Early Entry in the NBA Draft:
The Influence of Unraveling, Human Capital, and Option Value

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ABSTRACT In an influential article, "Unraveling in Matching Markets," Li and Rosen (1998) note the first seven picks, and 17 among 29 first round selections of the 1997 NBA draft, were not college seniors. In 2004, the first pick in the NBA draft was a high school senior, and 25 of the first 29 picks were not college seniors. Li and Rosen (1998) suggest early entry is a form of unraveling in a labor market as firms attempt to secure the most promising player. We suggest recent NBA contract provisions implemented to slow the early entry of talented players have instead provided additional incentives to both players and firms for early entry into the NBA. In particular, the lowering of the fixed wage contract and lengthening of rookie contracts have given firms limited monopsonistic power and the ability to capture economic rents. We explore two competing models that predict why teams choose a talented player sooner under the new rookie contract system. The first model is the traditional human capital model, and the second is the Lazear (1995) option value model. To test why unraveling occurs, we use a panel study of all NBA players for 12 years from 1989 through 2002. The data include individual player performance statistics on a season-to-season basis, salary, and draft number.

Introduction

In the pursuit of the best-qualified worker, unraveling may occur in the labor market (Roth, 1991, Roth an Xing, 1994, and Li and Rosen, 1998). In the literature, two types of unraveling are identified. The first type is identified as jumping-the-gun unraveling that occurs when offers are made earlier and earlier around a central clearing time. Examples of this type include early admissions at colleges and hiring of MBA candidates. The second type occurs when offers are extended early and workers do not join the firm until a later period. Examples of this type generally come from educational markets, where firms hire workers a year or two years before their education is complete.

On the surface, the National Basketball Association (NBA) labor market seems like a good example of the second type of unraveling. In this instance, the NBA has a centralized matching system to hire new talent: the NBA draft. Teams in the pursuit of talent have drafted players earlier and earlier in their college careers, or from high school, but here is where the similarity ends. In the unraveling model, once a match has been made, workers complete their education and then report to work. In the NBA draft, players once drafted start playing without finishing their education. Why does early entry occur? We suggest two models predict early entry into the draft: human capital and option value. The human capital model suggests players enter the NBA once a certain skill level is obtained. Thus highly talented players reach the NBA earlier because they do not need as much experience as less talented players. The option value model suggests college basketball provides signals for players. Therefore, the longer a player stays in college, the better the signal. Teams will then choose players who have a more varied signal (less college experience) if they can minimize the downside risk and capitalize on the upside potential.

In section one, we outline the history of the NBA collective bargaining agreement to establish how monopsonistic exploitation has increased with the rookie contract. In this section we explore how institutional and contract structures have increased unraveling in the NBA draft. In section two, we model the early entry decision for both players and firms, and then focus on testable implications of the both the human capital and option value models of early entry. In section three, we conclude with policy implications.

Section 1: Institutional Aspects of NBA CBAs affecting Early Entry

A Supreme Court ruling in the Haywood vs. NBA case in 1971 voided the requirement entrants into the NBA draft wait until their college class graduated. For a brief period, the NBA only allowed early entrants who requested and were approved entry based on financial hardship; in 1975 the NBA dropped the "hardship" criteria. The figures in Table 1 indicate, from 1976 through the 1994 draft, only 18.1% of the first round draft picks were early or foreign entrants; of these early entrants 79.5 % of the first round draft picks into the NBA were college juniors. The only foreign first round picks were Arvydas Sabonis, the star center on the Soviet Union Gold Medal Olympic team of 1988, who was drafted by Portland in 1986 but did not come to the NBA until 1995, and Vlade Divac, a twenty-one year old member of the 1988 and 1996 Silver Medal Yugoslavian Olympic teams. Divac was drafted by Lakers in 1989, and joined the NBA that year. During this time period, a rookie player individually negotiated a contract with the team that drafted him. Salaries and contract length varied greatly.

The introduction of team salary caps in the 1983 Collective Bargaining Agreement (CBA) was a compromise between owners and the players' union in return for 53% of NBA gross revenue being allocated to player salaries. The early cap level was below the payroll of five teams whose cap levels were frozen at their existing payroll (Staudohar, 1996). The introduction of the salary caps led to some inequities in rookie salaries. Teams could only pay a rookie either the league minimum, if they were at the cap, or the amount of room under the cap in other cases. In 1987, for example, the third pick in the draft, Dennis Hopson, was paid a reported $400,850 for his rookie season, whereas the fifth pick in the draft, Scottie Pippen, earned $725,000 his first season. The first pick in the draft in 1987, David Robinson, earned a reported salary of $1,046,000 from San Antonio, the highest salary on his team by more than $250,000.

Discontent among veterans at the prospect of unproven rookies earning more than they did, and dissatisfaction with the inequities the salary cap was exacting on the distribution of draft pick pay, led to the introduction of a rookie pay scale in the 1995 NBA CBA. Under the terms of the 1995 CBA, first round draft picks were given guaranteed three-year contracts, with salaries set according to a published table. Teams were allowed to exceed the published salaries by 20%, and most did so. Second- round draft picks were paid the league minimum, and contracts were not guaranteed.

Immediately following the introduction of this three-year rookie pay scale, the level and composition of early entrants into the NBA changed. During the period encompassing the 1995-1997 drafts, 44% of the first round draft picks were early or foreign entrants; only 20% of the first round draft picks were juniors. In addition four high school graduates were drafted with no college experience. Players sought earlier entry into the draft, knowing that the three-year rookie scale would delay the attainment of hefty free agent salaries.

