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Abstract

The contract year effect, which involves professional athletes strategically adjusting their effort levels to perform more effectively during the final year of a guaranteed contract, has been well documented in professional sports. I examine two types of heterogeneity in the National Basketball Association, a player's value on the court relative to their salary, and the presence of several contract options that can be included in an NBA contract. Loss aversion suggests that players who are being paid more than they are worth may use their current salaries as a reference point, and be motivated to improve their performance in order to avoid a "loss" of wealth. The presence of contract options impacts the return to effort that the players are facing in their contract season, and can eliminate the contract year effect. I use a linear regression with player, year and team fixed effects to evaluate the impact of a contract year on relevant performance metrics, and find compelling evidence for a general contract year effect. I also develop a general empirical model of the contract year effect given loss aversion, which is absent from previous literature. The results of this study support loss-aversion as a primary motivator of the contract year effect, as only players who are marginally overvalued show a significant contract year effect. The presence of a team option in a player's contract entirely eliminates any contract year effects they may otherwise show.

Introduction

The National Basketball Association is one of the most lucrative and widely followed professional sports leagues in the world. This leaves the players within the NBA open to a great deal of scrutiny, as well as providing them with massive compensation. While intuition would suggest that players in the NBA are always trying to do the best they can, the data suggests that this may not be the case. Strategic allocation of effort is one way in which NBA players may modify their production levels, and remains an active area of research. The contract year effect is the most commonly cited implication of strategic behavior within the NBA, and is often a point of discussion in the media. This effect essentially states that players can strategically utilize the final season of a guaranteed contract to increase their value on the free agency market. While research on the contract year effect is extensive, I use an individual fixed effects model to demonstrate the subgroups of players that drive the contract year effect. I then consider which aspects of performance are the most impacted by this effect, and whether different groups of players show stronger effects in different areas.

Standard economic theory would suggest that all players would be motivated to improve their market power by performing well in the final year of a guaranteed contract. The players who are expecting to sign the most lucrative contracts would have the highest expected utility from those contracts, and be the most motivated to optimize their earning potential by performing well in their contract seasons. However, prospect theory suggests that this intuition may lead to the wrong conclusions.

In prospect theory, individuals evaluate gains and losses in regards to a reference value, as opposed to evaluating their final wealth. Prospect theory also makes several changes to expected utility's assumptions about individual value functions, namely that these functions tend to be concave for gains and convex for losses. This suggests that individuals tend to be risk-averse in gains, and risk seeking in losses (Kahneman & Tversky, 1979). Kahneman and Tversky went on to discuss the theory of loss-aversion, which suggests that the individual value function is steeper in the negative than the positive domain (Kahneman & Tversky, 1991). This essentially states that a loss of a certain amount of wealth is more painful to our utility than an equivalent gain is beneficial. Taken in conjunction, these theories can motivate a different approach to evaluating the contract year effect in the NBA.

Players in the NBA are compensated for their performance with incredibly valuable salaries. However, sometimes these salaries are very out of line with actual production on the court. Players who are underperforming relative to their contract could be considered as "overvalued," whereas those who are outperforming their contracts would then be "undervalued." The crux of this paper involves the differential contract year effects between these specific subgroups of players, breaking it down into four comparison groups: players who are marginally overvalued, highly overvalued, marginally undervalued and highly undervalued. Working with the assumption that players who are out of line with their salaries are aware of that fact, and that their respective teams are also aware of that fact, prospect theory can make some strong hypotheses, namely that loss aversion may lead to a stronger contract year effect for overvalued players. Prospect theory suggests that the strongest effects should be found within the moderately overvalued subgroup of players, as they are within reach of their reference value and are motivated to try and attenuate their loss, whereas the highly overvalued players are so far out of line with their salaries that it is optimal to give up. This potential moderator of the contract year effect is absent from all previous research.

