# The Effect of Early Entry to the NBA

An Examination of the 19-Year-Old Age Minimum and the Choice between On-The-Job Training and Schooling for NBA Prospects

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# **Table Of Contents**

1. Introd	uction	3
i.	Issue and Historical Background	3
ii.	Age Minimum Incentives	7
2. Literat	ture Review	9
3. Choice	e Framework	12
4. Conce	ptual Framework	16
5. Empir	ical Model	22
6. Data		29
7. Result	S	35
8. Conclu	ision	47

#### **PART 1: INTRODUCTION**

#### I. Issue and Historical Background

Several decades ago, players entering the NBA directly from high school were few and far between. Moses Malone famously made the jump from high school in 1974, and more recently Shawn Kemp experienced early success after joining the NBA in 1989 without college basketball experience. In 1995, however, Kevin Garnett was selected fifth overall in the NBA draft and sparked the modern trend of bypassing college. Part of the reason behind his selection directly from high school was the new NBA collective bargaining agreement that forced rookies to sign under a slotted pay scale for three years rather than negotiate contracts. As Groothuis, Hill, and Perri (2007) suggest, teams could now pay players beneath their marginal revenue product for their first few years in the league and recoup any costs spent for on-the-job training and development.<sup>1</sup> Sports journalists jumped on Kevin Garnett's success story, and standout high school players began to follow his lead after witnessing his immediate impact in the league. During the next decade, early entrance to the NBA accelerated. Some players succeeded, but others struggled with making the jump directly from high school. For every Kobe Bryant and LeBron James, there was a Kwame Brown or Darius Miles whose potential on the court was only surpassed by his difficulty in adapting to professional basketball.

In 2006, the NBA decided to intervene and stop the rush of high school players. League officials, in conjunction with owners and the players' union through the collective bargaining agreement, raised the league age minimum from 18-years-old to 19-

<sup>&</sup>lt;sup>1</sup> Peter A. Groothuis, James Richard Hill, and Timothy J. Perri, "Early Entry in the NBA Draft: The Influence of Unraveling, Human Capital, and Option Value," *Journal of Sports Economics*, 2007, Vol. 8, p. 223.

years-old. The league does not currently require players to play NCAA basketball, but for many high school graduates this is the only logical option. Despite not being paid in college basketball, players do benefit from additional on-court experience at a relatively high level, extensive national publicity, and, of course, a free education. Some players have recently elected to play in foreign leagues, but the vast majority of prospects choose college basketball.

There were a number of factors in the NBA's decision to raise the age minimum to 19-years-old; some were publicized more than others, and some were more profitdriven than others. One major concern in the public arena was that high school athletes might not have the necessary emotional and psychological preparation for life in the NBA. The season is long, the fans are tough critics, and the money far exceeds anything that a high school athlete has encountered before. Many feared that 18-year-olds might not be equipped to handle the pressures of daily NBA life, especially without the experience of living on their own in college. NBA representatives also relied on the explanation that high school athletes' bodies were not developed enough to play in the NBA. At 18-years-old, players' bodies are still developing, and competition against stronger and more physically developed players might strain a young athlete over the course of the season. The logic was that a combination of these factors amounted to a much higher boom or bust potential for early entrants from high school than draftees from college. A handful of especially gifted athletes might succeed, but others might fail before they had fully grown into their bodies or developed the mindset needed to thrive in the NBA. Finally, many around the game of basketball advocated the value of a college education. Players who entered the league directly from high school had little to fall back

At the same time, however, the age minimum rarely persuaded these same players to remain in college after one or two years, doing little to help prospects attain a college degree. As Figure 1.1 shows, early entrance to the NBA has remained common over the past years despite the 2006 age minimum. Entrance after 1 or 2 years in college has grown while senior entrance has fallen.

# <u>Figure 1.1</u>



# <u>Percentage Breakdown of College Attendance</u> <u>Within American 1<sup>st</sup> Round Picks</u>

#### **II. Age Minimum Incentives**

The real reasons behind the NBA's age minimum definitely involved each of these concerns, but there must have also been a variety of monetary factors involved. With the potential exception of the entering players themselves, the age minimum was in the interests of every party involved. For the owners, an age minimum meant having to pay for one less year of player development – one less year of an 18-year-old sitting on the bench and making millions of dollars. At the same time, delaying a player's entrance might allow rookie contracts to cover more of a player's prime years. Unlike football, where rookies are among the highest paid players in the league, NBA draft picks are forced to sign under a lowered pay scale for the first 3-4 years of their career. Delaying the first free agent contract by one year might be the difference between paying a \$1 million or \$10 million dollars in annual salary to a young player in a given year. Finally, the NBA benefited from the free marketing it received for its incoming players. The vast majority of incoming players now attended college and took part in the hugely popular NCAA March Madness tournament, gaining incredible notoriety around the nation. As these players entered the NBA, they had attained a level of publicity that no high school athlete could ever achieve. Players also benefitted from this star power, but it represented a small gain compared to the costs of earning zero dollars (or at most the value of their scholarship) for an entire season when they could have been paid at their marginal revenue product in the NBA and making millions of dollars.

Other parties also benefitted. For the NCAA, an age minimum meant that the most talented young players in the nation now played under their system for at least one year. Despite the fast turnover, this meant a major increase in the level of competition

and a far better product, especially in the highly grossing March Madness tournament. For the players currently in the league, an age minimum provided protection against the major youth movement and a preservation of the status quo in terms of player personnel. When NBA teams were allowed to gamble on high school players, almost every team carried one or two high school draft picks on the bench. These players might have had the potential to become major contributors in the future, but it also allotted one fewer roster spot for an older veteran player who might be able to contribute more in the present. Therefore, for the NBA player's union that consisted of current NBA players rather than potential future players, agreeing to keep out high school draftees who might take up roster spots to sit on the bench and learn was a no-brainer.

The only people who the age minimum might have actually hurt were players who had not yet entered the NBA. Some of the protection theories presented by the NBA may have helped players who would have made a poor choice to enter the NBA directly from high school, but the age minimum greatly constrained the free market labor choices for every high school graduate. With four high school classes now having graduated since its inception, the effects of the 19-year-old NBA age minimum are beginning to become clearer. Although most players now play college basketball after high school graduation, many standout players stay only for their freshman year. Players now enter the NBA with more basketball experience, but this has also created a seemingly mercenary culture within college basketball of "one and done" star players.

This study hopes to shed some light on the effects of the 19-year-old age minimum and early entrance in general, a topic that has gone largely unstudied in economics. In the first part of this paper, an individual choice model and conceptual

framework is laid out for the decision to enter the NBA early and the effects of such a decision on earnings and performance. The model highlights the issue of skill differences being systematically related to the timing of NBA entry. The model also includes a player's consideration of the NBA salary structure and rookie pay scale in the decision-making process. In the next part, an empirical method is presented to study the effects of early entrance, especially focusing on the benefits of on-the-job training in the NBA compared to attending school and playing NCAA basketball. To this effect, long-run data is used to examine effects of early entrance on earnings potential, but other areas such as durability and on-the-court performance are also used because of complications with salary data. To overcome discrepancies that might arise over the long run, a player's second and third years out of high school are examined. At this point, players are at the same age, and the effect of attending college becomes the focus.

To help control for any potential selection bias, more recent player performance data is used to look at the effect of attending college with prospect rankings as a control for skill-level. A dummy variable controls for whether a player was in the top five recruits of his high school class, accounting for the fact that better players are more likely to leave early. Finally, serving as a natural experiment, the 2006 age minimum creates two distinct groups, those allowed to enter the NBA directly from high school and those forced to wait at least one year, that can be compared in a number of areas. The minimum offers a better situation to study the effects of early entrance because removes the bias inherent in player's decision-making, but the relatively small number of observations poses a separate issue. In the last section, the overall results and conclusions are presented. This study is especially pertinent because of the NBA's recent exploration of raising the age minimum to 20-years-old. Many of the same reasons are being used to advocate for such an increase, but much of the potential harm done by the current restriction would only be amplified. If the 2006 age minimum hurts NBA prospects, increasing the restriction by another year would only add to the problem.

#### **PART 2: LITERATURE REVIEW**

The effect of early entrance, especially from high school, is a topic that has gone largely unexplored in recent economic studies, but there are several studies that have delved into the topic. Many studies focus on entrance into sports leagues as a means of examining the option-value model and risk tolerance among professional teams. The overall theory of on-the-job training versus schooling is very prominent in Gary Becker's work on human capital and individual labor decision-making<sup>2</sup>, but the topic has received little attention in relation to professional sports leagues.

Groothuis, Hill, and Perri (2007)<sup>3</sup> examine early entrance into the NBA from a number of angles. The authors make several key points. First, they point to college basketball as a signaling mechanism for NBA scouts. As a player stays in college, their signal becomes less noisy and NBA teams accept less risk in drafting them. With the 1995 and 1999 collective bargaining agreements, the introduction of a rookie pay scale allowed teams to pay players less than their marginal revenue product and enhanced the value of finding a "diamond in the rough." Teams could now make more money off successes and were therefore encouraged to draft more raw talent. Groothuis et al also

Sugai 9

<sup>&</sup>lt;sup>2</sup> Gary Becker, *Human Capital*, (New York: Columbia University Press, 1975).