From 1995 to 1997 six young, foreign players were drafted. Rule changes in 1989 allowed professional players to play in the Olympics. This change induced foreign players, who previously could not play in the NBA and also play for their home country in the Olympics, to seek entry into the NBA; the change also allowed NBA scouts to evaluate foreign players as they competed against a team of select NBA players. A surge in world popularity for basketball followed the USA Olympic " Dream Team" winning of the gold medal in Barcelona, Spain in 1992. While the first "Dream Team" dominated world competition, the USA team of NBA stars won only a bronze medal in the 2004 Olympics in Athens. The NBA is now searching globally for the best basketball talent.

The distribution of salaries in the NBA became more and more skewed to the right (Hill and Groothuis, 2001) as pay for top free agents skyrocketed under the new agreement. The league pressed for individual caps on salaries during negotiations for a new CBA following the 1997-98 season. The main impetus for the hard-line stance of management during the negotiations was the $121 million dollar, six-year contract signed by Kevin Garnett following his second year in the league while he was still under the rookie scale contract he signed as an early entrant out of high school. Fearing this might be a portent of the future, the league locked out the players during negotiations. The new CBA signed in 1999, but effective for 1998 draftees, was an interesting compromise agreement that established caps on individual player salaries, lowered the three-year pay scale for rookies somewhat, added a fourth year option for teams at set percentage salary increases, set minimum salaries for players on an increasing sliding scale based on years of experience, and added a median player salary exception to the list of other salary cap exceptions.

The addition of another year to a rookie's tenure before free agency caused more players to seek early entry to the draft. For instance, in Table one, we show in 1976 only 6 players declared entry into the draft and were not drafted, but by 2004 58 players declared for the draft and were not drafted. In addition, teams were also more willing to accept early entrants. From 1998-2004, 74% of the first round draft picks were early or foreign entrants; only 23% of the first round picks were college juniors. The figures in Table 2 dramatically illustrate the effect of the rookie pay scale on the age of first round draft picks: first round picks in 2004 are almost two years younger on average than their 1994 counterparts. Given these shifts, owners now find free agents and rookies are no longer close substitutes. In particular a very talented new entrant becomes highly preferred because he costs much less than a veteran player and is more productive.

Roth and Xing (1994) predicted unraveling accelerates when senior candidates are not close substitutes for new entrants. In their article, they further state "It may be possible to develop quantitative tests of the effect of the availability of senior candidates on unraveling in the market for junior candidates by considering the markets for professional athletes such as baseball"{footnote this}. We suggest changes in the NBA collective bargaining agreement provide just such a natural experiment to test the theory of unraveling, human capital, and option value.

Section 2: Theories of Unraveling: Human Capital and Option Value

College basketball has long been the ‘minor leagues’ for the NBA. As a minor league, it serves a dual purpose. First, it is a training ground where players can hone their skills and become more productive. It is where players move from playing in front of small crowds to playing in front of large crowds and on national television. Second, college basketball serves as a signaling device to provide information and sort players into the NBA. When players leave early, they have less experience and a noisier signal than a player who stays in college. When owner’s choose an early entrant, they choose a player who is both riskier and with less experience.

Player’s Decision for Early Entry

Consider an individual who decides whether to wait one more year to enter the NBA. The rookie salary contract lasts for T years. An individual has an expected career of N years, $N > T$.[1] A player who waits one period has an expected career of length $\tilde{N}$., with $\tilde{N} = \delta N + (1-\delta)(N-1) = N + \delta - 1$, and $0 \leq \delta \leq 1$. If $\delta = 1$, then age does not constrain a player’s ability to stay in the league: waiting one more year to enter the league has no impact on how many years one can play. If $\delta = 0$, age has the largest possible effect on one’s playing career: waiting one more year to enter the league reduces one’s career by a year. Let A equal a player’s ability when he decides whether to enter the league or wait one year. Staying in school one more year[2] would add to one’s ability. One could argue those with lower ability have more to gain from staying in school. Alternatively, if staying in school tends to increase ability by a given percentage, then the more able have more to gain from staying in school. We assume the increase in ability from staying in school, α, is independent of initial ability, A.

Ignoring discounting,[3] a player is paid less than his ability/productivity during the rookie contract. Let k equal the fraction of a player's worth he receives during the rookie contract, $0 < k < 1$. After the rookie contract, the player is paid a wage equal to his ability. Thus the career earnings from one who stays one more year, W_{stay}, equal:

$$W_{stay} = k(A+\alpha)T + (A+\alpha)(\tilde{N} N-1-T) = (A+\alpha)[(k-1)T+N+\delta-1].$$

(1)

The career earnings for one who enters the league now, W_{go}, equal:

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

(2)

Thus, a player will enter the league now if $W_{go} \geq W_{stay}$, or if:

$$A \geq \alpha \frac{\alpha[(k-1)T+N-1]}{} [(k-1)T+N-1] \equiv A^*.$$

(3)

Note A^* is positive for $W_{stay} > 0$. Only those with ability of at least A^* will leave school early. With a given distribution of A, the larger is A^*, the fewer individuals who leave early. We have:

$$\frac{\partial A^*}{\partial \alpha}, \frac{\partial A^*}{\partial k}, \text{ and } \frac{\partial A^*}{\partial N} > 0, \text{ and } \frac{\partial A^*}{\partial T} < 0. \quad (4)$$

If the increase in ability from staying in school is larger ($d\alpha > 0$), fewer individuals leave early. The less rookies are underpaid ($dk > 0$), the fewer individuals who leave early. The longer one's expected career ($dN > 0$), the fewer individuals who leave early. Finally, an increase in the length of the rookie contract ($dT > 0$) results in more individuals leaving early.