The relative value of players is the key addition that this research will make to the literature, but I also explore several other potential moderators of the contract year effect. An additional area that has been absent from the literature involves the various options that can be included in NBA contracts. There are three options that can be included: team options, player options, and early termination options (ETOs). A team option gives the team the capability to evaluate the circumstances at the conclusion of the guaranteed seasons, and opt into an additional season at a predetermined price, or allow the player to enter free agency. A player option works in the same way, but the decision lies with the player as opposed to the team. An ETO is similar to a player option, but the player chooses between continuing with their current contract at the set price, or opting out and entering free agency. The main difference between a player option and an ETO is that player options can only be included for a single season in a given contract, whereas a player can have two ETO years within their current contract. The impact of these options has not been extensively explored in the literature.

The main results of this paper indicate that marginally overvalued players overwhelmingly drive the contract year effect. When considering all players within the same sample, which is the methodology of the previous literature, I found significant evidence of a moderate increase in overall performance. However, once the sample was separated into the four comparison groups, it became clear that the marginally overvalued players were responsible for the overall effect found in the NBA. This supports the predictions made by loss aversion. Players who are marginally below their reference point work very hard to avoid their salary dropping below that reference for their next contract. The data on the contract options suffered from sample size issues, but there did appear to be significant effects of being in a team option season, while the presence of a player option or ETO showed no significant effects.

Literature Review

The ability to "game the system" in order to maximize rewards has been studied in an array of professional settings. This paper examines what Maxcy et al. (2002) describes as *ex ante* strategic behavior, which is commonly known in the media as the contract year effect. This effect essentially states that due to the moral hazard problem where owners are unable to directly monitor the effort levels of the players, players will strategically increase their effort in the final season of their contract in order to increase their value on the free agency market. Stiroh (2007) showed that NBA teams overvalue a player's most recent season when making contract offers, which allows the players to strategically use the final season of their contract to increase their market value. Teams hope to capitalize on young players who have room to grow into superstars, and thus will value future potential (as indicated by most recent performance and growth) more highly than past career statistics. This is common practice in the NBA, as opposed to sports like baseball or football, which place a higher premium on current production. NBA contracts are fully guaranteed (barring extremely unusual situations), meaning that once a player has signed a multi-year contract, they will receive the agreed upon sum regardless of performance. This setting is ideal for opportunistic behavior; a player can increase their market value in their contract year, sign a long-term guaranteed contract, and then regress to baseline performance levels with no disincentives.

While this situation is highly salient in professional sports, it has been examined in other settings as well. Prendergast (1999) identifies issues within the principal-agent framework where it is very difficult to fully monitor individual actions, providing an opportunity for agents to strategically modify their behavior. In an interesting application of the contract year phenomenon, CEOs in the process of contract negotiations tend to manage earnings more aggressively; they are more likely to report earnings that outweigh analyst projections, and they reduce the amount of negative news information released about the firm (Liu & Xuan, 2014). The process of contract negotiations clearly provides a salient opportunity for strategic behavior. While sports provide an excellent opportunity for measuring incentive effects, these effects are present throughout most of the aspects of our professional world.

The contract year phenomenon and the incentive effects of guaranteed pay within sports have been a highly active area of research over the past decade (Berri & Krautmann 2006; Jean 2010; Gaffaney 2013; Ryan 2015). Recent studies like Stiroh (2007) have provided evidence for performance increases in the final year of a contract. However, within the NBA, there is not widespread agreement on either the magnitude or specific statistics most affected by this opportunistic behavior. As has been the case throughout modern sports analytics, research involving the contract year effect began within the domain of professional baseball.

Baseball is characterized by interactions between players that are far more isolated than those that occur in basketball, which lends itself well to statistical analyses. Baseball Prospectus' Dayn Perry extensively documents the contract year effect in professional baseball, finding an approximate 9% boost in statistics in the final year of a guaranteed contract when compared to the seasons immediately prior to and following a contract year (Perry, 2006). White and Sheldon (2013) used a similar methodology to analyze the contract year effect within the NBA, and found an increase of 5% in a catchall metric of performance known as Player Efficiency Rating (significant at the .001 level). Their study has been considered the defining work on the contract year effect within the NBA.