<sup>&</sup>lt;sup>3</sup> Groothuis, Hill, and Perri, p. 223.

notice unraveling in the NBA market, however. As teams sought to draft the next potential superstar and put them under contract for three-to-four years, the incentives began to shift towards drafting players at a younger age merely to beat out other teams. It probably was not in the NBA's best interests to draft so many young players, but for each individual team it made sense to draft young talent even if it involved increased risk and development time. Bad selections could be released relatively cheaply, but good selections could be kept on the team for several years at a low wage.

At the same time, Groothuis et al explain that the new rookie pay scale also shifted players' incentives to enter the NBA early. With free agents contracts that would pay a player their actual marginal revenue product now three to four years out from entrance into the NBA, players seeking superstar-type contracts entered the NBA earlier to compensate for the four-year delay. The authors note that between 1994 and 2004, the average age of first-round picks fell from 22.3 to 20.5. In order to avoid having pay-scale limitations during their prime career years, players now entered the NBA earlier so they could work under their limited wages at a younger age.

Empirically, Groothuis et al show two major patterns. First, they attempt to estimate wage equations for all players during the 1997 and 2002 seasons. Using a dummy variable to represent whether a player was under the rookie scale and an interaction variable combining this dummy with years of experience, they find that being under the rookie scale was at first beneficial to a player's salary but after became detrimental in the third and fourth years. Their estimates of the rent that NBA teams extracted on these more tenured players total \$539,141 under the three-year rookie contract in 1997 and \$1,294,917 under the four-year rookie contract in 2002. The authors

also incorporate variables involving performance and years of experience, concluding that years of experience and performance indicators are positively associated with salary. In the second part of their study, Groothuis et al examine player performance for firstround picks between the 1987 and 2002 seasons to see the effects of on-the-job training. They find that high school and college freshman entrants tended to play fewer minutes and exhibit a lower performance level than players who stayed for more years in college during the first two years in the league. However, during the third year, performance and minutes reached a similar level, and by the fourth year into the NBA players who entered early significantly outperformed college juniors and graduates. At the same time, Groothuis et al do not directly address the problem of endogeneity in this part of the study, failing to account for the notion that the best players were more likely to enter the NBA earlier. Without such a control, the results would have a tendency towards overstating the effects of early entry.

Several papers also examine the effect of risk in sports labor markets. Hendricks, DeBrock, and Koenker (2003)<sup>4</sup> look at NFL draft picks. As an instrument for a player's level of risk, they include whether a player attended a Division 1A school or a non-Division 1A school. These players from smaller schools, as the authors show, were riskier but had greater potential. They describe a the option-value model once proposed by Lazear (1995)<sup>5</sup>, writing, "Applicants from high-risk groups are more valuable to the firm if the firm has some way of capturing the rents associated with knowing this value.

<sup>&</sup>lt;sup>4</sup> Wallace Hendricks, Lawrence DeBrock, and Roger Koenker, "Uncertainty, Hiring, and Subsequent Performance: The NFL Draft," *Journal of Labor Economics*, 2003, Vol. 21, No. 4, p. 857.

<sup>&</sup>lt;sup>5</sup> Edward P. Lazear, "Hiring Risky Workers," Working Paper no. 5334, Cambridge, MA: National Bureau of Economic Research, 1995.

Thus, uncertainty improves the job prospects of members of these groups."<sup>6</sup> Hendricks et al confirm this option-value model, finding that riskier players were more likely to be drafted when rents were possible. The authors also describe why football, like basketball, is a good setting to study labor entry markets. As they describe, the problem of separating the effect of a player's skill-level upon entry from his development in the league (nature versus nurture) has less effect because the worst teams almost always draft the best players. Bollinger and Hotchkiss (2003)<sup>7</sup> perform a similar study for Major League Baseball, finding that firms are more likely to pay for riskier players when they have the ability to extract rents from them.

#### **PART 3: CHOICE FRAMEWORK**

In examining both the effects of on the-job training versus schooling and the overall impact of early entrance into the NBA, a model is needed to approximate a player's decision-making process. This study uses a choice framework originally proposed in an older paper that offers a basic model but also contains some limitations. The model is then adapted into a broader framework to include discounted income estimates and possible reasons for irrationality among NBA entrants.

Groothuis, Hill, and Perri (2007)<sup>8</sup> offer a model for the decision-making process of a high school graduate or college underclassman considering early entrance into the NBA. In evaluating the option of staying in school, a player considers the effects of how increased skill upon entrance in the league will affect his payment under two time

<sup>&</sup>lt;sup>6</sup> Hendricks et al, p. 858.

<sup>&</sup>lt;sup>7</sup> Christopher R. Bollinger and Julie L. Hotchkiss, "The Upside of Hiring Risky Workers: Evidence from the Baseball Industry," *Journal of Labor Economics*, 2003, Vol. 21, No. 4, p. 923.

<sup>&</sup>lt;sup>8</sup> Groothuis Perri, and Hill, p. 228.

periods: during and after his rookie contract. Let *k* equal the fraction of a player's worth he receives in rookie contract and let *T* equal the length of rookie contract in years (usually three years with a team option for four). To represent the increase in skill experienced after another year of development in college basketball, let *A* stand for a player's ability level at the time he makes the decision of whether or not to enter the league and let  $\alpha$  represent the added ability from staying another year in college. Finally, let N equal a player's expected career length in years. From this, we can form a representation of a player's career earnings (W) upon staying an extra year in college. A player loses a year in terms of career length, but he gains additional skill to increase his payment under both a rookie and free agent contract.

## $W_{\text{STAY}} = k(A+\alpha)T + (A+\alpha)(N-1-T) = (A+\alpha)[(k-1)T+N-1]$

In determining the value of going directly to the NBA, a player must consider the effect of entering the NBA at a lower skill level on his rookie and free agent contracts. He gains an extra year in his career, but he loses the impact of the added skill level from college  $(\alpha)$  on his career earnings.

## $W_{GO} = A(kT+N-T) = A[(k-1)T+N]$

Finally, combining these two equations leads to the overall decision-making process. A player should go to the NBA early if his skill level exceeds a certain threshold based on a number of factors.

# $W_{GO} \ge W_{STAY}$ if $A^* \ge \alpha[(k-1)T+N-1]$

Because k, T, and N are all assumed to be fixed, this states that the decision of whether or not to stay in college for an additional year relies on two variables: a player's current ability level and the added skill from playing another year of college. Essentially, if the

added value of college outweighs the income gained from an additional year in the NBA, a player should stay. At a higher skill level, the opportunity cost of that lost year's income rises and promotes early entrance.

There are some potential faults in the model. The notion that an extra year in college reduces an NBA career by one season is not definite, and in this study in some ways offers counter evidence through increased durability seen in college players. Over the course of a player's career, the model avoids explaining any further development in player skill level. The model also ignores discounting for the future earnings stream as players decide whether to stay for an additional year in college. In some senses, this could have a small effect because of a steady income stream and free access to credit and insurance. There might also be hyperbolic discounting among these players, however, which would potentially shift their incentives towards entering the NBA earlier to earn more money in the short-term.

Earnings after the NBA are also ignored in the model. Whether or not college improves player's performance in the NBA is debatable, but it surely adds some value to a player's human capital in other areas. College graduation leads to a higher salary in careers outside of basketball as well as a higher level of intelligence in all facets of life. The effects of college on NBA prospects remain unclear, however. Many of the best basketball players leave college before earning their diploma, offsetting the gains that might be had in non-basketball careers. Also, playing at a high level in the NBA creates its own career path in the form of media and coaching opportunities. The overall gains from college must be considered but are probably not a huge factor in the overall decision

to play in college or professional basketball. If we assume that a player will stay for four years in college, the following general model can be used:

- Expected Earnings (College) = (Discounted NBA earnings) + (Value of College Degree) + (Discounted Earnings Post-NBA)
- Expected Earnings (High School) = (Discounted NBA earnings) + (Discounted earnings post-NBA)

If a player does not properly weigh the added value of a college education in terms of his increase in human capital as well as his discounted earnings after playing in the NBA, he might not make a rational choice to enter the NBA early.

Although the model proposed by Groothuis et al might over simplify in some areas, it establishes one key concept: the decision to enter the NBA depends primarily on a player's current skill level. Other factors matter (such as the added value from another year of college or the length of the rookie contract), but the final determination relies on a comparison of all of these other factors with the player's ability to produce on a basketball court. The players most likely to benefit from the on-the-job training associated with early entrance into the NBA are those for whom the decision to turn pro is the correct choice. Therefore, this model would suggest that the top-notch players who have already achieved this level of A\* should turn pro and are most directly hurt by the age minimum.

