A Comprehensive Analysis of the Escalation of Commitment in Professional Basketball

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Honors Essay
Economics
University of North Carolina

April 1, 2014

Approved:

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Abstract

Traditional economic theory suggests that decision makers should not allow sunk costs to shape future actions. However, empirical studies have found a commensurate relationship between sunk costs and future expenditures even when expected marginal costs exceed expected marginal benefits, an idea referred to as the “escalation of commitment.” With large sunk costs annually incurred through player drafts, executives in the high-stakes business of professional sports may be particularly prone to this irrational behavior. This research specifically examines teams’ personnel decisions in the National Basketball Association (NBA) to determine the prevalence of escalation in the league. This study finds evidence of escalation that is lower in magnitude and shorter in duration than in previous studies. While a player’s draft position continued to affect his playing time, this effect was limited to the first two years. Furthermore, draft position among first round players played a minimal, if any, role in a team’s decision to retain a player. However, under the 1999 Collective Bargaining Agreement, being drafted in the first round significantly increased a player’s chances of retainment. No such effect was seen under the 2005 CBA.

Acknowledgements

There are many people responsible for the success of this research. First and foremost, I would like to thank my advisor Dr. Rita Balaban for her support and guidance throughout the entire process. Beyond her role as my advisor, her instruction in Economics 101 sparked my interest in this discipline, and without that experience I would never have been given this opportunity. I would like to thank Dr. Geetha Vaidyanathan whose incredible management of the program and accessibility through the entire year made this thesis possible. I also would like to thank my parents who I cannot thank enough for their support throughout my education. Lastly, I would like to thank the entire student body who made the past four years extraordinary and unforgettable.

I. Introduction

Traditional economic theory suggests that decision makers should not allow sunk costs to shape future actions. To allow these costs to affect a decision is to commit the Sunk Cost Fallacy, an irrational action that empirically is quite common. From politics to managerial choices to everyday economic decisions, evidence of this fallacy can be found throughout many disciplines (Staw, 1997; Garland, Sandefur and Rogers, 1990). In fact even US Presidents have succumbed to this Fallacy. Both Lyndon B. Johnson and George W. Bush openly justified military action through previously incurred monetary and human costs (Staw, 1997; Manier, 2006). Examining this fallacy, studies have found a commensurate relationship between sunk costs and future expenditures in a failing project, an idea known as the “escalation of commitment” (Staw, 1976).

In professional sports, labor choices are among the most important managerial decisions (Késenne, 2007). With large sunk costs incurred through annual player drafts, executives in the high-stakes business of professional sports may be particularly prone to the escalation of commitment. Under the goals of maximizing wins and profits, the rational action would be to play the most productive and lucrative players. However, there is plenty of anecdotal evidence to suggest that this is not always the case. Every year disgruntled sports fans and expert commentators are perplexed by the various personnel decisions made by their favorite teams.

This research evaluates NBA teams’ personnel decisions to determine the prevalence of the escalation of commitment. In order to do so, the study considers the effects of draft position on playing time and likelihood to be retained. Since higher draft picks have higher salaries than those drafted behind them, higher picks incur larger sunk costs. With appropriate controls, if an individual’s draft position predicts playing time or retainment, NBA teams may be guilty of escalation of commitment.

The previous studies on this topic have not fully encompassed the recent theoretical literature, have not been updated through the past four Collective Bargaining Agreements (CBAs) and have not utilized the most accurate performance measures. Recent theoretical research has shown that there is often rational behavior behind what is ostensibly the escalation of commitment. This study is conducted in light of this new theory, and the models are updated to appropriately separate rational behavior from what is perceived as irrational decision making. Also, as the current research in the literature has examined data only through the 1991 draft, this analysis better explains the dynamics of the present-day NBA. Lastly, instead of using the simple performance measures in the previous studies, the models in this paper utilize advanced statistics such as John Hollinger’s Player Efficiency Rating and the Win Shares metric.

In addition to multivariate analysis, this study also employs a logistic model. Though Staw and Hoang (1995) completed an event series analysis, a logistic model should allow assessments on a year-to-year basis while eliminating issues in the interpretation of a survival analysis. This study anticipates that a careful consideration of the newest theory, along with improved models and a vastly different NBA salary environment, will lead to finding less evidence of escalation of commitment than what has been seen in previous studies. In effect, this study anticipates finding more rational behavior among NBA decision makers.

II. Literature Review

A. Theoretical Background

The recognition of the Sunk Cost Fallacy and its relevance to decision-making is not a new phenomenon. Beginning with Kahneman and Tversky (1979), traditional utility theory was challenged in favor of Prospect Theory which sought to illustrate decision making under risk. To begin this discussion, consider traditional utility theory where $u(x_i)$ is the utility of outcome x_i and p_i is the probability of its occurrence. The expected utility of a set of potential outcomes is calculated as follows:

(1) $U(x_1, p_1; \dots; x_n, p_n) = \sum_{i=1}^{n} p_i u(x_i)$.

Furthermore, a prospect is added to an asset class, w, when

(2) $u(w) + \sum_{i=1}^{n} p_i u(x_i) > u(w)$.

This equation shows that a prospect is considered when its expected utility is a net benefit.

Kahneman and Tversky (1979) found in many experiments that individuals undervalue possible opportunities and overvalue guarantees. Furthermore, individuals were risk loving with sure losses and risk averse with definite gains. These empirical findings can be incorporated into a value function. In this function, utility is replaced by value, v, which is a change in wealth relative to an initial reference point. The likelihood of occurrence,$\pi(p_i)$, denotes an empirically-derived decision weight. This weight accounts for how an individual arrives at a sense of likelihood, rather than in utility theory where it is a subjective probability. Thus a prospect is evaluated as follows:

(3) $V(x_1, p_1; \ldots; x_n, p_n) = \sum_{i=1}^{n} \pi(p_i) v(x_i)$.

Thaler (1980) outlined this value function over a gains and losses plane according to general premises backed by both economic and psychological principles. The value function is steeper over losses than it is over gains. This reflects the psychological principle that any given magnitude of value provides more aggravation when lost than it does pleasure when gained. Furthermore, the function is concave over gains and convex over losses to incorporate risk-loving behavior with losses and risk-averseness with gains. This also implies that an identical difference between two values is perceived differently depending on their magnitude. For example, moving from 0 to 10 is greater value than from 500 to 510. This phenomenon has consistently been shown with experiments and even observed in large settings such as the US stock market (Weber and Camerer, 1997).

In the context of this study, this may explain why teams are prone to the escalation of commitment with higher draft picks. Consider a recently drafted player who is described as $v(g) + v'(-c)$ with v'representing value in the losses plane. Thus a player has potential value of g and his salary and other costs are c. Only if his costs are greater than his gains is their "pain." Consider a team that is indifferent to playing a "free" player, meaning $v(g) = -v'(-c)$. Then, if a player incurs a salary, s, the value equation becomes $v(g) + v'\big(-(c+s)\big)$. Because of risk-loving behavior in the losses space, $v(g) + v'\big(-(c+s)\big) > v'(-s)$. Therefore, a team otherwise indifferent to a player is induced to play him because of his incurred costs. Since higher picks have lower initial points on the losses plane, there potentially is a relationship between pick and playing time. Figure 1 shows the value function defined by Thaler (1980).

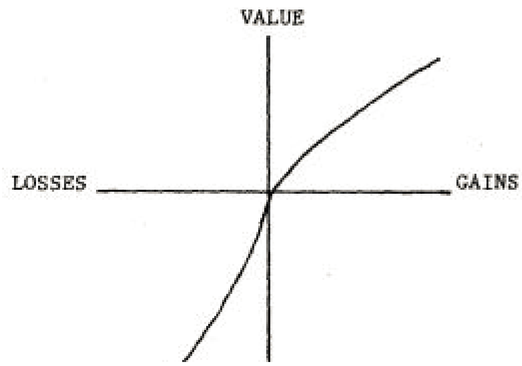

Figure 1: Value function as defined by Thaler (1980)

As for empirical studies, Arkes and Blumer (1985) examined the Sunk Cost Fallacy through a series of psychological experiments that studied individuals' decisions on events such as ski trips and movie theater showings. Overall they found that subjects were more likely to choose unsatisfying options with previously incurred costs over enjoyable alternatives with no incurred costs. Another experiment presented students with a managerial decision to invest in an incomplete project. In this study, they concluded a "greater tendency" to continue an endeavor once invested.