White & Sheldon provided the first rigorous demonstration of the contract year effect within the NBA, however Julian Ryan (2015) identified several key methodological issues with their, and other previous studies. White & Sheldon only included data in their sample for players who received a new contract at the conclusion of the free agency market. As Ryan (2015) points out, many players in the NBA do not receive new contracts, and by limiting the sample to only those who are able to reach an agreement with a team, many players on the lower end of the NBA spectrum are excluded from the dataset. This causes an upward bias in the reported result, as only the players who performed well enough in their contract year to earn an offer are included in the dataset. Jean (2010) and Gaffaney (2013) both found positive contract year effects, but fell victim to the same methodological issues as White & Sheldon. This study includes players who did not earn a new contract as well, in order to provide an unbiased estimate of the contract year effect.

The second issue that Ryan identifies is the metrics used to assess performance. The NBA has many statistics that measure player performance, but unlike baseball, there is not a consensus "holy grail" statistic that accurately encompasses players' on-court contributions. The issue of how to correctly quantify a basketball player's on-court contributions has long been a point of contention. David Berri provided the first rigorous empirical model in 1999, which was the early equivalent of the "Win Shares" statistic. This statistic uses a fixed effects linear model to measure how many wins a player provided for his team, including both offensive and defensive contributions (Berri, 1999). This statistic has empirical support as a measure of player productivity, as Win Shares across a team accurately sum to the total wins for that team, and due to its basis in box score statistics, it estimates a higher value to players who have produced more for their team. However, there have been many attempts to refine it. For an in depth discussion of the various statistical measures currently used throughout the NBA, see Ryan (2015, pp.19-31).

The previous research has mostly focused on box score metrics, which fail to account for the many indicators of effort and performance that are not captured by quantifiable statistics. In order to represent a player's contributions most accurately, this study includes all of the commonly cited catchall metrics, including Player Efficiency Rating (PER) and Win Shares, but the primary dependent variable is the recent measure developed by Daniel Myers of Basketball Reference known as "Box Plus Minus" (BPM). This measure relies on both box score metrics and the overall performance of the team to estimate a player's points above an average player on an average team, adjusting for team possessions and quality (Myers, 2015). Using these advanced metrics should provide a realistic estimate of the increase in performance present during a contract year.

The final limitation that Ryan identifies in the body of literature is the fact that players of lower quality are less likely to receive long-term contracts. This means that there is an endogeneity issue between the presence of a contract year and the players' statistics; players who do not perform as well are more likely to be in a contract year. To resolve this issue, I used an individual fixed effects model, including year, player and team fixed effects. The end result of these corrections was that Ryan provided evidence for a 3-5 percentile increase in performance for the median NBA player, with the effect most evident in the defensive categories of rebounds and steals (Ryan, 2015). Previous literature tended to endorse the claim that the contract year phenomenon showed the greatest effects in metrics that weigh offense more heavily than defense, such as Player Efficiency Rating. The intuition seems to support Ryan's conclusion, as strategically increasing effort would intuitively have the greatest effect on areas of play that are more "effort" based (such as rebounding) than "skill" based (such as shooting percentage). While this is a simplification, there is no widespread consensus on the areas most impacted by the contract year effect. I provide evidence for increases in both offensive and defensive statistics, with the most evident increases found in Player Efficiency Rating, blocks, steals, rebounds and true shooting percentage.

None of the previous literature examined heterogeneity among NBA players. This research is the first to explore whether different subcategories of NBA players are driving the general contract year effect, as well as examining heterogeneity in the specific contract structures. In the area of loss-aversion, a detailed overview of reference-dependent preferences can be found in Farber (2015). Individuals who are very far below the reference value will optimally give up, leaving loss-aversion to have the strongest impact on those who are only slightly below their reference point. For this study, that implies that highly overvalued players will show a limited contract year effect, while those who are just barely overvalued will work very hard to attain their reference point, and will show the strongest contract year effect. Together with previous research, this study supports the conclusion of a significant contract year effect within the NBA, and helps identify which groups of players are the main agents that lead to this effect.