Firm's Decision for Early Entry--Human Capital

Becker (1993) argues employees will pay for general training. Consider the standard two-period human capital investment model. In period 1, employees undertake training that will increase their marginal revenue product (MRP) in all firms in an industry. If the employees' wage during this period (W_1) exceeds the employee's MRP during this period (MRP_1), then the firm can only recoup this investment cost if the MRP of the employee in period 2 (MRP_2), post-training, exceeds the wage paid during this period (W_2), which, with general human capital, usually can not occur. One paid less than one's MRP will quit unless there is some monoposonistic power by firms.

In professional sports, leagues use a variety of methods to ensure the cost of general training is not borne by teams. In football and basketball, professional franchises have typically allowed the bulk of general training to be performed by colleges. Early entry erodes this approach. In baseball and hockey, professional teams have traditionally used minor league affiliates to provide training. These minor league teams are subsidized by the major league parent franchises. To recoup their training costs, leagues do not allow players to become free agents until they have been in the major league for a certain time period. In baseball, players must be in the major league for six seasons before they can opt for free agency. This approach is designed to provide teams a period of time in which overall player MRPs exceed wages so that teams can recoup investment in players in the minors, but it obviously involves some cross-subsidization (Hill, 1985).

In the years following the Haywood decision, teams in the NBA were free to draft players who had not completed college. The figures in Table 1 suggest, from 1976-1994, teams in the NBA in general drafted only college juniors. The human capital model would suggest, lacking a framework in which to recoup investment in general on-the-job (OTJ) training costs, franchises were reluctant to draft a player whose MRP would not at least equal his wage.

This approach dramatically shifted with the addition of the Rookie Scale in the 1995 NBA Collective Bargaining Agreement. With first round draft picks locked into three-year contracts with a predetermined salary, teams could now draft earlier entrants who might require some general training as long as the teams could recoup these costs before the end of the Rookie

Scale Contract. The changes in 1999 Collective Bargaining Agreement gave teams even more incentive to draft earlier entrants. By lowering the Rookie Scale Contract salaries and adding a fourth-year option for team at a predetermined percentage pay increase, the league and union added even more opportunities at the bargaining table for teams to recoup general OTJ training costs.

Other aspects of the NBA Collective Bargaining Agreement (CBA) make the above scenario more likely. In 1999 individual maximum salary caps based on years of experience were added to the CBA. This could allow teams to pay superstar players a wage below their marginal revenue product. To increase the likelihood a team that drafts and develops such a player is able to retain him past the fourth year of the Rookie Scale Contract and Option, a team is able to offer a 12.5% annual pay increase to players who have been with the club for three or more seasons but can only offer a 10% annual salary increase to others.[4] For stars earning nine million dollars, this two and a half percent pay difference is substantial.[5] An alternative explanation of early entry is Lazear's option value.

Firm's Decision for Early Entry--Option Value

Lazear (1995) argues risky workers are preferred to safe ones at a given wage because the risky workers have an upside option value. Firms are willing to hire risky workers if they can dismiss workers who do not measure up, and keep workers with upside potential. For this strategy to work, the employer must have some ex post advantage over other firms, such as costly mobility, private information, or the option value vanishes as the worker moves. In basketball the rookie contract and provisions in the CBA may provide just this advantage.

Previous studies have looked at the role of option value in the sports economic literature. For instance, Hendricks, DeBrock, and Koenker (2003) find in the NFL "As long as the employer can eliminate poor performers...it seems quite possible that employers take chances on risky workers in the hope of finding 'stars'."[6] In baseball, Bollinger and Hotchkiss (2003) find risky workers receive a pay advantage as long as firms enjoy some degree of market power. In the

NBA, we explore the possibilities early entrants are indeed risky workers who thus provide option value to the team that drafts them. To examine option value in the presence of monoposonistic rent, consider the following model.

Suppose an individual is under contract for a length of time T. After a length of time bT, b < 1, the firm may terminate the individual. The individual is paid W per unit of time. The individual's marginal value product, Q, equals A + D. Assume A is a measure of ability that is known to all prior to the contract. D is an ability measure (drive perhaps) that is unknown to the firm, but is learned before the firm may terminate the worker. Assume D ~ continuously on [D_{min}, D_{max}], with a p.d.f. and c.d.f. of f(D) and F(D) respectively. Further assume E(D) = 0 and the firm has monopsony power so E(Q) = A > W. With π a firm's expected profit, the probability of firing (*resp.* keeping) an individual given by prob(fire) (*resp.* prob(keep)), and the discount rate equal to zero, we have:

$$\pi = T\{\text{prob(fire)}[E(D|\text{fire}) + A - W]b + \text{prob(keep)}[E(D|\text{keep}) + A - W]\}. \quad (5)$$

Now a firm will fire an individual only if A + D < W, or if D < W - A. Thus

prob(fire) = $\int_{D_{min}}^{W-A} f(D)dD$ = F(W-A) and prob(keep) = $\int_{W-A}^{D_{max}} f(D)dD$ = 1- F(W-A). It is assumed

W - A > D_{min}, so prob(fire) > 0. Consider the first [•] term in eq.(5). Since

E(D|fire) = $\frac{1}{F(W-A)}\int_{D_{min}}^{W-A} D(f(D)dD$ is negative and larger in absolute value than W-A,

E(D|fire) < W - A and E(D|fire) + A - W < 0. With prob(fire) + prob(keep) = 1, and prob(fire)E(D|fire) + prob(keep)E(D|keep) = E(D) = 0, then $\pi|_{b=1}$ = A - W, which is positive by assumption. Using eq.(5), and the fact E(D | fire) + A – w < 0, $\frac{\partial\pi}{\partial b} < 0$. Thus, $\pi > 0\ \forall b$, and

$\pi > A - W$ for $b < 1$. Note $\pi = A - W$ for an individual with zero risk and $E(D) = 0$, so, for $b < 1$, π is greater for a risky worker, which is the basic result in Lazear (1998).