Furthermore, Boehne and Paese (2000) conducted a comprehensive set of experiments that presented subjects with varying degrees of completion and a "sales price" of a completed project. Though they found that individuals acted more rational than they did in the previous studies, they confirmed a "completion effect" where the closer individuals were to completing a project the more likely they were to continue with an endeavor (p. 178). In the NBA, if a young player is the "project," teams may believe higher picks are closer to "completion," or their expected career performance levels which could lead to increased playing time.

Re-evaluating the theoretical literature on sunk costs, McAfee, Mialon, and Mialon (2010) found that rational behavior often motivates the escalation of commitment. In their paper, they presented three general rational aspects to help explain the escalation of commitment. First, as sunk costs are correlated with future costs, they can shape expectations of future costs and reveal informational content of a project. This means that the aforementioned "completion effect" observed in previous studies actually can be rational.

To explain this, they present a simple two-period decision where C_i and p_i are the incurred costs and probability of completion in time period *i*. The completion cost, $\bar{C}$, is unknown and distributed according to a cumulative distribution function, $F(\bar{C})$. The cumulative hazard of investment is

(4) $p_2 = p_2(C_1, C_2) = \frac{F(C_1+C_2)-F(C_1)}{1-F(C_1)}$.

Therefore, because p_2 depends on C_1 it is rational to consider previously incurred costs when evaluating commitment in time period 2. Furthermore, with an increasing hazard rate in time period 1, the willingness to invest in time period 2 is positively related to sunk costs.

Second, under asymmetrical information, a manager may rationally continue a project in order to conceal that it was a failure and thus prevent reputation damages. In the NBA, after drafting a player higher than the general consensus expected, a team may play or keep a player to prevent its decision to appear wrong or ill-advised. Therefore, a change of a team's coach or general manager (GM), who are often teams' primary labor decision makers, may negatively affect a draft pick's playing time. This study incorporates this theory by introducing a dummy variable for a coach or team executive change. A player drafted high above his market value (i.e. higher than a third-party evaluation) may be played by a team to prevent from admitting it has made a mistake. In this sense, reputational "costs" manifest in decision makers' stubbornness and unwillingness to admit that the pick was unjustified.

Third, financial and time constraints can determine an individual's ability to undertake another project. As an individual's previous costs affect the ability to undertake a second option, budget constraints can cause an individual to continue with a current project. Empirically, Tan and Yates (2002) found that the prospect of overspending a budget actually deters the escalation of commitment. However, they also found that budgets can eschew the likelihood of undergoing beneficial investment opportunities. In the NBA, recent CBAs have reduced teams' commitments to high picks while rookie contracts have become a smaller part of teams' overall payrolls (Hill and Jolly, 2012). However a team may play a rookie simply because it is the only available option given its budget constraints and the talent distribution in the league.

B. Professional Sports Labor Market

To fully evaluate the escalation of commitment, the study must consider and ultimately assume certain motives behind NBA decision making. Zimbalist (2003) asserts that NBA owners may not strictly obey a profit-maximizing philosophy on a year-to-year basis but rather seek to maximize global and long-term returns. Berri, Brook and Schmidt (2004) found that wins maximize ticket sales in the NBA, not star power. For the purpose of this study it is assumed teams are profit-maximizers that value wins as their primary revenue-generators. It has been noted that external factors such as player popularity could motivate teams to play certain players. Though Staw and Hoang (1995) considered that this may affect a player's draft position and subsequent playing time, they assumed that any leftover popularity from college would soon dissipate and thus quickly become irrelevant to playing time decisions. Camerer and Weber (1998) recognized the potential effects of player popularity but were ultimately unable to find a metric that quantified a player's popularity. Since then Berri, Schmidt and Brook (2004) found that player popularity does not necessarily lead to increased ticket revenue. Ultimately, though individual popularity *may* cause increased revenue, this research maintains that a player's ability to "create" wins is paramount. For the ease of modeling, this study assumes that fans' affinities for certain players do not motivate playing decisions.

Furthermore, established sports economic theory suggests that the uncertainty of outcomes drives popularity (Keohane and Shmanske, 2012). As professional basketball has long experienced the lowest competitive balance of the four major North American leagues, the NBA has an incentive to promote team equality (Vrooman, 1995). Used in every major North American sports league, the reverse-order player draft is perhaps the most notable tool to increase competitive balance. Over the past 30 years, the league has instituted additional restrictions to increase its competitive balance, most notably a "soft" team salary cap in 1984. Overall, however, NBA salaries were governed by a loose set of restrictions prior to the 1995 CBA (Hill and Jolly, 2012).

In 1995 the NBA and the Player's Association instituted rookie scale contracts, providing guaranteed money in the first three years to all first round picks. Prior to the agreement, second round picks often were given the league minimum salaries, and this remained true under the 1995 CBA (Hill and Jolly, 2012). The 1999 CBA established a maximum salary for veteran players and granted a team option for the fourth year of a rookie contract. Though this CBA kept the rookie contract salary cap exemption, the scale amounts were lowered. In 2005 rookie contracts were shortened to two guaranteed years with a team option in both the third and fourth years. Though the 2011 CBA maintained rookie contracts in their 2005 form, CBAs have consistently lowered the costs of retaining young players perhaps motivated by their risky and unproven nature.

Hill and Groothius (2001) use the Median Voter Theorem to explain why individual salary caps were instituted in 1999. As top draft picks were often paid exorbitant amounts, this Theorem could be applied to explain why the Union initially approved of rookie scale contracts. Hill and Jolly (2012) attribute both the 1995 introduction of rookie contracts and the 1999 extension from three to four years to corresponding decreases in salary inequality. In particular, they found a significant economic rent shift from superstar rookies to veterans. Since rookies have become relatively cheaper and their associated sunk costs have become lesser in magnitude, theory predicts a decrease in escalation of commitment.

Given the draft's importance to improvement, teams have clear incentives to draft the best players and the ones most likely to produce wins. However, studies have concluded that professional sports teams are far from perfect at evaluating talent. Studying all major professional sports, Koz, Fraser-Thomas, and Baker (2011) found that draft position is a significant predictor of playing time but not a great predictor of performance. In the National Football League (NFL), Berri and Simmons (2011) concluded that teams are not very good at predicting quarterback performance. On the contrary, Boulier, Stekler, Coburn, and Rankins (2010) found that NFL teams are relatively successful at evaluating the future success of quarterbacks.

In the NBA, Berri, Brook and Fenn (2011) found overall inefficiency in the draft and that teams consider factors proven to be irrelevant to NBA production. In particular, collegiate scoring is among the most significant determinants of draft position. Also, players on Final Four teams saw their draft position jump by twelve spots on average. However, if players stayed in college for an additional year after reaching the Final Four, this effect dissipated. Furthermore, while a premium is placed on bigger players, shooting guards were taken lower and each year of aging led to a decline of six draft spots. For the sake of this study, it is important to understand that the market of NBA entrants may be inefficient. This inefficiency requires teams to re-evaluate their picks and continuously update their performance expectations, which provides the opportunity for escalation.

C. Previous Studies

Staw and Hoang (1995) conducted the initial research on the escalation of commitment in the NBA using data from the first five years of the players taken in the 1980-86 drafts. Using generic performance indexes and controlling for position, injury and trade, they found that draft position was a significant predictor of playing time in each of the first four years of players' careers. In addition, through an event history analysis, they found that draft position was a highly significant predictor of career longevity.