Hypotheses

Players who are inappropriately valued are likely to see this fixed during their next foray into free agency. Thus, if a player considers their previous salary as a reference value, then players' expecting to sign for reduced salaries in free agency may be subject to loss-aversion. This would suggest that an overvalued player, who is expecting a loss in salary once they enter free agency, is expecting to suffer a larger loss in utility than an equivalently undervalued player is expecting to gain. Therefore, an overvalued player may strategically alter his effort levels during a contract season to a greater degree than an undervalued player, with the intention of minimizing their losses and attenuating the disutility associated with a less lucrative contract. Prospect theory suggests that players that are very far from the reference point will optimally give up, while the players who are within reach of their reference point will show loss-aversion. Therefore, the highly overvalued players should show an insignificant contract year effect, and the marginally overvalued players would show the strongest contract year effects.

Undervalued players would be aware that they are already due for a pay raise, and would be less inclined to increase their effort levels and potentially risk injury. The undervalued players who are close to the reference value may be less inclined to coast, and show a stronger contract year effect than the highly undervalued players. Together, these predictions can be used to generate the following model of a player's utility in their contract year given loss aversion:

$$U = CYO(e) + a - c(e) + [\lambda(CYO(e) + a - R)]$$

The first term is a player's output in their contract year, which is a function of their effort. The second term is fixed and indicates the accumulated output already built up over the course of the player's current contract prior to the final season. The third term is the cost of effort expended during the contract year. λ is a scalar, and R is the player's reference value, which is their current contract. The bracketed terms make up the gain/loss framework. For overvalued players, $a < R$ and $\lambda > 1$. This suggests that if a player does not improve performance in their contract year, they will suffer a large loss of utility due to the bracketed terms. Players will then be motivated to increase effort in order to increase $CYO(e)$ and bring the bracketed term to zero (or even slightly positive). The key specifications of this model are that

$$\frac{\partial CYO}{\partial e} > 0, \qquad \frac{\partial^2 CYO}{\partial e} < 0, \qquad \frac{\partial c}{\partial e} > 0, \qquad \frac{\partial^2 c}{\partial e} > 0$$

Together, these conditions indicate that output in the contract year is increasing as a function of effort, but at a decreasing rate. However, the costs of effort increase at an increasing rate. Players who are only slightly below their reference value are then able to increase effort moderately, suffer a marginal cost of doing so, and bring their production in line with their reference value. However, players who are significantly below their reference would need to increase effort by so much that the cost becomes prohibitively expensive, and they are unable to reach their reference without incurring massive costs of effort.

For undervalued players ($a > R$), the only change to the model is that $\lambda = 0$. If this is the case, then players only face the first three terms in the expected utility model, and may show minor improvements in the contract year, but without the possibility of a large gain in utility from the bracketed term, increasing effort is only slightly beneficial, as the costs are increasing by more than the benefits. This is the first empirical model of the contract year effect that incorporates loss aversion.

Contract option effects have been discussed in the literature, but there is little consensus as to their effect. White and Sheldon acknowledge the presence of team and player options, but “did not attempt to deal with these differences” (White & Sheldon, 2013, p.3). Julian Ryan considered player options that had been accepted within his dataset, but did not include seasons in which players opted out of their contract, as he believed it would lead to an upward bias in the results (Ryan, 2015). While the logic stands that including players who performed well in their contract year, and thus opted out of their player option to enter free agency does imply that the contract year effect may be overstated, the players who have managed to earn a new contract and thus opt out of their player options did so while under the incentive effects of a contract year, and thus are worth including in the sample. Team options are slightly more complicated, as players may be motivated to underperform if they are unhappy in their current situation, or increase their effort if they desire to remain with the team.