The model would also suggest that an incorrect decision to go pro results from a breakdown of the framework. If a player overvalues his current skill level, undervalues the value added by an additional year of college, or incorrectly estimates his career length, he will make an incorrect decision to pro. At the same time, if irrationality exists in his decision-making (through hyperbolic discounting) he might also make an incorrect decision. Overall, the model would suggest that the top players would fare better with earlier NBA entrance and be hurt by the age minimum while other players who might be working with incorrect information or irrationally would benefit from an age restriction.

#### PART 4: CONCEPTUAL FRAMEWORK

Two main questions lie at the center of this study: do players benefit from entering the NBA directly from high school (or after 1-2 seasons of college), and do players benefit from the 2006 age minimum? If the answer to the first question were that players are better off when entering the NBA at a younger age, it would be difficult to form a convincing argument in favor of the age minimum. Traditional economic theory offers support for both sides of each question.

In determining whether the effects of early NBA entrance are positive or negative, economic theory could be used in favor of both the affirmative and the negative. In many ways, the debate breaks down into whether on-the-job training is more effective than schooling. Basketball players, like other workers, must consider the benefits of investing in school (NCAA basketball) or learning on the job (NBA basketball). It makes sense on many accounts that on-the-job training would raise an NBA player's human capital to a greater degree. While on an NBA team, the incentives of a player's coaches and managers are far more aligned with his own than an NCAA program's incentives would be. The priority of an NBA team is to win games, and the most effective way of achieving that goal is to raise the human capital on their roster as much as possible. Both an NBA player and their team want him to become the best possible player. In college however, a principle-agent problem arises as a coach's incentives to invest in a player

Sugai 16

rarely extend beyond the player's four years of eligibility. Investment in players still exists but in a far more shortsighted way. Much investment in human capital that occurs in college is not tailored to make the player great in the NBA, but rather to make them great in the collegiate style of basketball. For example, a player might be taught to play defense exclusively in a zone system – a system that is popular in college basketball but illegal in the NBA. Especially for college seniors, the school has little reason to invest in their ability to play basketball outside of their final season. Some NBA coaches might also be shortsighted, but their ability to keep players for more than four years naturally makes the NBA a more investment-oriented environment. In recent years, changes in the NBA collective bargaining agreement have made this difference in incentives even larger. As teams now have players under guaranteed contracts for four to five years before a player's first free agent contract, they have even more incentive to invest in their human capital.

On the other hand, on-the-job training in the NBA might be less effective than college schooling because of a limited opportunity to play. Many times, high school entrants to the NBA do not possess a skill level high enough to play meaningful minutes during their first several seasons in the NBA. In basketball, increases in human capital very much depend on time spent in actual games. The play involves far more pressure, competition is more skilled and more diverse (players only encounter players on their own team in practice), and the overall intensity of the game is far greater. Practice does not serve as an effective proxy for game situations, and unlike in other realms of labor there is a high degree of scarcity in the opportunities to work. (If one wanted to work for free at most businesses they would gladly accept the labor despite the a low-skill level,

but in the NBA teams would accept almost nobody for free.) There are far more opportunities to improve in actual game-time situations within college basketball, however. NCAA basketball offers a relatively comparable competitive setting with far more openings, allowing young players to spend more time on the court. In many ways, the value of on-the-job training versus schooling once again depends on a player's ability level. If he can play enough minutes to develop during his first few years in the league, it makes sense to enter the NBA because his interests are more aligned with his team. For less-skilled players, however, it might make more sense to attend college despite the principle-agent problem because of an increased opportunity to improve.

Other factors also enter into the question of whether players are better off upon early entrance into the NBA. One obvious concern is money. In college basketball, players are legally limited to receive only the value of their scholarship as salary for playing each season. Any additional income gained through their basketball ability – endorsements, bonuses, and even smaller activities such as team-affiliated coaching for youth summer camps – is in direct violation of the NCAA's regulations. In essence, their income is structurally limited to well below their actual marginal revenue product. The option remains to play professionally overseas in lieu of college, but for many this sacrifice is too large and does not result in the same advantage of a less-noisy signal for pro scouts that college offers. Upon entering the NBA, however, players receive massive monetary windfalls. Staying in school for an extra year often means the sacrifice of dollar amounts in the millions. The effects are even larger upon consideration of the NBA's overvaluation of young talent. The unraveling effect described by Groothuis et al<sup>9</sup> only

<sup>&</sup>lt;sup>9</sup> Groothuis, Perri, and Hill, p. 223.

augments early entrants' salaries as teams compete against one another to attain young prospects. This effect might even extend outside of the rookie contract since teams would be more willing to pay money to a 22-year-old with ample potential than a 26-year-old who is already entering his prime. NBA teams would appear to overvalue entrants directly out of high school or their first years of college, creating a situation where young players might be best served to enter the NBA early purely to be perceived as a prospect with greater potential.

The effects of early entrance on a player's NBA durability are also unclear. Playing professionally instead of in college puts more wear and tear on a player's body since there are usually at least 50 games more in an NBA season. The season also lasts several months longer, and practices are far more intense. The fact that younger players would have bodies that are still developing only contributes to the argument. On the other hand, playing college basketball could also have a negative impact on the length of a player's NBA career. Let's say that every player has only a fixed number of years of basketball in them. Whether they play amateur or professional basketball, they might be unable to continue beyond the age of 35 to 40. If this were true, then playing college basketball would only replace productive years in the NBA with unpaid years in the NCAA.

The second major question posed by this study thus arises: are players better off after the 19-year-old age minimum, both in terms of lifetime earnings and overall performance? Traditional theory offers many reasons why players would be harmed by such a restriction. In general, economic theory states that restrictions on labor decisions will hurt workers' welfare unless there are irrational decisions being made (this caveat

will be addressed later). Under the assumption that people can and do make the most rational labor decisions, an unregulated market maximizes overall welfare. A restriction on the options of an 18-year-old basketball player, if he has correct information, will make him worse-off. As the choice framework shows, the decision to enter the NBA depends largely on skill-level, not age. If a player possesses the skill-level A\* such that the added value of a year in college does not outweigh the gained income from another year in the NBA, the rational decision is to enter directly from high school. The effect would thus be larger for the best young prospects that could contribute to NBA teams right away. A player such as LeBron James, who produced at an all-star level during his rookie season in the league, would instead be relegated to college basketball and lose out on productive seasons and professional-level development. Such a restriction also goes hand in hand with the problem of the NBA as a monopsony. Because there is essentially only one professional buyer for basketball labor in the country, the NBA has immense power in dictating the labor decisions of its players. Through the age minimum, it achieves a free year of development while delaying rookie contracts for a year so that they continue further into a player's prime. In this case, the NBA's gain is coupled with the players' loss.

At the same time, economic theory could be used to create a strong argument in favor of the age restriction through the scope of irrational decision-making. High school athletes, without access to the discounted value of each career path (college or pros), could easily make irrational choices to enter the NBA early. Very few high school players know enough about the NBA as a business to make informed decisions. Sports agents often serve as these players' de-facto source for this information and their incentives to make money off a player while they have them under contract again create a principle-agent dilemma. Similarly, hyperbolic discounting exists as players might opt, especially if they were coming from a poor background, for the "fast cash" of an NBA rookie contract rather than the potentially more lucrative returns of delayed NBA entrance with a higher skill level and a college degree. Even though staying in school might be the rational choice for some players, the lure of the present NBA contract is too big of a prize to pass on. It would be unfair to state that there is systematic misinformation or irrational choices in the decisions of NBA prospects, but it would certainly seem as though the tendency would be towards players undervaluing their future NBA income stream.

Overall, my interpretation of the applications of economic theory on early entrance in the NBA labor market would lead to several hypotheses. First, the top-ranked players who enter the NBA sooner after high school will perform at a higher level than those who stay in school: more points per game, a higher player efficiency rating, etc. Their advantage would come from the choice of on-the-job training over schooling, resulting in investment from coaches whose incentives are aligned with their own. If they've made the correct decision to enter the NBA based on their ability, they should be playing enough to improve their human capital. For lower-ranked players who might not play enough to make on-the-job training valuable, early entrance to the NBA will show weaker performance. These players would have benefited from schooling at the collegiate level. Finally, I would hypothesize that the age minimum will hurt the best players in a high school graduating class but help other players. Because the top players have attained an ability level that allows for increased professional playing time, on-the-job training

Sugai 21

will benefit them more and attending college will only cost them a year of NBA salary. Less-skilled players, however, are more prone to making irrational choices to play professionally because on-the-job training offers them lower returns to their human capital. Early NBA entrance would be less advantageous for them because of lesser playing time, but they might make an incorrect decision to go pro based on poor information or hyperbolic discounting.

#### **PART 5: EMPIRICAL FRAMEWORK**

To test the conceptual framework, the study begins with the best possible methods and transitions into the most practical means of OLS regressions. The ideal method of examining the effects of entering the NBA directly from high school and the development associated with on-the-job training is through salary and earnings. If income represents a player's marginal revenue product, then the benefit received from on-the-job training will appear as higher salaries for players who entered earlier. Comparing the career NBA earnings and average salary of high school and non-high school entrants represents whether players benefit from bypassing college. In its basic form, such an examination would take on the following regression:

## $Salary_{1} = \beta_{1}(Constant)_{1} + \beta_{2}(HS/College)_{1} + \beta_{3}(Controls)_{1} + \varepsilon_{1}$

The inclusion of controls is a difficult issue because of endogeneity within the regression. Possible controls, such as pick number or available measures of skill-level, are endogenous to both high school entrance and the error term. Ideally, the empirical formula would account for a player's skill level to help control for selection bias. For this data, such controls are difficult.