Camerer and Weber (1998) modified Staw and Hoang's models. First, to account for team environments they used backup player performance, instead of simply team winning percentage. If a pick's backup is unsatisfactory, then a team may have no other option but to play the draft pick. Second, recognizing that draft position may provide inherent expectations of a player's future productivity, they controlled with a third party pre-draft ranking. Third, to account for differences in costs between rounds, they controlled for the absence of guaranteed money in second round picks. Because second round picks are often paid less and given unguaranteed contracts, their incurred costs differ from the set guaranteed amounts of first rounders. Fourth, they included a pick-trade interaction variable. They asserted that if a player's draft position is no longer predictive after a trade then escalation by the prior team potentially occurred. As noted in the study, this premise requires evidence of de-escalation as evidence of prior escalation. Lastly, in addition to lagged performance variables, they also used contemporaneous and decomposed performance indices. Contrary to their hypothesis, evidence of escalation persisted. In fact, they found draft position to be a significant predictor through the first three years, only one year less than discovered by Staw and Hoang.

D. Advanced Performance Metrics

Both of these studies used three-category performance indices: “scoring”, “toughness” and “quickness.” From a basketball perspective, the comprehensive statistics employed in this study are well-regarded tools to evaluate performance. The first statistic used in this study is John Hollinger’s Player Efficiency Rating (PER). Using linear weights, this statistic utilizes the entire box score to evaluate a player’s ability on a per minute basis. Though PER incorporates positive and negative characteristics and controls for game environment, Berri and Bradbury (2010) note that it is not highly correlated with wins. Therefore this study also considers a second metric, the Win Shares statistic (WS). This metric measures a player’s marginal win product. Using both team and individual performance, the WS statistic computes a player’s addition to wins. As this study is conducted under the assumption that teams seek wins under a profit-maximizing environment, tying performance statistics to win production is a critical improvement. The computations of both statistics are available in Appendix A.

III. Econometric Model

In their study, Staw and Hoang (1995) proposed a simple multivariate model to estimate minutes played per season on a year-to-year basis (*t*= time in years). However, to account for the 2011 shortened season, the dependent variable was switched to minutes played per game. This model was employed to compare the data between the studies:

(5) $$Min_t = \beta_1 + \beta_2 S_{t-1} + \beta_3 T_{t-1} + \beta_4 Q_{t-1} + \beta_5 Inj_t + \beta_6 Tr_t + \beta_7 Win_t + \beta_8 Pos + \beta_9 D + \varepsilon_t$$

Min= minutes played per game

S= Scoring

T= Toughness

Q= Quickness

Inj= injury

Tr= trade

Win= team winning percentage

D= draft number

Pos= guard or forward/center

Camerer and Weber (1999) modified this regression:

(6) $$Min_t = \beta_1 + \beta_2 X_i + \beta_3 BS_{t-1} + \beta_4 BT_{t-1} + \beta_5 BQ_{t-1} + \beta_6 D * Tr_t + \beta_7 B + \beta_8 R + \varepsilon_t$$

X= vector of variables used in Model (1)

BS, BT, BQ= back-up player performance indices

B= belief, or third-party pre-draft evaluation of player's ability

R= draft round

In this study, the multivariate model is based off equation (6) and equation (7):

$$(7) \qquad Min_t = \beta_0 + \beta_1 P + \beta_2 T_t + \beta_3 I_t + \beta_4 C_t + \beta_5 B + \beta_6 Tr_t + \beta_7 R + \varepsilon_t$$

P= vector of lagged and contemporaneous performance measures (PER/WS)

T= vector of team performance measures (win percentage, offensive efficiency and defensive efficiency)

I= injury

C= head coach or general manager firing

B= third-party pre-draft evaluation

In this model a dummy variable for a head coach or general manager firing is included to address a potential reputational concern. If the predictive value of draft position diminishes after a coach or GM change then reputational "costs" could have motivated a player's playing time or survival on a team.

Though Staw and Hoang (1995) used an event history analysis, such an analysis is invalid. A fundamental assumption of this study is that draft pick is a proxy for a player's salary. As ensuing contracts are not necessarily related to draft position, this assumption is invalidated once the initial contract expires or is terminated. Even more troublesome, the same expectations that motivated a player's initial draft position may rationally motivate an ensuing contract given that the contracts, i.e. sunk costs, are indeterminate and may incur little commitment. Therefore, analyzing the effect of *pick* on survival can be misleading.

Instead of an event history analysis a logistic regression is used to analyze decision making on a year-to-year basis. Also, with consideration of the relevant CBA, this model evaluates how rookie scale contracts affect a team's decision to retain a player. The model is as follows:

(8) $$Ret_t = \beta_0 + \beta_1 Z + \varepsilon_t$$

Ret= whether a team elects to retain a player

Z= vector of player and team factors in Model 3 without Injury and Trade

Considering the aforementioned lockstep relationship between pick and salary for first round picks, Models (7) and (8) will consider both a sample limited to first round picks and a pooled sample. Furthermore, the first round sample will be separated by CBA to determine if the change in rookie contracts affected teams' behavior. Lastly, draft position will be removed from the equation to evaluate the sole effect of round. Though there is a lockstep salary structure for first round picks, the differences in amounts are not only relatively minor but exempt from the salary cap. Thus all first round picks may effectively incur equal commitment to teams. Therefore, *pick* is removed from the model to evaluate round's sole effect on retainment.

IV. Data

All of the individual and team data were obtained from www.basketball-reference.com with the exception of injury data which were extracted from www.prosportstransactions.com. The data consist of all players from the 1999-2008 draft classes. Variable definitions and descriptive statistics are available in Appendix B.

V. Results & Discussion

This study hypothesized that there would be no evidence of escalation with respect to playing time. Furthermore, *pick* would have no effect on a player's odds of retainment. To begin the study the data were analyzed using the same model as Staw and Hoang (1995). *Pick* was highly significant through Year 3 (p-value<.001) and remained significant (p-value<.05) through the sixth year. Among the control variables, *trade* and *injury* were significant through all six years. *Scoring* and *quickness* also were significant predictors of playing time. These results were quite similar to those found by Staw and Hoang. With R-squared values between .39 and .51, this model proved to be a slightly better fit than with Staw and Hoang whose R-squared values never exceeded .46.

Table 1: Staw and Hoang model with Performance Indexes[1]

Minutes per game	Year 2	Year 3	Year 4	Year 5	Year 6
Scoring	2.647***	4.000***	3.551***	1.513***	3.086***
	(.4614)	(.5346)	(.5911)	(.5304)	(.6072)
Toughness	0.336	1.240*	1.326	1.043	2.434**
	(.6262)	(.7163)	(.8369)	(.7738)	(.9911)
Quickness	1.745***	2.750***	2.010***	1.651***	2.849***
	(.4989)	(.5359)	(.5776)	(.6369)	(.6393)
Injury	-8.196***	-9.127***	-7.606***	-11.272***	-7.526***
	(.8854)	(.9198)	(.9818)	(1.0825)	(1.1240)
Trade	-4.502***	-4.620***	-4.698***	-5.854***	-2.888**
	(1.1057)	(.9477)	(.9861)	(1.0971)	(1.2248)
Position	-1.145	-0.970	-2.619*	-3.291**	-1.98
	(1.2608)	(1.4270)	(1.5515)	(1.6361)	(1.7288)
Team Success	-8.746***	-4.397	-1.045	-7.021**	-2.196
	(3.0232)	(3.0897)	(3.2922)	(3.4016)	(3.6456)
Pick	-0.251***	-0.169***	-0.071**	-0.077**	-0.079**
	(.0307)	(.0324)	(.0352)	(.0347)	(.0373)
Constant	29.200***	28.853***	27.215***	34.706***	29.019***
	(1.6377)	(1.8347)	(2.0777)	(2.3526)	(2.4478)
N	378	350	311	280	236
R-squared	0.4752	0.5117	0.3963	0.4437	0.3866
Adj. R-squared	0.4638	0.5003	0.3803	0.4273	0.365

Note: *** denotes p-value<.01;** <.05; and * <.1. Standard errors are in parentheses and *trade* is a two-side test.