I hypothesize that players in the midst of a team option season will show a reduced contract year effect compared to players who are in a standard contract year. They have essentially zero incentive to outperform expectations, as they would then find themselves locked in to a previously determined salary for an additional season, and teams tend to undervalue performance in years prior to the most recent (Stiroh, 2007). Players in the midst of a player option or ETO season are hypothesized to show an equivalent or increased contract year effect, as they essentially are given a safety net in case they fail to earn a new contract. Players with one of these options can opt in to their option season if they feel they were unable to earn the contract they desire, allowing them to have a second chance at their contract year.

Methodology

In order to develop a measure of a player's value relative to their contract, this study utilized techniques enumerated by Nate Silver of FiveThirtyEight. All teams payrolls are averaged in order to create an index of average spending on players across the league for each season. Simply dividing this average spending by 41 (the amount of wins for an average NBA team) provides an estimate of the price of a win. Using each player's salary, it is then possible to create a variable of "salary expected wins," which estimates how many wins a player should have provided to their team according to their salary and the price of a win. The player statistical data gathered from Basketball Reference includes a statistic known as Win Shares, which estimates how many wins a player added to their team over the course of the season. The difference between a player's Win Shares and their Salary Expected Wins is a simple estimate of their relative value.

In a more recent article, Silver refined this process, yielding a more accurate measure of the expectations associated with a player's salary. As opposed to simply measuring a player's salary expected wins and total wins added this method utilizes a concept known as "Wins Above Replacement" (WAR). This statistic is estimated by multiplying Value Over Replacement Player (VORP) by 2.7 (Meyers, 2015). The idea behind this statistic is that when assessing the amount of wins that a player has added to their team, what you are doing is estimating how much better off the team is with that player versus without that player. However, if the team did not have that specific player, they would not simply eliminate that player, but would instead replace him with a "replacement level player." This is due to the fact that it is mandated by the NBA that all teams have at least 12 players on their roster at all times. Therefore, WAR is simply an estimate of how many *more* wins a player has added to their team than a hypothetical replacement level player.

WAR provides a more accurate estimation of how valuable a player is to their team, but it means that using the player's salary to estimate "Salary expected wins" is now inaccurate, as the replacement level player the team signs in his place would also require some salary. To fix this issue, Silver concluded that due to varying factors including a league minimum salary for each player as well as for the overall team, a reasonable approximation of a "replacement level salary" would be $1,000,000 (Silver, 2014 "Carmelo Anthony's Contract"). Therefore, in order to find average payroll "above replacement," you can simply subtract $12,000,000 from the league average payroll ($1,000,000 for each of the 12 replacement level players, yielding a payroll for a team of full replacement players of $12,000,000). This estimates how much the average team has paid relative to if they replaced all of their players with minimum cost replacements.

The first method discussed involved dividing the average salary by 41, the average number of wins per team. However, this again yields a biased result. The implication of dividing by 41 is that subtracting all 12 players from the roster and substituting replacement level players would result in a zero win team. However, empirical evidence suggests this is not accurate. A replacement level player has an approximate net rating of -2 per 100 possessions. A team full of replacement level players would thus expect to be outscored by 10 points per 100 possessions, as each of the 5 starters have a -2 net rating (Silver, 2014 "Lebron James Shouldn't Stay"). However, using a Pythagorean win projection (Appendix 1B) developed by Daryl Morey, a team that is outscored by 10 points every 100 possessions would expect to go 16-66 throughout the course of a season (Dewan 1993; Silver 2014, "Carmelo

Anthony's Contract"). Therefore to find the price of a win above replacement, I divided the "payroll above replacement" by 25, the difference in wins between an average team (41) and a replacement level team (16). I then calculated a players "Salary Expected Wins Above Replacement" using this price.