One argument against early entry of players in the NBA is the players have lower ability as more players leave college early or enter the NBA directly from high school. If the model herein represents the average individual a firm considers drafting, then (average) ability may be reduced as the contract period, T, is increased. This follows the argument more players enter the NBA early as T increases because they are not free agents until after their initial contracts have expired. Let $A = A(T,\theta)$ $\frac{\partial A}{\partial T} < 0$, $\frac{\partial A}{\partial \theta} = 1$, and $\frac{\partial^2 A}{\partial A \partial \theta} = 0$, where $d\theta > 0$ represents an exogenous increase in A. Note an exogenous increase in A raises π:

$$\frac{\partial \pi}{\partial \theta} = T[bF(W - A) + 1 - F(W - A)] > 0.^{7} \quad (6)$$

Assume the firm can choose T but b is exogenous. Clearly, for NBA teams, T and b are both subject to bargaining with the players' union. In recent contracts, the union apparently has shifted wealth from new players to existing ones by allowing for a longer period before free agency, and by accepting a salary scale for rookies. Assuming T is and b is not chosen by the firm (the league) essentially treats the league-union bargaining as allowing more rent to be taken from rookies as T increases, with the union insisting on a given value for b in order to limit such rent extraction. If the firm/team is not constrained by b, it will terminate those with $D < W - A$ once it learns D.

One can ask how a representative team would set T in order to maximize π. The first-order condition (FOC) is:

$$\frac{\partial \pi}{\partial T} = \frac{\pi}{T} + T \left\langle \begin{array}{l} b\left[prob(fire)\left(\dfrac{\partial E(D|fire)}{\partial A} + 1 \right) - f(W-A)\big(E(D|fire) + A - W\big) \right] \\ + prob(keep)\left(\dfrac{\partial E(D|keep)}{\partial A} + 1 \right) + f(W-A)\big(E(D|keep) + A - W\big) \end{array} \right\rangle \frac{\partial A}{\partial T} =$$

$$\frac{\pi}{T} + T\left[bF(W-A) + 1 - F(W-A)\right]\frac{\partial A}{\partial T} = 0 \qquad (7)$$

The second-order condition (SOC) is:

$$\frac{\partial^2 \pi}{\partial T^2} = -\frac{\pi}{T^2} + \frac{1}{T}\frac{\partial \pi}{\partial T} + \left[bf(W-A) + 1 - F(W-A)\right]\frac{\partial A}{\partial T}$$

$$T(1-b)f(W-A)\left(\frac{\partial A}{\partial T}\right)^2 + T\left[bF(W-A) + 1 - F(W-A)\right]\frac{\partial^2 A}{\partial T^2}. \qquad (8)$$

The first and third terms in the SOC are negative, the second term is zero from the FOC, the fourth term is positive, and the sign of the fifth term depends on the sign of $\frac{\partial^2 A}{\partial T^2}$. Assuming the SOC is negative, and, for simplicity, $\frac{\partial A}{\partial T} \equiv x$, a negative constant, so $\frac{\partial^2 A}{\partial T^2} = 0$, totally differentiate the FOC:

$$(SOC)dT + T[bF(W-A) + 1 - F(W-A)]dx + [TxF(W-A) + F(W-A)(E(D|fire) + A - W)]db$$
$$+ [Tx(1-b)f(W-A) + bF(W-A) + 1 - F(W-A)]d\theta = 0. \qquad (9)$$

Clearly $\frac{dT}{dx}$ is positive and $\frac{dT}{db}$ is negative. As x increases (becomes a smaller negative number), the reduction in A as T increases is smaller, so the team desires a longer contract. As b increases, it takes longer to fire one with a low realized value of D, so the team desires a shorter contract. The effect of θ on T is ambiguous. Even though $\frac{\partial \pi}{\partial \theta}$ is positive (eq.(6)), an exogenous increase in θ increases the expected duration of employment---T[bF(W-A) + 1 - F(W-A)]---as captured in the term Tx(1-b)f(W-A)dθ in eq(9). As T increases, A is reduced, and the cost to the team of raising T is larger the longer the expected duration of employment. Thus, an increase in θ does not unambiguously increase the optimal (to the team) length of the contract. From eq.(9), $\frac{dT}{d\theta}$ is positive only if:

$$bF(W-A) + 1 - F(W-A) > -Tx(1-b)F(W-A). \tag{10}$$

From ineq.(10), as |x| becomes larger (x becomes smaller), the RHS of ineq.(10) does not necessarily rise since $\frac{dT}{dx} > 0$ and a larger |x| implies a smaller x and a smaller T. However, a smaller b implies a larger value for T, so the RHS of ineq.(10) is negatively related to b, while the LHS of ineq.(10) is positively related to b. Thus, when b = 0, the possibility $\frac{dT}{d\theta} < 0$ is the largest. In this case, a positive value for $\frac{dT}{d\theta}$ requires a sufficiently small T:

$$T < \frac{1 - F(W - A)}{- xf(W - A)}. \tag{11}$$

An exogenous increase in θ *could* result in a shorter desired contract length. However, even if this were true, as demonstrated above, team profit increases if it hires individuals with more ability and with more risk, given ability. Many critics have noted the reduced skill level of NBA players due to early entry. This effect is allowed for above with the assumption $\frac{\partial A}{\partial T}$ is negative. As long as the negative effect of T on A is not extremely large, the rent earned over the contract period ensures an interior solution for T. If b→1 and W→A, then π→0 and the FOC for T would be negative: the optimal T would be zero. Otherwise early entry of players may lower A but still increase π.