As seen in Table 2, when the performance indexes were replaced with the advanced metric Win Shares, the model performed slightly worse. Compared to the Table 1 results, *pick* was greater in magnitude and was more significant in the later years. *Injury*, *trade* and *team*

[1] The regressions begin with Year 2 because of the lagged performance variable. Also, as the 2013-2014 season marks the sixth year for the 2008 class, these players were excluded from all of the Year 6 regressions.

success had similar effects. Interestingly, unlike the initial model, *position* had a highly significant negative coefficient, suggesting that guards experienced more playing time. In the initial model *toughness* accounted for forward/center qualities (rebounds and blocks) and *quickness* consisted of guard statistics (assists and steals). These performance indexes could have absorbed the explanatory power provided by *position* in the Win Shares model. As seen in Table 3, when the linear-weighted PER metric was used, *pick* was highly significant through Year 3, and was significant at the 5% level in Year 4.

Table 2: Staw and Hoang model with Win Shares

Minutes per game	Year 2	Year 3	Year 4	Year 5	Year 6
Win Shares	41.489***	31.134***	43.640***	11.074**	57.275***
	(5.8217)	(4.9680)	(7.2690)	(4.8550)	(10.7080)
Injury	-8.147***	-9.015***	-7.710***	-11.335***	-7.529***
	(.8763)	(.9630)	(.9940)	(1.0920)	(1.1660)
Trade	-2.985**	-5.264***	-4.429***	-6.661***	-3.669***
	(1.1267)	(.9880)	(1.0210)	(1.0820)	(1.2450)
Position	-4.238***	-3.727***	-4.351***	-4.107***	-3.404***
	(.8963)	(.9480)	(.9720)	(.9870)	(1.1060)
Team Success	-9.890***	-3.406	-3.364	-8.603**	-5.892
	(2.9857)	(3.2200)	(3.4000)	(3.4030)	(3.8610)
Pick	-0.2801***	-0.219***	-0.124***	-0.096***	-0.091**
	(.0299)	(.0340)	(.0350)	(.0350)	(.0380)
Constant	29.515***	28.982***	26.789***	35.903***	26.447***
	(1.6019)	(1.9090)	(2.0750)	(2.2520)	(2.6520)
N	378	350	311	280	236
R-squared	0.4816	0.4586	0.3719	0.4215	0.3371
Adj. R-squared	0.4733	0.4491	0.3595	0.4088	0.3197

Note: *** denotes p-value<.01;** <.05; and * <.1. Standard errors are in parentheses and *trade* is a two-side test.

Altogether, substituting advanced performance metrics into the Staw and Hoang model did not drastically change the results. The results from the PER model deviated from the previous studies as *pick*'s level of significance diminished after Year 3. However, *pick* remained significant through Year 5. Moreover, the adjusted R-squared values were consistently higher for the PER model. To limit redundancy in the other models, PER was the only performance statistic used going forward.

Table 3: Staw and Hoang model with PER

Minutes per game	Year 2	Year 3	Year 4	Year 5	Year 6
PER	0.801***	1.018***	0.899***	0.643***	1.052***
	(0.1015)	(0.1111)	(0.1173)	(0.1185)	(0.1301)
Injury	-7.831***	-8.642***	-7.168***	-11.141***	-7.119***
	(.8680)	(.9135)	(.9643)	(1.0462)	(1.0923)
Trade	-3.642***	-4.329***	-3.895***	-4.942***	-2.127
	(1.0912)	(.9460)	(.9928)	(1.0939)	(1.1953)
Position	-3.926***	-4.074***	-4.588***	-4.285***	-3.178***
	(.8714)	-(.8982)	-(.9398)	-(.9472)	(1.0237)
Team Success	-7.669***	-3.428	-1.486	-7.517**	2.479
	(2.9369)	(3.0466)	(3.2403)	(3.2649)	(3.5302)
Pick	-0.245***	-0.168***	-0.069**	-0.066*	-0.051
	(.0300)	(.0321)	(.0345)	(.0340)	(.0362)
Constant	20.304***	16.517***	15.435***	25.095***	12.692
	(2.0551)	(2.3964)	(2.6774)	(3.0417)	(3.2957)
N	378	350	311	280	236
R-squared	0.4953	0.5153	0.4113	0.4679	0.4198
Adj. R-squared	0.4872	0.5068	0.3997	0.4562	0.4046

Note: *** denotes p-value<.01;** <.05; and * <.1. Standard errors are in parentheses and *trade* is a two-side test.

After using the Staw and Hoang model, the study switched to the modified model in Equation (7). As seen in Table 4, *pick* remained significant in Years 2 and 3 and was significant at the 10% level in Year 5. However, the controls for reputational costs, informational value and contract differences between rounds resulted in slightly smaller *pick* coefficients. As for the additional controls, *round* was only significant in Year 3 while *belief* was significant in Years 2, 3 and 6. Both of these findings are contrary to Camerer and Weber (1999) who found that *belief* and *round* were irrelevant. Given that their sample was prior to the institution of the Rookie Scale contract, *round* may have become important once first round picks were mandated guaranteed money. The *reputation* coefficient was positively significant in Year 6 and insignificant in all other years. The positive relationship, which suggests that a coach or executive change increases playing time, was contrary to expectations. Compared to the previous model, the adjusted R-squared values were higher in all years, except in Year 4 when it was slightly lower.

Team decision makers undoubtedly continuously update their expectations of players. To account for this reality, controls for lagged and contemporaneous performance were added to the model. As displayed in Table 5, *pick* was significant only in Year 2. Contemporaneous *PER* was significant in all years, but lagged *PER* was largely insignificant after Year 3, possibly due to multicollinearity. As the adjusted R-squared values were higher than in the other regressions, the lagged and contemporaneous measures provided explanatory power.

Table 4: Modified model controlling for reputation concerns, informational content and first-round guaranteed money

Minutes per game	Year 2	Year 3	Year 4	Year 5	Year 6
PER	0.7475***	0.9309***	0.8994***	0.6229***	1.0282***
	(.1012)	(.1129)	(.1191)	(.1194)	(.1272)
Injury	-7.4227***	-8.7761***	-7.2322***	-11.2825***	-6.8312***
	(.8606)	(.9079)	(.9714)	(1.0483)	(1.0704)
Trade	-3.9637***	-4.8344***	-3.8875***	-4.7946***	-1.7670
	(1.0829)	(.9451)	(1.0015)	(1.0923)	(1.1649)
Position	-4.2639***	-4.2835***	-4.6269***	-4.3505***	-3.2357***
	(.8693)	(.8941)	(.9583)	(.9501)	(1.0014)
Team Winning	-36.1397***	-11.4161	-2.0082	-19.4236	14.2697
	(12.1019)	(12.7941)	(13.0145)	(12.7796)	(14.2971)
Team Offense	0.9323**	0.3510	-0.0571	0.4719	-0.3939
	(.3863)	(.4193)	(.4196)	(.4143)	(.4595)
Team Defense	-0.9797**	-0.1739	-0.1387	-0.3703	0.5487
	(.3921)	(.4054)	(.4161)	(.4111)	(.4474)
Round	-3.2143**	-3.6619**	0.7769	-3.0259	-1.6937
	(1.6161)	(1.7330)	(1.8111)	(1.9094)	(1.9325)
Belief	-0.1294***	-0.1225***	-0.0061	0.0114	-0.1657***
	(.0416)	(.0446)	(.0480)	(.0497)	(.0528)
Reputation	0.0195	-0.3016	0.6932	2.1472	3.6653**
	(.8520)	(.9337)	(1.0052)	(1.3609)	(1.5627)
Pick	-0.2126***	-0.1444**	-0.0367	-0.1484*	0.0842
	(.0645)	(.0690)	(.0745)	(.0771)	(.0780)
Constant	44.9137***	8.4366	34.9513*	22.3485	-13.1957
	(17.0910)	(17.3502)	(20.7182)	(20.7320)	(25.5668)
N	378	350	311	280	236
R-squared	0.5185	0.5339	0.4149	0.4813	0.4671
Adj. R-squared	0.5041	0.5187	0.3934	0.4600	0.4409

Note: *** denotes p-value<.01;** <.05; and * <.1. Standard errors are in parentheses and *trade* is a two-side test.