The major flaw with a regression involving salary, however, is the impact of the NBA's collective bargaining agreements (CBA) on player's salaries. With new CBA's in 1995 and 1999, the NBA has undergone repeated shifts in its payment structure, rookie contract scale, and salary cap. Inflation-adjusted salaries have not remained constant over time, especially for a long-term examination of the impact of skipping college or leaving college early on career earnings potential. The salary regression is incorporated in the study, but the results do not account for the problem of dramatic shifts in the structure of player payment.

Since salary does not offer the best variable for describing the effects of on-thejob training versus schooling, statistics of performance and durability are substituted for measures of income. A player's marginal revenue product is largely determined by onthe-court performance and ability to stay on the court. The basic form of the regression used is as follows, with performance as the main dependant variable in this instance.

#### Performance<sub>1</sub> = $\beta_1$ (Constant)<sub>1</sub> + $\beta_2$ (College / HS)<sub>1</sub> + $\beta_3$ (Controls)<sub>1</sub> + $\varepsilon_1$

A variable that represents the number of years a player spent in college (*yrcol*) and a dummy variable that represents whether a player entered the NBA directly from high school (*hs*) serve as the main independent variables of focus. For measures of performance, an ordinary least squares model is used. For other variables such as *total minutes* and *total games* for a player's career, statistics are capped under a TOBIT model. Because some players in the dataset still play in the NBA, the TOBIT model sets a limit on any truncated measurements at a figure that does not disadvantage members of more recent draft classes. For example, Kevin Garnett is currently playing his 15<sup>th</sup> season in the NBA, but his career length is limited to 8 under the TOBIT model to match Amare

Stoudamire and other members of the 2002 draft class who are also still playing. The TOBIT model is not perfect – if two players from the 1993 draft class played 8 years and 15 years respectively, they would each be weighted as playing 8 years. For *total games*, the upper limit in the TOBIT regression was set at 650 games, or approximately 8 seasons of 82 games. For *total minutes*, an upper limit of 15,000 minutes was used, representing an average number of minutes per season multiplied for an 8-year span.

The short-run effects of early entrance prior to the age minimum are also examined with respect to measures of performance. Players are compared two years and three years out of high school, with years of college and the high school dummy variable again serving as the main independent variables. Because more recent data only allows for an examination of two to three years after high school graduation, this sections serves as a bridge that connects the two datasets and maintains continuity. The focus remains on similar dependant variables – games, minutes, and player efficiency rating – only this time for a specific season rather than an entire career. The regressions resemble the following form.

# $2^{nd}/3^{rd}$ Season Performance<sub>1</sub> = $\beta_1$ (Constant)<sub>1</sub> + $\beta_2$ (College / HS)<sub>1</sub> + $\varepsilon_1$

By comparing players at a set number of years after their high school graduation, any discrepancies that arise from playing at an older age are controlled for. Groothuis et al  $(2007)^{10}$  perform a similar study except compare players after a set number of years in the NBA. This controls for players experience in the league, but players in their rookie season could vary from 18 to 22 years old – a large age variation in terms of NBA development. Both methods have inherent problems and there is no definitive way to

<sup>&</sup>lt;sup>10</sup> Groothuis, Perri, and Hill, p. 223.

measure the short-term effect of attending college, but the method of comparing among similar ages appears to offer the better means of studying the additional on-the-job training gained from early entrance. The inherent difference in league experience between an NBA rookie and third-year player surely has a slight effect on player performance, but the more important determinant is skill level. By focusing on years out of high school instead of years in the NBA, years remain equal in the comparison of onthe-job training and schooling. The problem of players having different league experience levels within the NBA appears to be the smaller sacrifice.

While these two methods of measuring player performance shed light on many of the effects of early entrance, the problem of selection bias arises within the sample. Because the best players are more likely to leave college early or enter the NBA directly from high school, results might be artificially skewed and favor early entrants' performance. Controlling for pick number might partially control for a player's skill level at a young age and take some of this effect into account, but it would still pose a potential source of bias. A player's skill level in the draft has already been influenced by his decision of whether or not to attend college, and better players are still more likely to jump directly to the NBA. Teams might also favor high school entrants because of their greater potential. Without proper rankings of high school prospects for this time period that would measure talent before the effects of college or NBA have occurred, it proves difficult to fully control for a player's skill level.

In a study involving more contemporary players, controlling for this selection bias is not as tough of a challenge. High school prospect information is much more readily available for players in recent years, providing a means to control for skill prior to any

impact from on-the-job training or development from schooling. The examination of players two and three years out of high school is repeated with players from the 2002 to 2008 high school graduating classes, but this time with high school class rankings as a control variable.

A measurement unavailable at the necessary level of accuracy prior to 2002, high school player rankings allow for an incorporation of player skill prior to the effects of any interaction with either NCAA or NBA basketball. The data includes the top 30 players for each high school class. The main variable used to account for skill is the dummy variable for a player ranked in the top 5 of his class (top 5). The coefficients for this variable account for the effect of skill on performance and are a necessary control, but an important issue is whether the early entrance, gains from on-the-job training, and the age minimum affect highly rated players differently. To examine this possibility, interaction terms (hstop5 and amintop5) are used to combine the skill dummy variable with the high school and aftermin variables. These coefficients tells us if the increased on-the-job training associated with earlier entrance has different effects for the elite players in a given draft class. The ranks are incorporated through a dummy variable that captures whether a player was in the top five players in his high school class, separating the elite players from other prospects. The regressions for a player's second and third years after high school take the following form:

## Performance<sub>1</sub> = $\beta_1$ (Constant)<sub>1</sub> + $\beta_2$ (HS)<sub>1</sub> + $\beta_3$ (Top5)<sub>1</sub> + $\varepsilon_1$

# Performance<sub>1</sub> = $\beta_1(Constant)_1 + \beta_2(HS)_1 + \beta_3(Top5)_1 + \beta_4(HS)(Top5)_1 + \varepsilon_1$

The regression now includes controls to help account for the selection bias that arises from the best players being more likely to enter the NBA directly from high school. At

the same time, however, there is likely still some level of endogeneity within the regression. Any equation that directly incorporates a player's decision to go pro will rely largely on skill level, and also incorporates a number of immeasurable factors such as misinformation or a need for money.

The 2006 age minimum in the NBA provides a unique natural experiment to study the effects of on-the-job training received from early entrance to the NBA. Since the age minimum made it impossible to enter the NBA directly from high school, it can serve as an instrument for the decision to go pro directly out of high school. The data associated with a study of players involved in the age minimum is also free from changes to the collective bargaining agreement. While this short-run examination has limited observations on which to base a study, it overcomes many of the potential sources for bias found in both the long-term study using data from the 1990s and regressions incorporating the high school dummy variable. With the age minimum implemented in 2006, three high school classes have now reached the point where they can legally enter the NBA. Therefore, the effects of the minimum are studied in players' second and third years out of high school. In terms of actual observations, 25 players have entered the NBA since the age minimum was imposed from these high school classes. Unlike the high school dummy variable, which might still possess some level of selection bias, there is a very low probability that being one of the best players would influence whether or not somebody graduated from high school after 2006. As an instrument, a dummy variable that accounts for whether a player graduated after the age minimum returns a tstatistic of -10.02 and an F-Test result of 100.45 for a player's second year after high

school and a t-statistic of -6.00 and an F-Test result of 35.95 for a player's third year out of high school.

Finally, the effects of the age restriction are directly examined through a reduced form comparison of all players two years and three years out of high school who have either directly entered the NBA or left school early. Instead of using years of college or a high school dummy variable as the main independent variable, a dummy variable that captures whether a player was eligible before or after the NBA age minimum (*aftermin*) is used. Years in college have an effect on NBA performance, and the age minimum has a large effect on years in college, especially when examining players two or three years out of high school. Therefore, this section skips the middleman and leaves out measures of college. The major concern is whether players are better or worse off after the age minimum, so the coefficient for the *aftermin* variable is the focus. Overall, the regression for this final part of the study takes the following form:

#### $Performance_{1} = \beta_{1}(Constant)_{1} + \beta_{2}(Aftermin)_{1} + \beta_{3}(Top5)_{1} + \beta_{4}(Amintop5)_{1} + \varepsilon_{1}$

Although another more minor form of selection bias might also arise in this regression, the potential effects seem to counteract each other to some degree. On one hand, players who have left school early and failed to make it to the NBA pose a problem. On the other hand, players who have stayed longer than two years in college and have no NBA experience in their third year out of high school are left out of the study. The age minimum could have affected both of these cases. If it created a culture of "one-and-done" where players who intended to stay in school left early, it could have contributed to the former case. Meanwhile, a player might have intended to go pro after

high school but decided to stay in college for longer once enrolled, contributing the latter case.