An additional return to hiring risky workers in the NBA is the limit on what teams other than one's current team can pay the individual once he is a free agent (that is, after the contract period considered above). The so-called Larry Bird rule allows teams to exceed the salary cap to re-sign their own players. Salary cap rules may prevent a raiding team from offering a player his marginal value product. Thus, a player who turns out to be highly productive may be retained if his team pays him more than another team can pay him, leaving some rent for his current team. The new maximum individual salary caps for players, added to the 1999 CBA, undoubtedly suppress superstar salaries below competitive market levels. Overall, this model suggests firms in the pursuit of talent will choose riskier players, ceteris paribus, to capture upside potential. To test both the human capital and option value models, we use a natural experiment approach focusing on the changes in the collective bargaining agreements in the NBA.

Empirical Evidence

The change in the collective bargaining agreement (CBA) provides an opportunity to test how incentives influence choices by both players and owners. To best focus on the changes, we estimate wage equations for two time periods 1997 and 2002. We examine the effect of the rookie scale salary using a log-linear regression model. Salary regression models for professional sports are usually estimated using the log of salary to adjust for the large disparity in salaries between average and superstar players. Using the log of salary as the dependent variable helps to make the regression line more linear and reduce problems with heteroskedasticity inherent in such estimations.[8] Performance statistics included as independent variables included: points per game, rebounds per game, assists per game, steals per game blocks per game, and turnovers per game. A priori the coefficients of points, rebounds, assists, and steals are expected to be positive, while the coefficient of turnovers is expected to be negative. A dummy variable equal to one if the player is under a rookie scale contract is included in the model. An interaction variable of years of experience times the rookie scale dummy variable is also included. The coefficients of these two variables should give insight into the impact of the rookie scale on player salaries. Draft number is also included in the model since the rookie scale is a sliding scale based on draft position in the first round. The regressions are estimated using all players in the league; older players who were drafted prior to the adoption of the rookie scale should also exhibit an inverse correlation between their salary and their draft number if the draft is an efficient indicator of potential. The number of years of experience and the number of years of experience squared are included to model the typical age/earnings profile.

The model is estimated using 1997 and 2002 salary data separately. These two years of observations were chosen to illustrate the impact of the changes in the rookie scale clause in the CBA. Since the original rookie scale was adopted in the 1995 CBA, using 1997 gives observations with one, two, and three years under the rookie scale. The scale was changed for the 1998 rookie class; using the 2002 season gives observations with one, two, three and four years under the new scale.

The results are presented in Table 3. The coefficients of years of experience are positive and significant for both years; the coefficients of years of experience squared are negative and significant for both years. The coefficient of draft number is negative and significant for both years. Performance statistics did not perform as well as anticipated. The coefficient of points per game is positive and significant for both years. The coefficient of rebounds per game is positive and significant for 1997, but is improperly signed and insignificant for the 2002 regression. The coefficient of assists per game is positive for both years but significant only for the 1997 regression. The coefficient for steals per game is negative for both years and significant in the 1997 regression. The coefficient of blocks is positive and significant for both years. The coefficient of turnovers is positive in 1997, yet is negative in 2002, and is insignificant in both regressions.

The results for the coefficients of rookie scale and rookie scale times experience tell an interesting tale. The coefficient of rookie scale is positive and significant for both years; the coefficient of rookie scale times experience is negative and significant both years. When experience equals zero for rookies, then the overall effect of the rookie scale is positive on player salaries. When first round draft picks are under the rookie scale but have one year of experience, the overall impact on salary from the rookie scale is almost zero in each regression. However, when years of experience is set equal to two and players are still under the rookie scale, the overall impact of the rookie scale is negative for both the 1997 and 2002 regressions. Adding the fourth year option to the rookie scale in the 1999 CBA means, for our 2002 regression, a player with three years of experience who is still under the rookie scale would see an even greater negative impact on his salary.

The results of the salary regressions lend support to the human capital model. First round draft picks are apparently paid more under the rookie scale than their performance would indicate in their first year in the league. During their second season their performance and pay tend to approximate that of others in the league not under a rookie scale contract. However, in the third year in the league under the 1995 CBA and the third and fourth years in the league under the 1999 CBA rookie scale, the players are underpaid based on their performance. Through the CBA, the NBA has set up an institutional arrangement that allows teams to capture the cost of general training that takes place during the first season in the league.

In Table 4 median estimated salaries for the 1997 and 2002 class of rookies are compared assuming the player is under the rookie scale versus not under the rookie scale. The difference between these two salaries is offered as a proxy for the rent the player receives on new first round picks. For the 1997 group players earn more than their market value in their first season. Teams earn a surplus during the players next two seasons. The total rent going to team owners is estimated at $539,141. For the 2002 group, players earn a surplus in their first two seasons. Teams reap a surplus in the next two seasons since there is a fourth year option for these rookies. Overall the estimated rent for teams is $1,294,917. This result is consistent with the firm specific human capital rent sharing hypothesis.