Table 5: Modified model with lagged and contemporaneous performance

Minutes per game	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
PER Year 1	0.6703***	0.4897***	0.1621	0.0169	0.3554**	0.2075
	(.0775)	(.1049)	(.1245)	(.1478)	(.1532)	(.1586)
PER Year 2		0.5725***	0.2271*	0.1885	-0.0194	0.1086
		(.0920)	(.1251)	(.1739)	(.1863)	(.2066)
PER Year 3			1.0637***	0.244	0.0379	-0.077
			(.1118)	(.1726)	(.1961)	(.2143)
PER Year 4				0.7109***	0.1599	0.1898
				(.1401)	(.1662)	(.1862)
PER Year 5					0.5623***	0.1541
					(.1419)	(.2046)
PER Year 6						0.8576***
						(.1872)
Injury	-5.2795***	-7.1267***	-7.3975***	-6.6431***	-11.0290***	-6.8336***
	(.6680)	(.8208)	(.8310)	(.9717)	(1.0599)	(1.0462)
Trade	-0.9164	-3.3763***	-3.6666***	-3.5822***	-3.9342***	-0.4593
	(1.7531)	(1.0354)	(.8626)	(.9774)	(1.0812)	(1.1562)
Position	-2.6198***	-4.5536***	-6.0686***	-5.3035***	-5.8455***	-2.9410***
	(.7036)	(.8290)	(.8142)	(.9511)	(.9594)	(1.0500)
Team Success	-6.0603	-32.9696***	-7.3887	-1.9629	-24.6716*	20.1674
	(9.6609)	(11.5341)	(11.5175)	(12.7943)	(13.4615)	(14.4175)
Team Offense	-0.4242	0.7634**	-0.0337	-0.0165	0.5898	-0.6274
	(.3042)	(.3688)	(.3756)	(.4141)	(.4385)	(.4600)
Team Defense	0.2054	-0.8583**	-0.1222	-0.1083	-0.4487	0.766*
	(.3076)	(.3738)	(.3643)	(.4070)	(.4286)	(.4487)
Round	-1.7802	-2.3443	-2.7165*	0.4532	-4.0676**	-1.1349
	(1.2678)	(1.5451)	(1.5457)	(1.8494)	(1.9267)	(1.9916)
Belief	-0.0979***	-0.1075***	-0.0902**	0.0265	-0.015	-0.0959
	(.0315)	(.0398)	(.0404)	(.0503)	(.0509)	(.0557)
Reputation	-0.5539	-0.1133	-0.3627	0.7988	1.748	2.8731
	(.8848)	(.8115)	(.8399)	(1.0088)	(1.4022)	(1.7790)
Pick	-0.1911***	-0.1931***	-0.0744	-0.0574	-0.1158	0.0302
	(.0487)	(.0615)	(.0622)	(.0762)	(.0778)	(.0800)
Constant	40.6754***	42.347**	31.5023*	23.5446	15.5089	-20.6921
	(13.3123)	(16.2784)	(16.0177)	(20.4796)	(20.7840)	(25.2034)
N	430	378	329	280	245	203
R-squared	0.5677	0.5647	0.6566	0.4848	0.5757	0.5797
Adj. R-squared	0.5564	0.5504	0.6424	0.4576	0.5479	0.5436

Note: *** denotes p-value<.01;** <.05; and * <.1. Standard errors are in parentheses and *trade* is a two-side test.

As previously discussed, due to rookie scale contracts, *pick* is only a perfect proxy for salary during the first four years among first round picks. Therefore, the sample was limited only to first rounders. As seen in Table 6, *pick* was insignificant after Year 2. Contemporaneous PER was generally significant but the effects of lagged PER were mostly indeterminate. In Year 2 and Year 4 the adjusted R-squared values were higher than with all players while it was slightly lower in Year 3. Altogether, the additional controls and cumulative performance measures led to decreased evidence of escalation. In fact there was little evidence to suggest escalation past Year 2. However, limiting the sample to first round picks did not drastically change the results.

Switching to the logistic model to evaluate player retainment resulted in largely indeterminate effects of *pick*. With the exception of Year 3 under the 1999 CBA where it was significant at the 10% level, *pick* was insignificant. As seen in Table 7, the sample was split by CBA to determine if the decrease in commitment to first rounders from three years in the 1999 CBA to two years in the 2005 CBA affected teams' decisions. Similar to the multivariate regression, contemporaneous performance affected playing time but prior performance was not significant. Contrary to expectations, *reputation* was positively significant in Years 2 and 3 under the 2005 CBA and in Year 4 under the 1999 CBA, suggesting that a decision maker change led to an increased chance of retainment. The pseudo R-squared values were consistently higher for the 1999 CBA but never exceeded .25.

Table 6: Multivariate model only with first round picks

Minutes per game	Year 1	Year 2	Year 3	Year 4
PER Year 1	0.8157***	0.3608***	0.2061	-0.0532
	(.1036)	(.1337)	(.1572)	(.1740)
PER Year 2		0.9688***	0.2008	0.2407
		(.1322)	(.1649)	(.2098)
PER Year 3			0.9912***	-0.0518
			(.1409)	(.2055)
PER Year 4				1.0441***
				(.1878)
Injury	-5.8703***	-8.1109***	-8.3712***	-6.6449***
	(.8905)	(.9349)	(1.0094)	(1.0669)
Trade	2.0854	-2.3973	-4.6787***	-2.7145**
	(3.0357)	(1.3380)	(1.0384)	(1.1179)
Position	-3.6230***	-5.3995***	-5.3399***	-4.6777***
	(.8698)	(.9438)	(.9753)	(1.0579)
Team Success	-2.903	-31.9135**	-8.0438	0.3216
	(12.7127)	(13.1928)	(13.3256)	(14.2115)
Team Offense	-0.6906*	0.6866	0.0488	0.0246
	(.4036)	(.4204)	(.4424)	(.4599)
Team Defense	0.2719	-0.8678**	-0.1328	0.0022
	(.4075)	(.4306)	(.4283)	(.4556)
Belief	-0.1377**	-0.1381**	-0.1191*	0.1228
	(.0544)	(.0574)	(.0620)	(.0772)
Reputation	-0.1537	-0.2205	-0.3127	1.7815
	(1.1798)	(.9097)	(1.0083)	(1.1375)
CBA	1.3299	-0.278	0.3578	-1.3255
	(.9972)	(1.0617)	(1.1343)	(1.1178)
Pick	-0.2181***	-0.1856**	-0.0501	-0.1667
	(.0804)	(.0831)	(.0888)	(.1080)
Constant	57.5421***	46.0196**	22.6661	5.5795
	(19.6414)	(21.3058)	(22.6740)	(23.2563)
N	271	263	242	215
R-squared	0.5978	0.6288	0.6524	0.5203
Adj. R-squared	0.5807	0.611	0.6325	0.4867

Note: *** denotes p-value<.01;** <.05; and * <.1. Standard errors are in parentheses and *trade* is a two-side test.