Together, each of these regressions uses the available data to complete the best possible portrait of the effects of early entrance. The progression of the OLS equations within the study represents steps towards a more unbiased regression, but at the same time specificity of variables and extensiveness of data are sacrificed. Further detail will be taken on the issue in the data section. Several variables are used in each part of the study to control for various factors, but one variable that was purposefully left out was a player's position. Originally, position dummy variables were used to control for any possible differences between guards, forwards, and centers. After preliminary regressions, however, position dummies were found to have little explanatory power in the study. In almost all cases, the positional dummies lowered the statistical significance of the results according to F-Test calculations, making it tougher to reject the original hypotheses at a lower level of explanatory power.

#### PART 6: DATA

There are two distinct samples within the dataset. The first group is comprised of first-round picks in the NBA draft between 1993 and 2002. Focusing on first-round picks captures a variety of players as they enter professional basketball, excluding more volatile second-round picks who generally have much shorter careers. The years are chosen to incorporate two years prior to Kevin Garnett beginning the trend of early entrance from high school in the 1995 draft. Stopping the data set at the 2002 draft also focuses only on players who could have played at least 8 years in the NBA, helping to

determine long-term effects of early entrance to the NBA. 2002 also represents the last year before high school rankings were compiled with reliable accuracy, the defining characteristic of this study's second dataset. Finally, foreign players are also excluded from the 1993-2002 dataset. Within the draft, the selection of a foreign player generally includes a number of complicating factors that do not arise with American players. For instance, foreign players might remain overseas for several years, sometimes require a buy-out for another professional team, or could have already played professional or semiprofessional basketball. Each foreign player has their own complex story, and for the most part these players' career paths do not tell us much about the effects of attending college. Overall, the dataset includes 256 NBA players.

#### *Table 6.1*

**Dataset Statistics (American 1<sup>st</sup> Round Picks, 1993-2002)** 

Variable	Mean	St. Dev.
Years of College	3.1	1.2
% High School	5%	N/A
Age Upon Entrance	21.8	1.4
Career Length (Years)	8.5	4.0
Total Games	488	288
Games Per Year	52.5	15.5
Total Minutes	12,800	10,000
Minutes Per Year	1270	700
Player Efficiency Rating	13.4	4.0
Earnings (Million \$)	39	4.0
Salary (Million \$)	3.76	2.84
% PG	.16	N/A
% SG	.21	N/A
% SF	.22	N/A
% PF	.24	N/A
% C	.17	N/A

Note: N=256

(a) Data from BasketballReference.com.

Table 6.1 shows the summary statistics for the first round picks between 1993 and 2002. To measure each player's college attendance, two main variables are used. First, years of college measures the number of years that a player attended college. This variable accounts for attending college, but it also examines the effect of each additional year of college on NBA career prospects. The variable ranges from 4, which means that a player stayed in school through his senior season, to 1, which means that he left after his freshman season. The average among the dataset is 3.1, which equates to entrance after the junior year of college. Secondly, a high school dummy variable captures whether or not a player made the direct transition from high school to the NBA (1 for direct jump and 0 for attended college before NBA). The average for this dummy variable in the dataset is .05, meaning that one in twenty players entered the NBA directly from college. The possibility existed of including entrance from high school as a 0 value for years of college, but the difference between skipping college all together and leaving early is great enough to warrant its own variable and its own analysis. Also, since the main goal of the study is to examine the effects of the age minimum high school must be examined separately. Entrants directly from high school are the main group affected by the age minimum, so their long-term career prospects deserve examination.

To study the short-run effects of the NBA age minimum, a dataset is used that includes players from several years before and after the minimum was instituted in 2006. The dataset includes four years of high school graduates prior to the minimum (2002-2005) and three years after the minimum (2006-2008). The players included in the study come from the Rivals<sup>11</sup> high school basketball prospect rankings for each year, allowing for comparison of the athletes widely regarded as the best for each year before the NBA entrance process could affect them. This portion of the dataset does not go further back than 2002 because high school ranking data before this point do not possess the necessary level of accuracy. The incorporation of high school ranks is critical because it provides a measure of skill level before professional or collegiate basketball could have any effect. This is, in effect, the raw and untouched measurement for player ability. The signal might be noisy because of limited scouting, but the dataset is large enough that this effect should even out. For graduating classes from 2002 to 2008, the top 30 prospects are included in the dataset.

Table (	5.	2
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	HS Entrants, Ranked 1-5	Attended College, Ranked 1-5	HS Entrants, Ranked 6-30	Attended College, Ranked 6-30
# Players	11	14	14	38
Avg. pick	16.9	7.3	26.8	19.3
Games	64	68.6	43.1	58.4
Minutes	2099	2344	816	1267
PPG	16	14.7	5.3	6.3
PER	18.3	16.9	13.1	12.5
PER-Games	1224.8	1137.9	605.7	726
<b>PER-Minutes</b>	42,232	38,868	11,712	16,695

# **Dataset Statistics, Third Year Out of High School High School Graduates Ranked in Top 30, 2002-2008**

Note: N=77

(a) Data from BasketballReference.com. (b) Rankings from Rivals.com

Table 6.2 shows the summary statistics for the more recent portion of the dataset.

There are more players who have been ranked outside the top five of their high school

<sup>&</sup>lt;sup>11</sup> "The Rivals 150 Prospect Rankings," Used for classes from 2002 to 2008, <u>Rivals.yahoo.com</u>, <a href="http://rivals.yahoo.com/basketballrecruiting/basketball/recruiting/rankings/rank-rivals150/2002">http://rivals.yahoo.com/basketballrecruiting/basketball/recruiting/rankings/rank-rivals150/2002</a>.

class and attended college than each of the other three groupings, but given the small dataset the division between each possibility is relatively equal and no one group is underrepresented. The summary statistics also represent the validity of the high school rankings, as players who are ranked in the top five of their class outperform other prospects no matter their decision to go pro or attend college. Also of note, the gap between those who attended college and those who turned pro appears to be smaller for the top five recruits. Statistics show a fairly even level of performance for all top five prospects, but prospects outside of the top five who attended college outperform those who turned pro in all categories but one.

A number of variables are used to examine the overall production of players in the NBA. Both games played and minutes played are incorporated to look at how long a player was able to stay on the court in his first several seasons, indicating durability, conditioning, and overall value to the team. PER, or player efficiency rating, is used as a statistical proxy for a player's overall production. Developed by John Hollinger of ESPN, PER measures a player's all-around production on a per-minute basis. The measurement combines all major statistics such as points, rebounds, and assists, also accounting for team tempo and defensive measures. The average PER in the NBA usually hovers around 15; a value less than ten represents poor play and a figure higher than 20 represents very good play.<sup>12</sup> Within the dataset, PER offers a reliable and generalized variable with which to examine on-court performance. Another statistic incorporated into the study is points per game, which represents either a seasonal average for the yearly studies or a career average for the long-run section. While not as telling as PER as to a player's

<sup>&</sup>lt;sup>12</sup> John Hollinger, "What Is PER?" <u>ESPN.com</u>, 6 October 2009, 8 December 2009,

<sup>&</sup>lt;a>http://sports.espn.go.com/nba/columns/story?columnist=hollinger\_john&id=2850240>.</a>

overall effectiveness, points are the most appreciated NBA statistic and are sometimes overvalued by both NBA fans and teams. Points per game might say less about a player's overall production, but it might tell more about a player's value to a team and overall star power.

Additionally, a statistic is created to examine a player's full contribution to his team: PER-minutes. Because PER tells the story of a player's output per minute, it only makes sense to multiply it by the number of minutes he plays and create a statistic of overall output. Two players might post PER's of 20 for a season, but if one played 2000 minutes compared to another who played 300 minutes he was far more valuable to his team. Meanwhile, players who play very few minutes in a season can post skewed PER's that might throw off the data if not properly weighted. For example, Von Wafer's PER of -40 in his second NBA season becomes far less impactful when weighted by the 1 minute he played the entire season. All totaled, the variable delivers an accurate portrayal of a player's on-court production. For all players three years out of high school in the dataset, LeBron James, Amare Stoudamire, Dwight Howard, Chris Paul, and Kevin Durant take the top five rankings – five consensus all-stars whose values are through the roof.

In the long-run portion of the study, player earnings potential is also examined. To examine the effect of attending college on a player's earning potential – the ideal means of determining the benefit from on-the-job training received from early entrance – career *earnings* and average *salary* are included for each player in the dataset. The natural log of each player's average annual salary is also included. Some economists, such as Groothuis et al  $(2007)^{13}$ , claim that a log function is needed for professional

<sup>&</sup>lt;sup>13</sup> Groothuis, Perri, and Hill, p. 223.

athletes' salaries because of the large discrepancy between superstars and the rest of the league. Both methods (with and without logs) are included in the study.