To examine whether the application of the Human Capital model can explain early entry into the NBA, we shall use a measure of player performance called the efficiency formula. As reported by NBA.com, this index is calculated as: (points + rebounds + assists + steals + blocks) – (field goals attempted – field goals made) + (free throws attempted - free throws made) + turnovers). The figures on player efficiency presented in Table 5 lend support to the human capital model as an explanation for the increase in early entry into the NBA. Player efficiency rises for players' first four seasons in the league no matter what their level of college experience, with the exception of players with two years of college between their third and fourth seasons. If early seasons represent OTJ training for players, the rise in productivity is dramatic between the first and fourth seasons, and is even more so for players with little or no college experience.

If teams invest in player human capital in their early seasons, it seems logical to expect that minutes played per game would be lower in early seasons and rise with tenure in the league. The numbers in Table 6 on minutes played per game confirm this. First round picks average more minutes played per game during each of their first four years in the NBA. While players with two or more years of college play more minutes than those with one year of college or no college experience the first two seasons in the league, this situation is soon reversed. The figures in Tables 5 and 6 lend support to the Human Capital Model as an explanation for early entry into the NBA.

To empirically test Lazear's option value model, consider two groups: early entrants and four-year college entrants. The signal for the early entrant is expected to be noisier and riskier than for the four-year college performer. Thus we predict, when the cost of choosing a lemon falls, more early entrants will be selected. In the NBA, costs fell with both the CBA in 1995 and 1999. To test if option value matters, we focus on both the upper and lower tail of the distribution. In table 7 we focus on the lower tail and look at players who wash out of the NBA in their first four years. We find only one of the 31 early entrants from the 1989 through 1994 drafts failed to stay in the NBA for his first four years. For the 1995 through 1999 draftees, when rookie scale measures were in effect, six out of 58 early entrants failed to stay in the NBA for four years. This table lends support to the option value model.

To further test the impact of option value, we estimate an All-star equation to see if early entrants are more likely to be all-stars. All-star status is used because it is one measure of a player being in the upper tail of talent.

Consider the following equation:

$$AS = x\beta + \tau + \varepsilon,$$

where AS is all-star status and equals one if the NBA player is on the all-star team. $x\beta$ is a vector of explanatory variables where we specify three separate models. In all three specifications, we include Early Entry, which is a dummy equal to one if the player did not have a complete college career; Years in the league; Years in the league squared; height; weight; and white, a dummy variable equal to one if the player was white and equal to zero otherwise. The second specification also includes draft number. The third specification adds the efficiency measure. The models are estimated using a random effects probit model for a panel study. In our panel, we have 5132 observations on 1092 players. The panel length varies from 1 year to 13 years depending upon how long the player's career is and whether the panel is right or left censored. The average length of the panel is 4.7 years.

We report the results of the random effects probit in Table 8. In all specifications, the coefficient on years in the league is positive while years squared is negative. Both are statistically significant. This result supports the OJT hypothesis players gain human capital with increased experience in the league. The negative coefficient on years squared supports the hypothesis athletic skill declines with age.

When focusing on early entry, we find, in the first specification, the coefficient is positive and significant supporting the unraveling conjecture: in the pursuit of talent, teams draft future all-star players earlier. This lends support to the option value model: teams pursue players with upside potential. Early entry becomes insignificant, however, once we control for draft number. The coefficient on draft number is negative and significant, indicating the draft is efficient in sorting talent.

In the third specification, we also include the efficiency measure. The coefficient on efficiency is positive and significant, showing that skill is indeed important in determining all-star status. In this specification, draft number is negative and significant, while early entry is insignificant. Overall, the results tend to lend slight support to the option value model of unraveling in the labor market.

Section 3: Conclusions

Early entry in the NBA is becoming common. In 2003, the first pick in the NBA draft was a high school senior with no college experience, and 21 of the first 29 picks were not college seniors. We suggest early entry is a modified form of unraveling in a labor market as firms attempt to secure the most promising player and players wish to lengthen their careers. We also suggest the recent NBA contract, particularly the lowering of the fixed wage contract and lengthening of rookie contracts, has given firms limited the ability to pay for general human capital.

Our analysis shows players who enter early improve quicker and play fewer minutes in their first year than those with 4 years of college experience. Our results suggest teams in the pursuit of talent are willing to take players who are less skilled than in the past. With the addition of the fourth year option to the rookie scale, both teams and players have incentives for early entry in order for players to obtain additional skills on the job instead of in the NCAA. Our results also lend slight support to the option value hypothesis firms select players early to capitalize on upside potential. Lastly we suggest early entry is particularly true for young super-star athletes. With these players, teams not only capitalize on the rookie scale, but they also use the maximum salary-caps that limit superstar salaries. Thus, if a team captures a superstar early, it can exploit the economic rent from him for years.