The final step in this process involved finding the difference between a players WAR and their Salary Expected WAR. This resulted in a continuous variable that estimates how overvalued (negative difference score) or undervalued (positive difference score) a player was relative to their salary. A lagged version of this variable was used to separate the players into the primary comparison groups, highly undervalued players were those who had a difference score greater than 1, marginally undervalued players had a difference score between 0 and 1, highly overvalued players had a difference score less than -1, and marginally overvalued players had a difference score between 0 and -1. Regression model 1 (elaborated below) was then run on each of these groups, as well as all players combined.

Model 1:

$$Y_{itk} = a + \theta_i + \beta_1 ContractYear + \beta_2 Age + \beta_3 Age^2 + \beta_4 MinutesPlayed + \beta_5 Age > 30 + \gamma_t + \varphi_k + \varepsilon_{itk} \quad (1)$$

Y_{itk} represents the standardized box plus minus for a player i, in year t playing for team k. The primary results of this paper involve the significant difference in β_1 between the primary comparison groups. ContractYear is a dummy variable that takes a value of 1 if the player was in a contract year. Players were marked as being in a contract year if they fell under one of four categories: they were in the final season of a guaranteed contract, they were in the midst of a player option season, they were in the midst of a team option season, or they were in the midst of an ETO season. Model 1 was also run with a variety of dependent variables, mainly to serve as a robustness check. This model included player, year and team fixed effects.

To evaluate the effects of the contract options, regression model 2 was utilized.

Model 2:

$$Y_{itk} = a + \theta_i + \beta_1 ContractYear + \beta_2 PlayerOption + \beta_3 TeamOption + \beta_4 ETO + \beta_5 MinutesPlayed + \beta_6 Age + \beta_7 Age^2 + \gamma_t + \varphi_k + \varepsilon_{itk} \quad (2)$$

This model was run on each of the three comparison groups, as well as the full sample. The coefficients β_2, β_3, and β_4 were the primary interest for this portion of the project. The model also included fixed effects for player, year and team.

Data

This research will use data collected from Basketball Reference, which includes the advanced metrics mentioned previously as measures of player productivity. The dataset will include all players from the 2006-2014 seasons, as the 2005 season saw a new collective bargaining agreement (CBA) between the players association and the owners of the teams, which changed the structure of NBA contracts a great deal. Prior to the 2005 season, there was no maximum contract length, beginning in the 2006 season it was changed to five years, with a team having the option to include a sixth year for an incumbent player. For this reason, data prior to the 2006 season will be excluded from this study. There was a new CBA signed in 2011 which adjusted these contract lengths to four and five years respectively, but this change was minor enough that the data for 2011-2014 will be included with the data from 2006-2011.

The format of rookie contracts was also adjusted after the 2005 season, with first-round picks now being signed to four-year contracts, with two fully guaranteed years and two team-option years. The salary rookies receive for their initial contract is determined solely by their order of selection in the draft, as defined within the CBA. These contracts provide a differing set of incentives from fully guaranteed contracts, after the third year of a rookie contract; they become eligible for an extension of up to five years. The strongest players often sign these five-year extensions, making the third season of a rookie contract a “quasi-contract year” (Ryan, 2015).

If they do not sign an extension, and the player plays the fourth year of their rookie contract, they then enter restricted free agency at the conclusion of the fourth season, which allows their incumbent team to match any offer the player receives. If the incumbent team matches an offer sheet, the player must accept. If a player does not sign with a new team or resign with their current team, then they can accept a qualifying offer for a fifth season, which is often far below market value. At the conclusion of the fifth season, the player then becomes an unrestricted free agent, with the incumbent team no longer able to force them to sign a matched offer. This makes the fifth year of a rookie contract a guaranteed contract year, as would be the case for any player in their final guaranteed year. Due to the differential nature of the incentives offered in rookie contracts, all rookie contracts that do not reach the fifth year were excluded from the dataset. However, due to the sample size issues with the contract options, for model 2 the dataset included rookie scale contracts.

