fact that there have been several instances of players who could be drafted suffering from injuries in their college years, causing them to never play at the professional level. The reason that there is no inclusion of player statistics here as seen in previous studies is that, in general, one would assume that statistics would correlate almost perfectly with the performance variable minutes per game based on the coach making the appropriate playing time decisions.

With the second model, per the articles above, one might think that there would still be a positive correlation in years in college to success seven years out of high school. Below in Figure 1 are two proposed graphs, the first giving the assumption that going to college or not converges and the second having the assumption that the intangibles from college will always leave the player who attended college above one who did not.
These graphs are not based on any sort of real data, but they just represent the skill level as it might increase over the course of a career. If college is found to be a positive variable with a low p-value and no multicollinearity, then one could say that the skill level will be more like the alternative graph than the null hypothesis.
REGRESSIONS AND RESULTS

First Year

First, calculating the correlations of age to years in college and wins to wins the previous year was important before the variables were included. In the first calculation, it was found that the correlation coefficient for age to years in college was close to .69, which leads to a Variance-Inflation Factor (VIF) of close to 3. In the second calculation, it was found that the correlation coefficient for wins to wins the previous year was about .72, which leads to a similar VIF. In terms of VIF’s, this is relatively low as it normally takes a VIF of 10 to constitute true multicollinearity.

The regression with all the variables from the first equation leads to many variables being insignificant. The variables “Foreign,” “Year,” and “Center” are eliminated as their p-values are too high based on a 95% confidence level. This means that with all other variables considered, people coming from other countries do not seem to effect the playing time. Since the “Year” variable is insignificant, it means that there is no time trend on minutes per game over the ten draft classes considered. Also, since playing the forward position was chosen as the base case, the fact that “center” is insignificant means that forwards and centers are not significantly different in terms of playing time. This is not surprising being that the two positions are often interchangeable by taller forwards.

When these variables are eliminated, the coefficients can be seen in the second figure below:
### Figure 2

Dependent Variable: MPG  
Method: Least Squares  
Date: 04/30/12  
Time: 18:36  
Sample: 1 578  
Included observations: 578

<table>
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<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
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<tr>
<td>COLLEGE</td>
<td>1.021131</td>
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<td>3.014077</td>
<td>0.0027</td>
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<td>FOREIGN</td>
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<td>1.061603</td>
<td>-1.018582</td>
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<td>PREVWINS</td>
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<td>WINS</td>
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<td>0.028678</td>
<td>-6.543282</td>
<td>0.0000</td>
</tr>
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<td>-17.94187</td>
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<td>YEAR</td>
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<td>CENTER</td>
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<tr>
<td>GUARD</td>
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<tr>
<td>C</td>
<td>108.8676</td>
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<td>0.461888</td>
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R-squared  0.530858  
Adjusted R-squared  0.523424  
S.E. of regression  7.257999  
Sum squared resid  29921.41  
Log likelihood  -1960.759  
F-statistic  71.41341  
Prob(F-statistic)  0.000000

### Figure 3

Dependent Variable: MPG  
Method: Least Squares  
Date: 04/30/12  
Time: 18:45  
Sample: 1 578  
Included observations: 578

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<th>t-Statistic</th>
<th>Prob.</th>
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<td>COLLEGE</td>
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<td>4.903530</td>
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<td>PICK</td>
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<td>WINS</td>
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<td>C</td>
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<td>5.642697</td>
<td>7.938367</td>
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R-squared  0.526642  
Adjusted R-squared  0.521668  
S.E. of regression  7.271361  
Sum squared resid  30190.31  
Log likelihood  -1963.344  
F-statistic  105.8792  
Prob(F-statistic)  0.000000
What's good about all of these coefficients is that all p-values are less than .01, meaning that we are at least 99% sure that they are significant. These results are as one would expect, showing that wins and previous wins decrease playing time as the team is better. The coefficient for college is also as one would expect, meaning as one spends one more year in college, their minutes per game increases by approximately 1.3 minutes during their rookie year, given all other variables constant. There are also two more methods of regression analysis, with college as a dummy variable (Figure 4), then predicting each time spent in college as its own dummy variable (Figure 5). Here are the results for these regressions:

**Figure 4**

<table>
<thead>
<tr>
<th>Dependent Variable: MPG</th>
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<tbody>
<tr>
<td>Method: Least Squares</td>
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<td>Date: 04/30/12 Time: 19:05</td>
</tr>
<tr>
<td>Sample: 1 578 Include observations: 578</td>
</tr>
<tr>
<td>HAC standard errors &amp; covariance (Bartlett kernel, Newey-West fixed bandwidth = 6.0000)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
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<td>29.17996</td>
<td>1.540856</td>
<td>18.93750</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared 0.521989 Mean dependent var 11.55571
Adjusted R-squared 0.517810 S.D. dependent var 10.51359
S.E. of regression 7.300624 Akaike info criterion 6.824123
Sum squared resid 30487.09 Schwarz criterion 6.869378
Log likelihood -1966.172 Hannan-Quinn criter. 6.841769
F-statistic 124.9249 Durbin-Watson stat 1.789161
Prob(F-statistic) 0.000000
In the first equation we see that going to college increases minutes per game by approximately 3.3 minutes, given all other variables the same. In the second equation, the variables “College4,” “College3,” and “College2” represent going to college four years, three years, and two years. The “College1” variable was found to be statistically insignificant, which is logical, meaning that going to school one year is not much different than not going to school at all. Not attending college is the base case presented in the second model. We see that leaving after your second year of college makes a little bit more sense than going for three years, but neither compare to going to school for all four years. In almost all of the regressions, the R-Squared values are close to .52 which is acceptable given the fact that none of the player-quality statistics are included.
Seventh Year (post-high-school)

The regression had to be performed on the players seven years ago, in 2005, so that all players are able to be included in the data. The preliminary regression results on all of the variables in the players' seventh year after high-school did not come out quite as significant as the results in the first year. One would expect this, given that a lot of convergence would have occurred over time, but the questionable independent variable was college. Here are the first regression results:

Figure 6

Dependent Variable: MPG7  
Method: Least Squares  
Date: 04/30/12    Time: 18:56  
Sample: 1 578  
Included observations: 578

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According to these sets of data, just draft pick number and age are relevant in the calculation of minutes per game. With "College" having such a high p-value, this means that years in college have little-to-no effect on minutes per game and indicates convergence. The final equation and variables, with all the insignificant variables left out, is:
Also tested was college as a dummy variable and years in college as separate dummy variables, but in both instances, the p-values were greater than .4, meaning that they were nowhere close to being considered statistically significant. This means that college has no effect on minutes per game seven years out of high school based on the tested equations. It also means that one is forced to accept the null hypothesis that the careers of college players and non-college players converge in the long-run over their careers.

**CONCLUSIONS**

According to the data in the study, there were two major conclusions. In the first year in the NBA, it is worth it to have gone to college because any given player will play more minutes per game. In the seventh year after high-school, whether one goes to college or not, it does not affect one’s playing time in the NBA. So, in terms of general effects on the league, this information should affect the
contracts in the league, the decision on whether or not to enter the NBA draft for a college basketball player, and the decision of the NBA and NCAA on whether or not to require years in college.

According to the newly signed CBA, the maximum rookie contract is four years. With the data pointing to the fact that players who are just out of high school need a few seasons to catch up to players joining the NBA out of college, it might make sense for them to sign shorter contracts at lower levels. This would mean that for players to maximize wealth, they should take a lower salary for a short period of time, since they will improve at a quick rate. This would make it so that if they were to improve greatly, over their first few years, they would be able to sign new contracts at much higher pay rates. The risk here is that they would sign a four-year contract at a low rate, then as their skill level approaches those who attended college, they would still only earn the pay rate that they did in their first year. For the players coming out of college, they should desire to attain their maximum wealth over the first few years of their career, as they will only retain their competitive advantage over their draft class for a short period of time. They should desire to obtain long-term, high-pay-rate contracts when they are drafted to sustain their short-lived competitive advantage.

For a pre-professional basketball player, this study shows that if you’re attending college, it would not be worth it to attend just one year, and if you are to attend college, you should go all four years. If maximization of wealth is your goal, however, this study shows that one may want to enter the NBA as early as possible. Either way your career will converge at some point, so it makes the most sense to profit from more years of earning an NBA contract. This is based on the idea that teams don’t behave as suggested above with respect to giving out contracts. With the lifetime of NBA players being so short, it is important not to waste years of athleticism or risk a career ending injury by playing in college, when there is no intangible gain.

Beginning in 2006, the NBA changed its eligibility rules to require the minimum age to enter the league to be 19 years old, and at least one calendar year removed from high school. This deal was most
likely made with the NCAA in order to create a larger market for college basketball games. The NBA possibly did this because they believed that a year in college yielded less uncertainty in quality of players, but per the first regression, this is not so. According to this study, the rule change was in favor of the NCAA, because without the rule change there would be no reason for elite high-school basketball players to go to college at all. Since the first year in college is shown to have no significance on playing time, the rule change simply decreased the career length of players, without increasing their performance in any way. The NCAA must have made an impressive bargain to convince the NBA to make such a decision, unless the NBA believes that going to one year of college will prevent reputation-ruining choices made later on during a career.