Table 7: Logistic model separated by CBA

Retained by draft team	Year 2		Year 3		Year 4	
	1999 CBA	2005 CBA	1999 CBA	2005 CBA	1999 CBA	2005 CBA
PER Year 1	0.1429***	0.0495	0.0561	0.0658	0.0715	-0.0217
	(.0433)	(.0427)	(.0510)	(.0465)	(.0543)	(.0691)
PER Year 2			0.2082***	0.0428	0.0506	0.1228
			(.0516)	(.0370)	(.0582)	(.0750)
PER Year 3					0.2001***	0.0778
					(.0574)	(.0728)
Position	0.8626**	0.5984	0.4145	0.5498	0.0747	-0.2048
	(.3912)	(.4586)	(.3579)	(.3847)	(.3688)	(.4582)
Team Success	-3.0100	-3.7212	-1.5216	4.3249	5.0906	-0.9894
	(5.5982)	(5.2579)	(4.7362)	(5.6058)	(5.0555)	(6.2091)
Team Offense	0.1194	0.0653	0.1206	-0.0680	-0.1402	0.1064
	(.1785)	(.1648)	(.1543)	(.1746)	(.1625)	(.2037)
Team Defense	-0.2135	-0.1739	-0.1076	0.0283	0.0861	-0.2239
	(.1851)	(.1692)	(.1526)	(.1891)	(.1541)	(.1998)
Round	1.1696*	0.6390	1.7648**	-0.2138	0.9766*	-1.4463
	(.6482)	(.7347)	(.6968)	(.7076)	(.7165)	(.8610)
Belief	0.0163	-0.0184	0.0606***	-0.0084	0.0252	-0.0119
	(.0148)	(.0176)	(.0187)	(.0196)	(.0181)	(.0240)
Reputation	0.2915	0.9707**	-0.1953	0.9466**	0.1778*	0.9501*
	(.3453)	(.4542)	(.3506)	(.4013)	(.3664)	(.5374)
Pick	-0.0344	-0.0128	-0.0533*	-0.0345	-0.0211	-0.05
	(.0238)	(.0278)	(.0275)	(.0298)	(.0287)	(.0358)
Constant	10.2734	14.0127	-5.1622	1.3391	-2.4036	12.1265
	(7.7964)	(10.7675)	(6.9002)	(11.2719)	(7.5709)	(12.7470)
N	248	182	219	159	193	136
Pseudo R-squared	0.2196	0.1926	0.2482	0.1444	0.2273	0.1842

Note: *** denotes p-value<.01;** <.05; and * <.1. Standard errors are in parentheses and *trade* is a two-side test.

As seen in Table 8, the CBA samples were pooled together and the sample was limited to first round picks. With this limitation, the model was only significant at the 10% level in Year 2 (prob>chi2=.0835) but was highly significant thereafter. However, the pseudo R-squared values were lower than when both rounds were included. *Pick* was significant at the 10% level in Year 3, but there was no significant effect of *CBA*. Altogether, *pick'*s reduced significance and lack of significance past Year 2 in the multivariate regression (Table 6) suggest little escalation among first round players.

Table 8: Logistic model with only first round picks

Retained by draft team	Year 2	Year 3	Year 4
PER Year 1	0.1376***	0.0409	0.0347
	(.0452)	(.0435)	(.0505)
PER Year 2		0.1783***	0.1027*
		(.0461)	(.0554)
PER Year 3			0.1543***
			(.0515)
Position	-0.0330	0.1213	-0.2422
	(.3840)	(.3133)	(.3173)
Team Success	-1.1186	-1.9843	4.0425
	(5.5147)	(4.2822)	(4.2299)
Team Offense	0.0685	0.1086	-0.1329
	(.1761)	(.1380)	(.1377)
Team Defense	-0.0484	-0.1400	0.0721
	(.1794)	(.1382)	(.1346)
Belief	0.0094	0.0304	0.0128
	(.0231)	(.0192)	(.0195)
Reputation	0.5951	0.6573**	0.4503
	(.3763)	(.3056)	(.3287)
Pick	-0.0721	-0.2407*	-0.3523
	(.4269)	(.3480)	(.3726)
CBA	-0.0244	-0.0473	-0.0299
	(.0334)	(.0275)	(.0286)
Constant	-1.3154	1.981	0.4375
	(8.3425)	(6.8956)	(7.4621)
N	271	263	242
Pseudo R-squared	0.0674	0.1489	.1786

Note: *** denotes p-value<.01;** <.05; and * <.1. Standard errors are in parentheses and *trade* is a two-side test.

As mentioned earlier, rookie scale contracts are not only a relatively small part of a team's payroll, but they are also exempt from the salary cap. Therefore, it is possible that the differences in first round salaries are relatively minor, and thus commitment among all first round players is effectively equal. If this is assumed true, escalation could still exist if *round* affects retainment. As seen in Table 9, when *pick* was removed, *round* was significant in all years under the 1999 CBA but was never significant under the 2005 CBA. These results suggest that being drafted in the first round affected chances of survival under the 1999 CBA but did not affect odds of retainment under the 2005 CBA. As previously mentioned, the 1999 CBA guaranteed three year contracts to first rounders while the 2005 CBA guaranteed two years. The results indicate that first round picks under the 1999 CBA were more likely than second round players to be retained through their guaranteed years. Furthermore, first round picks also were more likely to be retained for their optional fourth year. However, since there was no proportionate decrease in escalation under the 2005 CBA, there is little evidence to suggest that the change in the CBA affected the retainment of first round players.

Table 9: Logistic model without Pick variable separated by CBA

Retained by draft team	**Year 2**		**Year 3**		**Year 4**	
	1999 CBA	2005 CBA	1999 CBA	2005 CBA	1999 CBA	2005 CBA
PER Year 1	0.1431***	0.0502	0.0615	0.0678	0.071	-0.0252
	(.0430)	(.0427)	(.0509)	(.0463)	(.0544)	(.0690)
PER Year 2			0.2046***	0.0471	0.0475	0.1153
			(.0514)	(.0368)	(.0580)	(.0744)
PER Year 3					0.2060***	0.097
					(.0570)	(.0710)
Position	0.8506**	0.6376	0.3985	0.6289*	0.0539	-0.1086
	(.3897)	(.4517)	(.3546)	(.3783)	(.3670)	(.4450)
Team Success	-3.8032	-3.8498	-2.2913	4.8546	5.1827	-1.8596
	(5.5113)	(5.2565)	(4.6867)	(5.4928)	(5.0434)	(6.1371)
Team Offense	0.1322	0.0613	0.1307	-0.0944	-0.1477	0.1278
	(.1765)	(.1643)	(.1528)	(.1708)	(.1618)	(.2014)
Team Defense	-0.23	-0.1783	-0.1095	0.0401	0.0894	-0.2381
	(.1828)	(.1691)	(.1522)	(.1861)	(.1538)	(.1996)
Belief	0.0074	-0.0225	0.0413***	-0.0229	0.0173	-0.0338*
	(.0133)	(.0152)	(.0150)	(.0152)	(.0145)	(.0185)
Reputation	0.2403	0.9441**	-0.2106	0.9187**	0.1486	0.8449
	(.3402)	(.4497)	(.3489)	(.3977)	(.3642)	(.5261)
Round	1.8244***	0.8689	2.6018***	0.3299	1.2988**	-0.5988
	(.4755)	(.5411)	(.5586)	(.5328)	(.5714)	(.6040)
Constant	10.047	14.6021	-6.9408	1.7236	-2.522	10.4605
	(7.7380)	(10.7062)	(6.8314)	(11.1930)	(7.5800)	(12.6076)
N	248	182	219	159	193	136
Pseudo R-squared	0.2125	0.1916	0.2353	0.1383	0.2252	0.1732

Note: *** denotes p-value<.01;** <.05; and * <.1. Standard errors are in parentheses and *trade* is a two-side test.

VI. Conclusion

By incorporating recent theoretical literature and considering the current NBA labor environment, this study predicted that there would be evidence of little, if any, escalation of commitment. Furthermore, it sought to improve the data sample by limiting it to observations where draft position was predictably related to salary, i.e. "commitment." Rejecting the suitability of an event history analysis, this study employed a logistic model designed to offer insight not provided by the previous studies. The study predicted that while draft pick may lead to increased playing time, escalation would not exist if draft position did not affect teams' decisions to retain their young players. If this hypothesis proved correct, escalation of commitment would be rejected.