The major control used within the study is a dummy variable that accounts for whether or not a player was ranked in the top five of his high school graduating class. This takes the form of the dummy variable *top5*, and is only available for the 2002 to 2008 dataset. Dummy variables for a player's position are excluded because they show little statistical significance.

#### PART 7: RESULTS

The results of the regressions follow the format of the model described in the empirical methods section. Beginning by studying the effect of early entrance on measures of long-term earnings, the study moves forward with regressions that begin to lessen the bias inherent in comparing high school and non-high school entrants. At the same time, in moving towards a comparison that involves a smaller dataset and a more limited scope of player performance, the explanatory power of more accurate regressions diminishes.

Overall, the results suggest mixed effects for the increased on-the-job training that is associated entering the NBA at a younger age. The age minimum, which serves as an instrument for the choice to go pro directly from high school, is found to show a tendency towards positive effects, but perhaps less so with players ranked in the top five of their class. Overall statistical significance is low for the portion focusing on more recent years because of limited data and a small sample size, but results show more significance and

explanatory power for the long-term examination. The results for the study are examined within each section.

In the portion of the study that examines the long-term statistics of first round picks between 1993 and 2002, the results depict a negative relationship between attending college and both earnings and performance. At the same time, the selection bias that occurs without controls for skill-level might overstate the earnings of high school entrants. Table 7.1 shows the results for regressions involving measures of income. The coefficients for the high school dummy variable are positively associated with earnings while attending college is negatively associated. Entrance directly from high school is associated with \$46,200,000 million more in a player's career earnings, and \$3,500,000 million more for a player's average yearly salary – large differences that are at least in some way augmented by the superstar success of several high school entrants during this period. On the other hand, the years of college variable is negatively associated with measures of earnings and salary. Attending college for an additional year is associated with \$11,400,000 less in career earnings and \$850,000 less per season. While these results suggest that high school entrants make more money, both selection bias and the incongruity of salaries for this time period make it a difficult area to study. With dramatic changes to the NBA's collective bargaining agreement in 1995 and 1999, including a rookie pay scale, the data for salary has its problems. It should also be noted that taking the natural log of each player's salary reduces the statistical significance of the coefficients. Some economists suggest that salary needs to be used as a log variable because of the skewed salaries for superstar players. While this reduces the explanatory power of the results, however, it does still shows a positive relationship between early

entrance and earnings potential. While high school standouts such as Kevin Garnett and

Kobe Bryant who have made immense sums of money in the NBA may somewhat inflate

this figure, bypassing college here appears to be correlated with a higher earning

potential.

<u>Table 7.1</u>

# <u>Earnings in</u> 1<sup>st</sup> Round Picks (1993 – 2002)

Spec	Career Earnings Up To 8 Seasons <sub>1</sub>	Career Earnings Up To 8 Seasons <sub>2</sub>	Average Salary <sub>1</sub>	Average Salary <sub>2</sub>	Ln Average Salary <sub>1</sub>	Ln Average Salary <sub>2</sub>
HS	29,800,000***		3,457,000***		.832***	
Entrant	(6,900,000)		(814,000)		(.242)	
Years in		-7,300,000***		-851,000***		233***
College		(1,200,000)		(144,000)		(.043)
R <sup>2</sup>	.07	.12	.07	.12	.05	.11

Note: \* = 10% sig., \*\* = 5% sig., \*\*\* = 1% sig.

(a) Data from BasketballReference.com.

In addition to examining player earnings, this study also looks at the effects of attending college on a player's long-term performance. Table 4 shows these results, which again might contain selection bias since better players are more likely to enter the NBA earlier. For every measure of performance, coefficients for the high school dummy variable are positive and statistically significant at a five percent level. Early entrance from high school is associated with a 3.93-point increase in career player efficiency rating and 12,765 more PER minutes per year. At the same time, coefficients for the years of college variable are negative for all measures of player performance. Every additional year of college is associated with a .94-point drop in career player efficiency rating and 3661-point drop in PER minutes per season.

# *Table 7.2*

Spec.	Games <sub>1</sub>	Games <sub>2</sub>	PER <sub>1</sub>	PER <sub>2</sub>	PER Minutes <sub>1</sub>	PER Minutes <sub>2</sub>	PER-Min Per Year <sub>1</sub>	PER-Min Per Year <sub>2</sub>
HS	2.94***		2157**		65,450***		8364**	
Entrant	(1.05)		(1054)		(25,945)		(3428)	
Years in		45**		-354*		-10,889**		-1481**
College		(.21)		(206)		(5070)		(669)
$\mathbf{R}^2$	.02	.03	.04	.08	.04	.09	.04	.09

# Player Performance in 1<sup>st</sup> Round Picks (1993 - 2002)

Note: \* = 10% sig., \*\* = 5% sig., \*\*\* = 1% sig.; Games limited to 650; Minutes limited to 15,000 (a) Data from BasketballReference.com.

While each of the regressions that utilize the 1993 to 2002 dataset suggests that the on-the-job training associated with early entrance results in better and higher-paid players, the results must be taken with a grain of salt. Disjunction in the NBA's collective bargaining agreements limits the accuracy of salary measures for the dataset, and the inherent selection bias that results from the most-skilled players going pro at an earlier age creates endogeneity within the regression. The best players are more likely to leave early, so it would make sense that the best players would see increased performance and earnings. To help control for this selection bias, a second dataset that looks at high school graduates between 2002 and 2008 is used. With player rankings prior to the decision to go pro or attend college, a control variable for elite prospects can be incorporated.

In the section examining high school graduating classes between 2002 and 2008, the results show general tendencies but few associations that can be confirmed at a statistically significant level. The results in this section are grouped by performance statistic and include games, minutes, points per game, player efficiency rating, and PERminutes. To account for any potential selection bias that might remain even with the ranking control, the 2006 age minimum is then used as an instrumental variable for the

decision to enter the NBA directly from high school. Overall the trend in the data suggests that players might be hurt by entering the NBA directly from high school unless they are among the top five recruits of their class. For these more skilled players, entering the NBA immediately after high school has more neutral effects and in some cases might even result in improved performance. This falls in line with both the theoretical expectations and earlier results. The elite players from a graduating class are more likely to possess an ability level above A\* in their choice framework, making a correct decision to turn pro a more likely option. The other general trend is also for players to perform better after the 2006 age minimum, but less so for the top prospects in each class. This result also makes sense since the age minimum prevented high school entry, which is shown to be associated with weaker performance for most players. Again, however,

The first focus variable that is examined for more recent data is games played, which accounts for a number of factors such as durability, skill, and conditioning. Table 7.3 shows the results for total games in a player's third year after high school. The results for both the old and recent dataset show little significance without the proper control for ranking. Once the ranking is included, however, the results suggest a negative relationship between games played and entrance directly from high school. Entering directly from high school is associated with 11.17 fewer games in a player's third season after high school graduation. The figure rises to 21.13 fewer games when using the age minimum as an instrument for early entrance. When an interaction term is included (Table 7.4), the coefficients for entrance directly from high school remain negative. The coefficients for the interaction terms, although not statistically significant, suggest that players ranked in the top five of their graduating class fare better than lower-ranked players when they enter the NBA directly from high school and fare worse than lowerranked players after the 2006 age minimum.

# *Table 7.3*

Specification	1	2	3	4	5
Model	OLS	OLS	OLS	IV	Reduced
Dataset	Old	New	New	New	New
HS	10.24	-8.97	-11.17*	-21.13*	
Entrant	(7.42)	(6.68)	(6.59)	(12.12)	
After				Instrument	11.29*
Minimum					(6.37)
Top 5			14.26**	15.80**	13.54**
Ranked			(6.59)	(6.88)	(6.53)
$\mathbf{R}^2$	.03	.02	.08	.06	.09

Games Played, 3rd Year after High School

Note: \* = 10% sig., \*\* = 5% sig., \*\*\* = 1% sig.

(a) Data from BasketballReference.com. (b) Rankings from Rivals.com

*Table 7.4* 

# Games Played, 2<sup>nd</sup> and 3<sup>rd</sup> Years after High School

Specification	1	2	3	4	5	6	7
Model	OLS	OLS	OLS	IV	IV	Reduced	Reduced
Years After HS	2	3	3	2	3	2	3
HS	-17.68**	-15.23*	-13.12	-9.37	-29.50*		
Entrant	(9.03)	(8.41)	(9.42)	(11.08)	(16.34)		
Freshman			4.61				
Entrant			(9.08)				
After Age				Used as	Used as	7.72	14.24*
Minimum				Instrument	Instrument	(9.28)	(7.72)
Top 5	6.75	10.20	-0.60	8.29	7.43	30.29**	16.79**
Ranked	(9.03)	(8.41)	(16.62)	10.19	(11.35)	(9.28)	(8.11)
(Top5)(HS)	18.11	10.66	21.5	14.82	21.97		
Interaction	(13.54)	(13.62)	(19.80)	17.06	(24.30)		
(Top5)(Fresh)			11.81				
Interaction			(19.64)				
(Amin)(Top5)				Used as	Used as	-12.00	-9.37
Interaction				Instrument	Instrument	(13.91)	(13.76)
$\mathbf{R}^2$	.14	.09	.11	.12	.06	.10	.10

Note: \* = 10% sig., \*\* = 5% sig., \*\*\* = 1% sig.; Players ranked in top 30 of HS graduating class.