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Table 1
Declared & Drafted Foreign & Early Entrants in the NBA (1976-2004)

Picks Per round*	Declared but Not Drafted					Year	First Round Picks					Second Round Picks				
	Early				FL		Early				FL	Early				FL
	HS	FR	SO	JR			HS	FR	SO	JR		HS	FR	SO	JR	
17			2	4		1976				4				1	2	
22				2		1977				3						
22			1			1978				4						
22						1979			2	1						
23				3		1980				1					2	
23						1981			1	2						
23		1		3		1982				9						
24						1983			1	4					1	
24				1		1984				4					3	
24				1		1985				5			1			
24				2		1986			2	3	1				1	
23				3		1987				2				1	1	
25		2				1988			1	2				2	1	
27		2	2	4		1989		1		2	1			1	1	
27				7		1990			2	1				1	3	
27			1	3		1991			1	3					2	1
27			2	10		1992				4						
27		5		7		1993		1	1	5						
27		1		6		1994			2	7			1		2	
29				5	1	1995**	1		4	5				2	1	
29	1	2	3	15		1996	2	2	2	7	5			1	3	
28	1		4	20	3	1997	1	1	2	5	1		1	3	1	5
29	2	2	5	8	2	1998	1	2	2	7	4	2			3	1
29	1	3	3	8	9	1999	2	2	7	3	2					3
29		2	6	10	13	2000	2	2	7	3	4			2	3	5
28	1	6	8	13	11	2001	4	4	5	6	4	1	2	2	3	3
28	3	6	9	16	10	2002	1	1	3	10	6		2	1	3	8
29	1	4	5	16	11	2003	4	2	1	5	8	1		2	1	12
30	4	3	5	22	24	2004	8	2	1	8	6		2	1		8

*In select cases the number of first round picks is different than the number of second round picks because teams were made to forfeit a draft pick for violation of league rules.
This data was complied from The Official NBA Encyclopedia, Third Edition and Patricia Bender's website, the official NBA website, sportsstats.com and various editions of the Official NBA Register. **In 1995 players were allowed to withdraw from the draft and return to school if no agent was signed.

Table 2
Average Age of First Round Draft Picks in NBA (1989-2004)

Year	Age/Number of Picks
2004	20.5/29
2003	20.9/29
2002	21.6/28
2001	20.6/28
2000	21.6/29
1999	21.3/29
1998	21.6/29
1997	22.0/28
1996	21.3/29
1995	22.0/29
1994	22.3/27
1993	22.5/27
1992	22.0/26
1991	22.4/26
1990	22.3/27
1989	22.4/27

Table 3: NBA Salary Regressions: 1997 & 2002

Variables/Year	1997	2002
Constant	13.11689 (88.008)	13.55396 (81.736)
Years of experience	0.251777 (7.751)	0.325304 (10.192)
Years of experience squared	-0.0148688 (-6.784)	-0.0169929 (-8.313)
Rookie scale	0.3188155 (1.992)	0.274006 (1.696)
Rookie Scale* Experience	-0.3412246 (-3.518)	-0.2460031 (-3.647)
Draft number	-0.0157093 (-8.344)	-0.0130085 (-5.568)
Points per game	0.046531 (3.742)	0.0400588 (3.232)
Rebounds per game	0.0781239 (3.595)	-0.0053695 (-0.200)
Assists per Game	0.1114124 (3.155)	0.001252 (0.031)
Steals per game	-0.2101413 (-1.894)	-0.0584586 (-0.487)
Blocks per game	0.2087753 (2.472)	0.2320798 (2.410)
Turnovers per game	-0.0614914 (-0.579)	0.1324582 (1.244)
Adjusted R-square Number of observations	.6174 398	.5991 389

Table 4

Rent Estimates of 1997 Rookies

Years of Experience	Estimated Salary (with rookie scale)	Estimated Salary (with no rookie scale)	Difference as Rent Estimate
0	$1,468,864	$1,067,895	$400,969
1	$1,832,149	$1,873,651	$-41,503
2	$2,049,281	$2,947,899	-$898,607
		Total	**-$539,141**

Rent Estimates of 2002 Rookies

Years of Experience	Estimated Salary (with rookie scale)	Estimated Salary (with no rookie scale)	Difference as Rent Estimate
0	$1,357,289	$1,031,990	$325,299
1	$1,588,022	$1,544,174	$43,848
2	$1,599,177	$1,988,716	-$389,539
3	$2,158,663	$3,433,189	$1,274,524
		Total	**-$1,294,917**

Table 5
Efficiency Index for NBA First round Picks in Their First Four Seasons*
(1987-2002)

	Season in NBA			
Years in College	1 mean eff. (stan. dev.) (N)	2 mean eff. (stan. dev.) (N)	3 mean eff (stan. dev.) (N)	4 mean eff. (stan. dev.) (N)
0	7.75 (5.26) (31)	10.86 (5.96) (20)	14.55 (7.38) (14)	17.61 (7.30) (12)
1	6.87 (4.96) (15)	9.90 (5.35) (11)	13.00 (6.06) (7)	16.55 (5.33) (5)
2	9.15 (6.51) (46)	12.74 (6.46) (39)	14.10 (6.36) (31)	13.78 (6.96) (24)
3	9.26 (5.37) (54)	12.12 (6.28) (49)	12.83 (6.50) (51)	14.04 (7.84) (50)
4	8.16 (5.44) (268)	10.04 (6.13) (260)	10.60 (6.48) (262)	11.94 (6.49) (236)

*This table includes foreign players. If foreign players who did not attend college in the U.S. are deleted from the population then the first row of the table becomes:

0	6.84 (4.02) (12)	11.21 (6.52) (8)	15.50 (8.09) (6)	20.07 (8.23) (5)

Table 6
Minutes Played Per Game for NBA First round Picks in Their First Four Seasons*
(1987-2002)