In this study cumulative performance measures and additional controls not only provided more predictive power of playing time and retainment but also reduced *pick*'s effects. However, a coach or GM change did not lead to less escalation and thus there was no evidence of reputational concerns. In fact, on many occurrences there was evidence that an executive change positively affected a player's odds of survival and playing time. In accordance with expectations, when the sample was limited to the first round, *pick* lost much of its predictive value which suggests that team behavior is similar among first round players. In the multivariate model there was a significant effect only in Year 2 and only at the 5% level. Furthermore, the logistic model provided no direct relationship between *pick* and probability of retainment. However, under the 1999 CBA guaranteed money increased not only the likelihood of retainment during the guaranteed years but also increased the likelihood of offering a team option in Year 4. Under the 2005 CBA no such effects were found.

Reference List

Arkes, H. R., & Blumer, C. (1985). The psychology of sunk cost. *Organizational Behavior and Human Decision Processes*,*35*(1), 124–140.

Berri, D. J. (2000). Who is the "Most Valuable"? Measuring the Player's Production of Wins in the National Basketball Association. Managerial and Decision Economics, 20(8), 411–427.

Berri, D. J., & Bradbury, J. C. (2010). Working in the Land of the Metricians. Journal of Sports Economics, 11(1), 29–47.

Berri, D. J., Brook, S. L., & Fenn, A. J. (2011). From college to the pros: predicting the NBA amateur player draft. *Journal of Productivity Analysis*, *35*(1), 25–35.

Berri, D. J., Schmidt, M. B., & Brook, S. L. (2004). Stars at the Gate: The Impact of Star Power on NBA Gate Revenues. Journal of Sports Economics, 5(1), 33–50.

Berri, D. J., & Simmons, R. (2011). Catching a draft: on the process of selecting quarterbacks in the National Football League amateur draft. *Journal of Productivity Analysis*, *35*(1), 37–49.

Boehne, D., & Paese, P. (2000). Deciding Whether to Complete or Terminate an Unfinished Project: A Strong Test of the Project Completion Hypothesis. Organizational Behavior and Human Decision Processes, 81(2), 178–194.

Boulier, B. L., Stekler, H. O., Coburn, J., & Rankins, T. (2010). Evaluating National Football League draft choices: The passing game. *International Journal of Forecasting*, *26*(3), 589–605.

Camerer, C. F., & Weber, R. A. (1999). The econometrics and behavioral economics of escalation of commitment: a re-examination of Staw and Hoang's NBA data. *Journal of Economic Behavior & Organization*, *39*, 59–82.

Chen, A. (2013, May 11). How the Mind and Body React to Watching Big Games; Tracking Heart Attack Rates After the Super Bowl. The Wall Street Journal.

Coon, L. (2013). *NBA Salary Cap FAQ*. Retrieved from http://www.cbafaq.com/salarycap.htm

Fort, R., & Quirk, J. (2004). Owner Objectives and Competitive Balance. *Journal of Sports Economics*, *5*(1), 20–32.

Frick, B. (2010). Management Abilities, Player Salaries and Team Performance. S. Rosner & K. L. Shropshire (Eds.), The Business of Sports (pp. 285–289). Sudbury: Jones & Bartlett Learning.

Garland, H., Sandefur, C. A., & Rogers, A. C. (1990). De-escalation of commitment in oil exploration: When sunk costs and negative feedback coincide. Journal Of Applied Psychology, 75(6), 721-727.

Hakes, J. K., & Sauer, R. D. (2006). An Economic Evaluation of the Moneyball Hypothesis. The Journal of Economic Perspectives, 20(3), 173–185.

Hill, J. R., & Groothuis, P. A. (2001). The New NBA Collective Bargaining Agreement, the Median Voter Model, and a Robin Hood Rent Redistribution. Journal of Sports Economics, 2(2), 131–144.

Hill, J. R., & Jolly, N. A. (2012). Salary Distribution and Collective Bargaining Agreements: A Case Study of the NBA. Industrial Relations, 51(2), 342–363.

Kahane, L. H. (2012). The Oxford handbook of sports economics. Oxford ;New York: Oxford University Press.

Kahneman, D., & Tversky, A. (1979). Prospect theory: an analysis of decision under risk. *Econometrics: Journal of the Econometric Society*, *47*(2), 263–192.

Keohane, L. H., & Shmanske, S. (2012). *The economics of sports*. New York: Oxford University Press.

Késenne, S. (2007). The economic theory of professional team sports : an analytical treatment. Cheltenham, UK ;Northampton, MA: Edward Elgar

Késenne, S. (2000). The Impact of Salary Caps in Professional Team Sports. Scottish Journal of Political Economy, 47(4), 422–430.

Koz, D., Fraser-Thomas, J. and Baker, J. (2012). Accuracy of professional sports drafts in predicting career potential. *Scandinavian Journal of Medicine & Science in Sports*, 22, 64–69.

Lowe, Z. (2013). *32 Bold Predictions for the NBA Season*. Retrieved from http://www.grantland.com/story/_/id/9860683/32-bold-predictions-2013-14-nba-season

Manier, J. (2006, October 29). The Sunk Cost Fallacy and Iraq. The Chicago Tribune.

McAfee, R. P., Mialon, H. M., & Mialon, S. H. (2010). Do Sunk Costs Matter? *Economic Inquiry*, *48*(2), 323–336.

Staw, B. M. (2002). The escalation of commitment: update and appraisal. Z. Shapira (Ed.), Organizational Decision Making (pp. 191–212). Cambridge: Cambridge University Press.

Staw, B. M. (1976). Knee-deep in the big muddy: a study of escalating commitment to a chosen course of action. Organizational Behavior and Human Performance, 16(1), 27–44.

Staw, B. M., & Hoang, H. (1995). Sunk Costs in the NBA: Why Draft Order Affects Playing Time and Survival in Professional Basketball. *Administrative Science Quarterly*, *40*(3), 474–494.

Szymanski, S., & Kesenne, S. (2004). Competitive balance and gate revenue sharing in team sports. The Journal of Industrial Relations, 52(1), 165–177.

Tan, H.-T., & Yates, J. F. (2002). Financial Budgets and Escalation Effects. Organizational Behavior and Human Decision Processes, 87(2), 300–322.

Thaler, R. (1980). Toward a positive theory of consumer choice. Journal of Economic Behavior & Organization, 1(1)

Vrooman, J. (1995). A General Theory of Professional Sports Leagues. Southern Economic Journal, 61(4), 971–990.

Weber, M., & Camerer, C. F. (1998). The disposition effect in securities trading: an experimental analysis. Journal of Economic Behavior & Organization, 33(2), 167–184.

Zimbalist, A. (2003). Sport as Business. Oxford Review of Economic Policy, 19(4), 503–511.

Appendix A

1. The Player Efficiency Rating is calculated as follows:

$$\boldsymbol{uPER} = \left(\frac{1}{MP}\right) \times \left[3P + \left(\frac{2}{3}\right) \times AST + (2 - factor \times \left(\frac{tmAST}{tmFG}\right) \times FG + \left(FT \times 0.5 * \left(1 + \left(1 - \left(\frac{tmAST}{tmFG}\right)\right) + \left(\frac{2}{3}\right) \times \left(\frac{tmAST}{tmFG}\right)\right)\right) - VOP \times TOV - VOP \times DRB\% \times (FGA - FG) - VOP \times 0.44 \times \left(0.44 + (0.56 \times DRB\%)\right) \times (FTA - FT) + VOP \times (1 - DRB\%) \times (TRB - ORB) + VOP \times DRB\% \times ORB + VOP \times STL + VOP \times DRB\% \times BLK - PF + \left(\left(\frac{lgFT}{lgPF}\right) - 0.44 \times \left(\frac{lgFTA}{lgPF}\right) \times VOP\right)\right]$$

$$factor = \left(\frac{2}{3}\right) - \frac{0.5 \times \left(\frac{AST}{lgFG}\right)}{2 \times \left(\frac{lgFG}{lgFT}\right)}$$

$$VOP = \frac{lgPTS}{(lgFGA - \lg ORB + lgTOV + 0.44 \times lgFTA)}$$

MP=minutes played

FGA=field goal attempts

FG=field goals made

3P=three point FG made

AST=assists

FT=free throws made

TOV=turnovers

DRB%=defensive rebounding percentage

STL=steals

BLK=blocks

ORB=offensive rebound

The unadjusted PER (uPER) is then standardized to the league pace and the league average:

$$PER = [pace\ adj. \times uPER] \times \left(\frac{15}{lgaPER}\right)$$

2. The Win Shares metric is calculated as follows:

Marginal offense is computed:

$$MO = pts.prod. - 0.92 \times \lg pts\ per\ poss. \times off.poss.$$

Then, the marginal points per win (MPW) is calculated:

$$MPW = 0.32 \times (\lg pts.per\ game) \times \left(\frac{tm\ pace}{lg\ pace}\right)$$

Then Win Shares is computed as follows,

$$WS = \frac{MO}{MPW}$$

Appendix B

1.