(a) Data from BasketballReference.com. (b) Rankings from Rivals.com

The variable that measures minutes provides an even more accurate description of a player's durability, skill-level, and conditioning. Table 7.5 shows the results for minutes in a player's third year after high school graduation. When controlling for a player's rank to mitigate selection bias, entrance from high school is associated with 373 fewer minutes in a player's third season after graduation. Meanwhile, coming after the age minimum is associated with increased playing time. The coefficient suggests that entering after the minimum is associated with 433 more minutes in the third season after high school. With the inclusion of "Top 5" interaction terms, the results are again limited in their significance but suggest that high school entrants generally see fewer minutes. Likewise, players after the age minimum, when high school entrance s no longer an option, generally see more minutes. Being within the top five prospects of the class seems to work against both of these effects. The increased playing time that is associated with a higher skill level might help contribute to the effectiveness of on-the-job training early in a player's career.

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Specification	1	2	3	4	5
Model	OLS	OLS	OLS	IV	Reduced
Data	Old	New	New	New	New
HS	555*	-194	-373*	-809*	
Entrant	(324)	(260)	(226)	(420)	
After				Used as	433**
Minimum				Instrument	(217)
Top 5			1156***	1223***	1137***
Ranked			(226)	(238)	(223)
$\mathbf{R}^2$	.04	.01	.27	.24	.29

**Minutes Played, Third Year After HS Graduation** 

Note: \* = 10% sig., \*\* = 5% sig., \*\*\* = 1% sig.

(a) Data from BasketballReference.com. (b) Rankings from Rivals.com

Specification	1	2	3	4	5	6	7
Model	OLS	OLS	OLS	IV	IV	Reduced	Reduced
Years After HS	2	3	3	2	3	2	3
HS	-446	-451	-408	-298	-922*		
Entrant	(313)	(289)	(319)	(384)	(565)		
Freshman			95				
Entrant			(306)				
After Age				Used as	Used as	246	445*
Minimum				Instrument	Instrument	(316)	(264)
Top 5	762**	1077***	274	682*	1110***	1196***	1150***
Ranked	(313)	(289)	(563)	(353)	(393)	(316)	(278)
(Top5)(HS)	456	206	1010	640	295		
Interaction	(470)	(469)	(671)	(591)	(841)		
(Top5)(Fresh)			983				
Interaction			(666)				
(Amin)(Top5)				Used as	Used as	-514	-40
Interaction				Instrument	Instrument	(473)	(471)
$\mathbf{R}^2$	.27	.28	.31	.25	.24	.26	.29

#### *Table 7.6*

# Minutes Played, 2<sup>nd</sup> and 3<sup>rd</sup> Years after High School

Note: \* = 10% sig., \*\* = 5% sig., \*\*\* = 1% sig. Players ranked in top 30 of HS graduating class. (a) Data from BasketballReference.com. (b) Rankings from Rivals.com

In terms of a player's skill level, points per game represents one of the most valued statistics in the NBA. Table 7.7 shows the results for a player's third year after graduation while table 7.8 shows the results when including "Top 5" interaction terms. Again, the results show limited statistical significance but do suggest a pattern of weaker performance upon high school entry and improved performance after the age minimum, especially for players ranked outside of the top five of their high school class. When including a dummy variable for NBA entrance after the freshman year of college, high school entrance is associated with 7.62 more points per game for players in the top five of their class.

|--|

Specification	1	2	3	4	5
Model	OLS	OLS	OLS	IV	Reduced
Data	Old	New	New	New	New
HS	2.86	1.23	13	-1.96	
Entrant	(1.99)	(1.70)	(1.36)	(2.46)	
After				Instrument	1.03
Minimum					(1.27)
Top 5			9.24***	9.51***	9.34***
Ranked			(1.36)	(1.41)	(1.34)
$\mathbf{R}^2$	.03	.01	.39	.38	.40

# Points Per Game, Third Year After HS Graduation

Note: \* = 10% sig., \*\* = 5% sig., \*\*\* = 1% sig.

(a) Data from BasketballReference.com. (b) Rankings from Rivals.com

# *Table 7.8*

# Points Per Game, 2<sup>nd</sup> and 3<sup>rd</sup> Years after High School

Specification	1	2	3	4	5	6	7
Model	OLS	OLS	OLS	IV	IV	Reduced	Reduced
Years After HS	2	3	3	2	3	2	3
HS	-2.08	98	03	-2.24	-2.02		
Entrant	(1.97)	(1.70)	(1.80)	(2.41)	(3.20)		
Freshman			2.27				
Entrant			(1.73)				
After Age				Used as	Used as	1.84	0.97
Minimum				Instrument	Instrument	(1.95)	(1.52)
Top 5	4.87**	8.39***	3.12	3.88*	9.46***	8.41***	9.27***
Ranked	(1.97)	(1.70)	(3.24)	(2.21)	(2.27)	(1.95)	(1.70)
(Top5)(HS)	2.42	2.35	7.62**	5.66	.16		
Interaction	(2.95)	(2.83)	(3.91)	(3.71)	(5.00)		
(Top5)(Fresh)			5.65				
Interaction			(3.84)				
(Amin)(Top5)				Used as	Used as	-4.53	.19
Interaction				Instrument	Instrument	(2.92)	(2.81)
$\mathbf{R}^2$	.28	.40	.45	.27	.38	.30	.18

Note: \* = 10% sig., \*\* = 5% sig., \*\*\* = 1% sig. Players ranked in top 30 of HS graduating class.

(a) Data from BasketballReference.com. (b) Rankings from Rivals.com

Like points per game, player efficiency rating (PER) describes a player's ability level and statistical production. PER includes almost all measures of basketball performance and controls for pace of play, making it a composite measure of player performance. Table 7.9 shows the PER results for the third season after high school, and Table 7.10 shows PER results with a "Top 5" interaction term. The results are mixed and show limited statistical significance or explanatory power outside of the "Top 5" control variable. The interaction terms again suggest that players who are ranked in the top five of their graduating class seem to fare better than other players when entering directly from high school and worse after the age minimum, but the pattern cannot be statistically confirmed. Player efficiency rating appears to be one of the areas least effected by the onthe-job training associated with early NBA entrance.

	0				
Specification	1	2	3	4	5
Model	OLS	OLS	OLS	IV	Reduced
Data	Old	New	New	New	New
HS	2.87	1.79	.93	78	
Entrant	(2.28)	(1.41)	(1.31)	(2.53)	
After				Instrument	.38
Minimum					(1.23)
Top 5			4.68***	4.98***	4.88***
Ranked			(1.27)	(1.34)	(1.26)
$\mathbf{R}^2$	.02	.02	.19	.17	.19

<u>Table 7.9</u>

Player Efficiency Rating, Third Year After HS Graduation

Note: \* = 10% sig., \*\* = 5% sig., \*\*\* = 1% sig.

(a) Data from BasketballReference.com. (b) Rankings from Rivals.com

#### *Table 7.10*

Specification	1	2	3	4	5	6	7
Model	OLS	OLS	OLS	IV	IV	Reduced	Reduced
Years After HS	2	3	3	2	3	2	3
HS	.76	.63	1.41	.36	-1.78		
Entrant	(1.59)	(1.73)	(1.90)	(2.00)	(3.61)		
Freshman			1.75				
Entrant			(1.73)				
After Age				Used as	Used as	28	.75
Minimum				Instrument	Instrument	(1.56)	(1.51)
Top 5	1.89	4.43	4.65	1.31	4.15*	2.93*	5.29***
Ranked	(1.51)	(1.58)	(3.11)	(1.71)	(2.13)	(1.53)	(1.59)
(Top5)(HS)	.76	.72	.51	2.06	2.39		
Interaction	(2.30)	(2.69)	(3.81)	(2.93)	(5.03)		
(Top5)(Fresh)			-1.04				
Interaction			(3.70)				
(Amin)(Top5)				Used as	Used as	-1.62	-1.13
Interaction				Instrument	Instrument	(2.29)	(2.63)
$\mathbf{R}^2$	.09	.19	.21	.09	.17	.10	.19

# Player Efficiency Rating, 2<sup>nd</sup> and 3<sup>rd</sup> Years after High School

Note: \* = 10% sig., \*\* = 5% sig., \*\*\* = 1% sig. Players ranked in top 30 of HS graduating class. (a) Data from BasketballReference.com. (b) Rankings from Rivals.com

The final major performance variable studied for the 2002-2008 dataset is PER Minutes, which represent the overall contribution of a player to his team. Because PER is a measure of per-minute performance, multiplying PER by the number of minutes that a player was on the court during a season describes his overall level of output. Table 7.11 shows the results without the "Top 5" interaction term and Table 7.12 shows the results with the interaction term. A similar pattern exists for PER minutes as seen for each of the other measures of player performance, but again there is limited statistical significance. Also of note is the significantly positive coefficient for high school entrance using the older dataset. This might reflect an actual positive relationship, but the selection bias inherent in the regression might also have an impact. Also, in the earlier dataset, players are compared to all NBA entrants rather than only players who have left college after their freshman and sophomore years. This could conceivably set a lower bar for average

performance and results in higher coefficients than seen in more recent data.