	Season in NBA			
Years in College	1 mean minutes (stan. dev.) (N)	2 mean minutes (stan. dev.) (N)	3 mean minutes (stan. dev.) (N)	4 mean minutes (stan. dev.) (N)
0	16.85 (8.21) (31)	22.36 (8.97) (20)	26.33 (10.78) (14)	29.7 (9.76) (12)
1	17.1 (10.41) (15)	21.69 (9.30) (11)	27.34 (10.4) (7)	32.17 (6.88) (5)
2	21.49 (12.15) (46)	27.58 (11.45) (39)	29.53 (9.62) (31)	29.7 (11.2) (24)
3	20.85 (9.44) (54)	25.19 (10.11) (49)	26.21 (10.13) (51)	27.14 (10.28) (50)
4	18.86 (9.82) (268)	21.87 (10.08) (260)	22.65 (10.38) (262)	24.66 (9.91) (236)

*This table includes foreign players. If foreign players who did not attend college in the U.S. are deleted from the population then the first row of the table becomes:

0	15.23 (7.3) (12)	23.11 (9.52) (8)	27.77 (11.4) (6)	32.32 (11.5) (5)

Table 7: First Round Draft Picks Survival through First Four Years

Draft Pick/ Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	*	*	*	*	*	*	*	*	*	*	*
2	*	*	*	*	*	*	*	*	*	*	*
3	*	*	*	*	*	*	*	*	*	*	*
4	*	*	*	*	*	*	*	*	*	*	*
5	*	*	*	*	*	*	*	*	*	*	*
6	*	*	*	*	*	*	*	*	*	*	*
7	*	*	*	*	*	*	*	*	*	*	*
8	*	*	*	*	*	*	X/4	*	*	*	*
9	*	*	*	*	*	*	X/4	*	*	*	*
10	*	*	*	*	*	*	*	*	*	*	*
11	*	*	*	*	*	*	*	*	*	*	X/4
12	*	*	*	*	*	*	*	*	*	*	X/2
13	X/4	*	*	*	*	*	*	*	*	*	*
14	*	X/4	*	*	X/4	*	*	*	*	*	*
15	*	*	*	*	*	*	*	*	*	*	X/F
16	*	*	*	*	*	*	*	*	*	*	*
17	*	*	*	*	*	*	*	*	X/4	*	X/4
18	*	*	X/4	*	X/2	*	*	*	X/F	X/F	*
19	X/4	*	X/4	*	*	*	*	*	*	*	X/4
20	X/4	X/4	X/4	*	*	*	*	*	X/4	*	*
21	*	*	X/4	*	*	*	*	X/3	X/4	*	*
22	X/4	*	X/4	*	*	*	X/4	*	X/4	*	*
23	X/4	*	*	*	*	*	*	X/F	*	*	*
24	*	*	*	*	*	*	*	*	X/4	*	*
25	X/4	*	X/4	*	*	*	*	X/F	X/4	*	X/4
26	*	X/4	X/4	X/4	X/4	*	X/4	*	X/4	X/4	X/4
27	X/4	*	*	*	X/4	X/4	X/3	X/4	*	*	*
28								X/1	X/4	X/2	*
29								*		*	X/0

- * means that the player lasted through first four seasons
- X means the player did not last through his first four seasons
- F indicate a foreign born player who did not attend college in the U.S.
- 0-4 indicates the years of college for players that did not survive

Table 8
All-Star Status in the NBA*
(1987-2002)

	Model 1	Model 2	Model 3
Constant	-9.50 (3.19)	.718 (0.27)	-5.44 (2.71)
Early Entrant	1.11 (5.20)	.117 (0.34)	.038 (0.23)
Years	.566 (9.31)	.531 (8.98)	.275 (4.32)
Years Squared	-.041 (9.22)	-.040 (9.40)	-.015 (3.71)
Height	.079 (1.47)	-.040 (0.98)	-.003 (0.10)
Weight	-.009 (1.30)	-.003 (0.55)	-.007 (1.79)
White	-.748 (3.26)	-.149 (0.60)	.165 (0.71)
Draft number	--	-.063 (8.50)	-.013 (2.40)
Efficiency	--		.290 (15.47)
Log likelihood	-710.29	-668.69	-411.14
Rho	.766	.700	.282

*Random effects probit model, number of observations 5132, number of groups 1092, observations per group range from 1 to 13 with the average 4.7.
**Absolute-value z-statistic in parenthesis.

[1] It would be straightforward to consider a situation in which $N \leq T$, but N is a random variable which can have values greater than T. Also, one could assume an individual who waits one year to enter the NBA reduces his expected work life by some amount δ, $0 \leq \delta \leq 1$. Such an assumption would have little effect on the theoretical results.

[2] For a high school graduate, the decision is whether to go to college for one year. The possibility of a high school dropout entering the league is ignored.

[3] If we allowed for discounting, a higher interest rate would increase the tendency for players to leave early.

[4] In some cases teams are allowed to pay a 12.5% increase to players with only two years or less tenure with the club if certain criteria are met.

[5] 9 million was the maximum allowable pay for a player with less than 7 years experience in 1999.

[6] Hendricks *et. al*., p.883.

[7] The term $\frac{\partial \pi}{\partial T} \frac{\partial T}{\partial \theta}$ is omitted from eq.(2) since $\frac{\partial \pi}{\partial T} = 0$ for a maximum of π (eq.(3)).

[8] The Cook-Weisberg test for heteroskedasticity was run for the regression equations in Table 5 and for the same regression model using salary instead of the log of salary. The chi-square statistic for the 1997 model was 582.04 for the linear model and 0.46 for the log-linear model; the chi-square statistic for the 2002 model was 189.62 for the linear model and 4.51 for the log-linear model.