Table 1a: Variable definitions

Variable	Description
Minutes per Game	Minutes played per game
Retained by Draft Team	If a player is retained by his drafted team for the entirety of the year then the variable is equal to 1, and equal to 0 if not.
Scoring	Standardized performance index consisting of points per minute, field-goal percentage and free-throw percentage
Toughness	Standardized performance index consisting of rebounds per minute and blocks per minute
Quickness	Standardized performance index consisting of assists per minute and steals per minute
PER	Player Efficiency Rating
Win Shares	Win Shares per 48 minutes
Pick	Player's draft position expressed as the draft number.
Round	Dummy variable equal to 1 if drafted in the first round and equal to 0 if drafted in the second round.
Belief	Average of the third-party draft projections of www.nbadraft.net and ESPN draft analyst Chad Ford, both reputable experts in player evaluation.
Injury	Dummy variable equal to 1 if a player missed more than 10 games during the season and equal to 0 if not.
Trade	Dummy variable equal to 1 if traded or cut before or during the season and equal to 0 if not.
Position	Dummy variable equal to 1 if a player is a Power Forward or Center and equal to 0 if not.
Team Success	Team winning percentage, inputted as a decimal.
Team Offense	Points produced per 100 possessions
Team Defense	Points allowed per 100 possessions

2.

Table 2a: Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Pick	587	29.8620	16.9780	1.0000	60.0000
Belief	587	32.2010	19.5459	1.0000	61.0000
Round	587	0.4974	0.5004	0.0000	1.0000
Position	587	0.2675	0.4430	0.0000	1.0000
Year 1					
Minutes per game	430	11.0642	9.8209	0.0366	38.0732
Scoring	430	0.0000	1.0000	-3.4842	3.4894
Toughness	430	0.0000	1.0000	-2.1940	2.9082
Quickness	430	0.0000	1.0000	-1.6132	3.5699
PER	430	10.9823	4.9157	-20.4000	26.0000
Win Shares	430	0.0384	0.0827	-0.3710	0.3450
Trade	430	0.0256	0.1579	0.0000	1.0000
Injury	430	0.3066	0.4615	0.0000	1.0000
Team Success	430	0.4613	0.1508	0.1585	0.8171
Team Offense	430	104.6550	3.7886	92.2000	113.9000
Team Defense	430	105.8470	3.4781	95.4000	114.7000
Reputation	430	0.1329	0.3397	0.0000	1.0000
Year 2					
Minutes per game	408	14.9629	11.0349	0.0122	41.3171
Retained by Draft team	408	0.7428	0.4375	0.0000	1.0000
Scoring	408	0.0000	1.0000	-4.6811	6.3793
Toughness	408	0.0000	1.0000	-2.2448	2.7208
Quickness	408	0.0000	1.0000	-1.6694	5.1444
PER	408	12.2909	6.5227	-48.6000	53.0000
Win Shares	408	0.0645	0.1214	-1.2640	0.7100
Trade	408	0.2641	0.4412	0.0000	1.0000
Injury	408	0.2470	0.4316	0.0000	1.0000
Team Success	408	0.4705	0.1413	0.1463	0.8049
Team Offense	408	105.1951	3.6933	92.2000	115.3000
Team Defense	408	106.1066	3.5041	95.4000	114.7000
Reputation	408	0.3407	0.4744	0.0000	1.0000
Year 3					
Minutes per game	378	17.0086	11.6729	0.1098	40.9878
Retained by Draft team	378	0.5281	0.4996	0.0000	1.0000
Scoring	378	0.0000	1.0000	-4.7772	3.4567
Toughness	378	0.0000	1.0000	-2.1236	3.9197
Quickness	378	0.0000	1.0000	-1.6943	4.6050
PER	378	13.2471	5.4148	-9.0000	35.3000
Win Shares	378	0.0739	0.0878	-0.4500	0.3720

Table 2a (continued): Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Trade	378	0.4770	0.4999	0.0000	1.0000
Injury	378	0.2351	0.4244	0.0000	1.0000
Team Success	378	0.4818	0.1439	0.1463	0.8171
Team Offense	378	105.7622	3.5727	92.2000	115.3000
Team Defense	378	106.2654	3.5609	94.1000	114.4000
Reputation	378	0.4634	0.4991	0.0000	1.0000
Year 4					
Minutes per game	327	18.8302	10.5495	0.0366	41.1342
Retained by Draft team	327	0.4055	0.4914	0.0000	1.0000
Scoring	327	0.0000	1.0000	-5.2204	2.3003
Toughness	327	0.0000	1.0000	-2.1655	3.8521
Quickness	327	0.0000	1.0000	-1.6162	4.1431
PER	327	14.1844	5.9642	-54.4000	33.3000
Win Shares	327	0.0886	0.0991	-1.3120	0.2950
Trade	327	0.5963	0.4911	0.0000	1.0000
Injury	327	0.1925	0.3946	0.0000	1.0000
Team Success	327	0.4894	0.1418	0.1061	0.8171
Team Offense	327	105.9805	3.4517	95.2000	114.5000
Team Defense	327	106.3539	3.3660	94.1000	114.7000
Reputation	327	0.4600	0.4988	0.0000	1.0000
Year 5					
Minutes per game	299	20.0106	11.0884	0.0488	41.2683
Retained by Draft team	299	0.3322	0.4714	0.0000	1.0000
Scoring	299	0.0000	1.0000	-4.8258	4.1788
Toughness	299	0.0000	1.0000	-2.0699	3.1860
Quickness	299	0.0000	1.0000	-1.7246	4.1299
PER	299	14.9268	4.5551	3.7000	35.2000
Win Shares	299	0.1031	0.0622	-0.0860	0.4840
Trade	299	0.6678	0.4714	0.0000	1.0000
Injury	299	0.1465	0.3539	0.0000	1.0000
Team Success	299	0.5058	0.1463	0.1585	0.8049
Team Offense	299	106.4754	3.3931	99.0000	115.3000
Team Defense	299	106.2148	3.5835	94.1000	114.7000
Reputation	299	0.5860	0.4930	0.0000	1.0000
Year 6					
Minutes per game	249	20.5452	10.0556	0.0610	39.3537
Retained by Draft team	249	0.2828	0.4507	0.0000	1.0000
Scoring	249	0.0000	1.0000	-3.4585	2.5814
Toughness	249	0.0000	1.0000	-2.2255	3.0159
Quickness	249	0.0000	1.0000	-1.5703	4.5486

Table 2a (continued): Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
PER	249	14.5438	4.9018	-4.8000	33.0000
Win Shares	249	0.0956	0.0643	-0.1790	0.3180
Trade	249	0.7019	0.4578	0.0000	1.0000
Injury	249	0.1431	0.3505	0.0000	1.0000
Team Success	249	0.4876	0.1497	0.1061	0.8171
Team Offense	249	106.4357	3.2563	95.2000	114.5000
Team Defense	249	106.9176	3.2529	98.2000	114.4000
Reputation	249	0.6099	0.4882	0.0000	1.0000