# *Table 7.11*

Specification	1	2	3	4	5
Model	OLS	OLS	OLS	IV	Reduced
Data	Old	New	New	New	New
HS	12,164**	2476	-1846	-6754	
Entrant	(5982)	(5178)	(4397)	(7900)	
After				Instrument	3591
Minimum					(4150)
Top 5			25,310***	26,148***	25,434***
Ranked			(4397)	(4573)	(4346)
$\mathbf{R}^2$	.06	.01	.31	.30	.32

PER-Minutes, Third Season After HS Graduation

Note: \* = 10% sig., \*\* = 5% sig., \*\*\* = 1% sig.

(a) Data from BasketballReference.com. (b) Rankings from Rivals.com

*Table 7.12* 

# PER-Minutes, 2<sup>nd</sup> and 3<sup>rd</sup> Years after High School

Specification	1	2	3	4	5	6	7
Model	OLS	OLS	OLS	IV	IV	Reduced	Reduced
Years After HS	2	3	3	2	3	2	3
HS	-6193	-4982	-3810	-5218	-7604		
Entrant	(6032)	(5572)	(6018)	(7386)	(10,425)		
Freshman			2785				
Entrant			(5784)				
After Age				Used as	Used as	4297	3671
Minimum				Instrument	Instrument	(6007)	(4986)
Top 5	13,330**	22,174***	6267	11,051	25,261***	22,796***	25,530***
Ranked	(6032)	(5572)	(10834)	(6790)	(7398)	(6007)	(5454)
(Top5)(HS)	9491	8346	24,253*	14,697	2346		
Interaction	(9041)	(9089)	(12949)	(11,368)	(15,852)		
(Top5)(Fresh)			18,953				
Interaction			(12,842)				
(Amin)(Top5)				Used as	Used as	-11,747	-268
Interaction				Instrument	Instrument	(9003)	(9136)
$\mathbf{R}^2$	.24	.32	.35	.23	.30	.25	.32

Note: \* = 10% sig., \*\* = 5% sig., \*\*\* = 1% sig. Players ranked in top 30 of HS graduating class.

(a) Data from BasketballReference.com. (b) Rankings from Rivals.com

All totaled, the more recent dataset returns results with a relatively low level of statistical significance. This might result from a truly neutral relationship between the timing of NBA entrance and player performance, but it might also be a consequence of the small number of observations that are currently available. Within the confines of the data, however, a general trend emerges both two and three years out of high school. Players ranked outside the top five of their high school graduating class demonstrate weaker performance upon entrance into the NBA directly from high school and improved performance after the 2006 age minimum. For players who are ranked in the top five of their class, the effects seem to be more neutral and perhaps even positive in some cases.

#### **PART 8: CONCLUSION**

The low statistical significance of the results makes it difficult to form any broad claims about the effects of early entrance into the NBA or the potential gains from increased on-the-job training. The general pattern in the data would suggest that less-skilled players perform at a lower level when they enter the NBA earlier and are therefore helped by the 2006 age minimum. For these players, playing college basketball seems to be correlated with an improved level of performance that would lead to a higher earning potential, but this cannot be proven at a statistically significant level.

For more-skilled players, the trends in the data seem to suggest that entering the NBA at an earlier age might have a neutral if not positive effect. Although the results show primarily negative coefficients for performance after entrance from high school, the primarily positive coefficients for the "Top 5" interaction term have the opposite effect. Combining these two coefficients tells us that top five recruits who enter the NBA

immediately after high school fair about the same as those who attend college and in some cases outperform them. If these results were indeed true, it would mean that early entrance remains the best option for these players. The actual on-the-job training that the players gain might have limited benefits, but the mere fact that they are being paid to develop while not sacrificing any amount of skill level would make the NBA a better option coming out of college. The earnings results for the older dataset do not disprove this notion. High school entrants, in general, appear to earn more money and produce at a higher skill level during their NBA careers. Some of this might be due to selection bias and salary incongruities, but the fact remains that players entering the NBA directly from high school have enjoyed their fair share of success in the past. For the top players, the effects of entry directly from high school appear to be neutral if not positive, and the argument that even the most-skilled players are at a disadvantage when they enter the league directly from high school simply is not true.

In determining whether players benefit from the on-the-job training that they receive from early entrance or whether attending school helps their overall career prospects, the results would lean towards suggesting that the elite players are more likely than less-skilled players to benefit from on-the-job training as opposed to attending college. Far more data is needed to produce a definitive conclusion, however. In order to attain the necessary significance to make such a claim, more data on high school entrance is needed in addition to more information about skill and ability prior to high school graduation. Accurate high school ranking information does not really exist prior to 2002, and more graduating classes are needed with more time to play in the NBA to produce the necessary number of observations. A longer time period for the rank-controlled

dataset would allow for both a wider range of players to increase the number of observations as well as a more long-term perspective of each individual player. Ideally, the salary structure would also remain constant so that each player's long-term earning potential could be compared. Salary would be the ideal method of judging the impact of on-the-job training, especially over a longer time period.

The age minimum's direct effects are difficult to study because only four years have passed since its implementation, but the restriction appears to have mixed effects for the most skilled players and help less-skilled players, in line with the economic hypotheses presented earlier. In some ways, the overall impact of the age minimum on NBA prospects depends on how one frames the question. For a given high school graduating class, the age minimum might actually result in a loss of total income. Since the best players are kept from earning top dollar in the NBA following high school graduation, the overall loss of at least one season's salary for these players might outweigh the gains for other players. The results show relatively little difference between high school entrance and college in terms of performance for each class' top prospects, meaning that in many cases their best choice might be to turn pro and begin their NBA income stream. On the other hand, the age minimum might benefit a high school graduating class on the whole by preventing players from incorrectly entering the NBA. The results show that coming after the age minimum is associated with improved performance, and it would be tough to argue that the age minimum increases the chances of players being busts. The best players might not be helped by the minimum but their careers are not shortened, and less-skilled players appear to improve with college basketball, therefore becoming less likely to completely fail in the NBA.

Ideally, the age minimum would be replaced by some solution between an entirely free market and a full restriction. One method would be to offer exceptions to the age minimum for high school graduates who possess an ability-level above the cutoff that makes early entrance a rational decision. This would allow the best players to improve as much as possible in the NBA without letting other players make irrational choices to skip college. In practice, however, such a restriction would be nearly impossible to implement. A more viable option might be to drop the age minimum completely. Elite players who are unable to pursue NBA-type income directly out of high school while gaining little from college are hurt by the restriction, and they should be allowed to enter the league directly out of high school if that is the correct decision. At the same time, the NBA could implement a rigorous education program to properly inform high school graduates on the benefits and costs of early entrance. There might have been irrational choices to go pro before the age minimum, but with more education and unbiased information players are more likely to make a correct decision. Such a program could involve meeting with a financial advisor, contact with past NBA players who made the jump directly from high school, and overall communication with basketball experts who are not sports agents looking to make quick money off of young prospects.

A stronger development league would also help the issue. Right now, the NBA's de-facto use of college basketball as a farm system makes it tougher on players to decide correctly: convincing a high school graduate to turn down a million dollar contract to essentially play for free is no easy task. Having a development league whose interests are more aligned with NBA teams would allow players to get paid without forcing them to have an immediate NBA ability-level in order to develop. NBA owners do not have to

pay NCAA athletes, but they might eventually produce weaker competition if they rely on college basketball to properly develop players' skills. The results show mixed effects on attending college among top prospects, and owners who want the best possible production might not find outsourcing players to college to be in their best interests.

As the NBA commissioner David Stern considers raising the age minimum to 20year-old, the league should consider the effects of its original policy. The NBA has partially corrected the problem of irrational decision-making by less-skilled high school graduates, but in doing so it may have had unintended effects on some of its top prospects. A further increase to the age restriction might harm elite high school graduates, at least through the income lost from another NBA season and potentially through a weaker course of development that limits player performance. Doing away with the age minimum, in conjunction with a program to increase prospects' access to decision-making information, might prove to be the best possible solution so long as such a program truly enhances prospects' rationality. The results of this study make one thing fairly clear, however: at least some level of irrationality exists in NBA prospects' human capital and labor decision-making. Why else would a regulation that greatly restricts prospects' choices actually improve their performance for all *aftermin* coefficients in the results except for one? Some combination of asymmetric information, hyperbolic discounting, and overall irrationality contributed to poor decisions to go pro before the age minimum, and the minimum appears to have since helped to correct these. Finding a cure for irrationality among prospects (especially less-skilled prospects) might be the best solution, but if the NBA cannot find a way to achieve such a result then an age minimum that constrains each player's choices for one year might not be the worst option.

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