It is worthwhile to note that there is a large spike in free agency occurring in the 2010 offseason. This is due to a combination of factors. The first is the rookie contract changes developed in the 2005 CBA. The new standard of four-year contracts with a fifth qualifying year for the 2005 rookie class meant that a large percentage of that draft class entered free agency in the 2010 offseason. This fact was compounded by the infamous "Decision" of LeBron James. LeBron publicly acknowledged that he was going to opt out of his contract and enter free agency well in advance of the 2010 offseason. This was a massively popular event, with almost 10 million viewers watching his live announcement of what team LeBron would sign his new contract with (Nielsen, 2010). With the foreknowledge that this was coming, NBA players chose to enter free agency during the 2010 offseason as well in order to potentially secure a spot on the new team of LeBron's choice. The combination of these events led to an unusually large amount of contract years prior to the 2010 offseason. However, this should not impact the results of this study, it is simply an observational anomaly in the dataset.

While there was a spike in free agency in the 2010 offseason, the number of contract years in the seasons following stayed relatively consistent (with the exception of 2011-2012, which was a lockout shortened year and has many irregularities). This is likely due to the increasing salary cap and the increasing returns to free agency following the 2011 CBA. To control for this yearly variation, the regression includes a year fixed effect variable as well as the player and team fixed effect variables.

Salary data was gathered from Patricia Bender's *Various Basketball Stuff* website, where she tediously compiled a record of every players salary dating back to the 1985-86 season. When possible, this data was cross-referenced with NBA.com and Basketball Reference in order to ensure accuracy. The contract year seasons were identified through three primary sources, NBA.com/transactions, NBA.com/freeagents and RealGM.com/nba/transactions. These sources were again combined to accurately identify when a player was in a contract season, as well as whether or not a player was in a season with a team or player option. The descriptive statistics for box plus minus in each comparison group are reported in table I. Additional descriptive statistics are reported in table V in Appendix 1A. The amount of observations within each category is included in Appendix 1C.

The sample used for this study had 916 independent player observations, with an average of 3.6 seasons per player. This resulted in 3,330 total player/year observations. Some of the reported analyses used a sample with rookie scale contracts included, which resulted in 1,053 players averaging 4.0 seasons each for a total of 4,169 observations. Any result that includes rookie scale contracts makes note of that fact. Table VI in Appendix 1A reports age, salary, and several other statistics broken down by player relative value in order to get a sense for the players included in each value bracket.

Table I Box Plus Minus Descriptive Statistics	(1) N	(2) Mean	(3) sd	(4) Min	(5) Max
All Players (Rookies Excluded):					
Box Plus Minus	3,330	-1.903	4.406	-53.60	26.60
Highly Overvalued Players (Rookies Excluded):					
Box Plus Minus	1,306	-2.688	3.882	-36.1	11.2
Marginally Overvalued Players (Rookies Excluded):					
Box Plus Minus	948	-3.018	5.194	-53.60	26.60
Marginally Undervalued Players (Rookies Excluded):					
Box Plus Minus	374	-1.44	3.692	-26.9	10.7
Highly Undervalued Players (Rookies Excluded):					
Box Plus Minus	700	0.821	3.183	-17.3	13

Results

Table II	Estimates of Contract Year on Player Performance Dependent Variable: Standardized Box Plus Minus				
	(All Players)	(Highly Overvalued)	(Marginally Overvalued)	(Marginally Undervalued)	(Highly Undervalued)
Contract Year	0.0831***	0.0194	0.316***	0.178	0.0143
	(0.0246)	(0.0438)	(0.103)	(0.152)	(0.0348)
Age	0.116	0.229*	-0.515	4.943***	0.243***
	(0.113)	(0.125)	(0.320)	(1.110)	(0.0927)
Age^2	-0.000945	-0.00117	0.00907*	-0.0209***	-0.00390***
	(0.000957)	(0.00173)	(0.00476)	(0.00718)	(0.00131)
Minutes Played	0.000519***	0.000487***	0.000689***	0.000165	0.000378***
	(2.21e-05)	(4.06e-05)	(0.000109)	(0.000150)	(3.19e-05)
Age>30	-0.0396	-0.0494	-0.541*	0.453	-0.167**
	(0.0480)	(0.0737)	(0.284)	(0.380)	(0.0661)
Player Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Team Fixed Effects	Yes	Yes	Yes	Yes	Yes
Constant	-2.993	-6.759**	6.142	-134.8***	-3.613*
	(3.234)	(2.869)	(6.766)	(35.43)	(2.086)
Observations	3,330	1,306	948	374	700
R-squared	0.775	0.825	0.827	0.978	0.917

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table II suggests that the contract year effect is significant when evaluating all players together, but when separated into comparison groups based on relative value, it's clear that the marginally overvalued players are driving the overall effect. The first column suggests that when controlling for age, age^2, minutes played, and a term to indicate if a player is declining (marked as age>30), being in a contract year increases box plus minus by 8.31% of a standard deviation. The second column indicates that highly overvalued players have no significant contract year effect. The third column shows a highly significant contract year effect of 31.6% of a standard deviation for marginally overvalued players. The fourth and fifth columns indicate that there are no significant contract year effects for undervalued players, regardless of how close they are to the reference point. The significance of these results was unchanged when using clustered standard errors to account for possible serial correlation. Adding several other control variables did not chance the results, including an interaction term to evaluate the contract year effect between older and younger players separately. Appendix 2 includes a variety of further specifications and modifications to the primary model.

Table III	Estimates of Contract Option Effects on Player Performance Dependent Variable: Standardized Box Plus Minus				
	(All Players)	(Highly Overvalued)	(Marginally Overvalued)	(Marginally Undervalued)	(Highly Undervalued)
Player Option	-0.0396	-0.0726	-0.0578	0.173	0.0544
	(0.0518)	(0.0837)	(0.258)	(0.218)	(0.0790)
Team Option	-0.112***	-0.0692	-0.0760	0.360*	-0.0510
	(0.0398)	(0.0718)	(0.171)	(0.206)	(0.0596)
ETO	-0.0982	0.0226	-0.461	-0.819	0.0250
	(0.0879)	(0.128)	(0.447)	(0.774)	(0.125)
Contract Year	0.106***	0.0379	0.220**	0.0163	-0.0125
	(0.0242)	(0.0433)	(0.0961)	(0.0302)	(0.0389)
Player Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Team Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	4,169	1,608	1,137	455	967
R-squared	0.768	0.817	0.817	0.978	0.885

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Rookie scale contracts are included in the samples for this model, as the sample size for each contract option was too low with rookies excluded. See Appendix 1A for the exact sample sizes with rookies included. Each option variable is an interaction with Contract Year.

Table III indicates that across all comparison groups, there are no significant effects of being in a player option season or an ETO season, but there are significant effects of being in a team option season. It is worthwhile to note that all option years were also indicated as contract years, so each option variable is an interaction term with Contract Year. The first column shows that across all players in the sample, the team option entirely eliminates the effect of being in a contract year. Players who are in a contract year that is not a team option year have 10.6% of a standard deviation increase in box plus minus. Players who are in a team option have this effect reduced by 11.2% of a standard deviation, resulting in a net effect of -0.6% of a standard deviation in their contract year, which is insignificantly different from zero (F = 0.03). The second column suggests that highly overvalued players have no significant contract year effect, and no significant interactions with any of the option years. The third column indicates a contract year effect of 22% of a standard deviation for the marginally overvalued players who are not in the midst of a team option season, but the presence of a team option reduces that effect by 7.6%, resulting in an insignificant contract year effect (F = 0.86). The fourth column indicates that marginally undervalued players have no significant effects of being in a player option or ETO season, but interestingly, show an increased contract year effect when in a team option season. However, this result is subject to sample size issues, as the marginally undervalued players have a significantly smaller number of observations than any comparison group, and the effect is only marginally significant. The fifth and final column suggests no significant effects or interactions for the highly undervalued players.

The various other statistics that were used as dependent variables are all reported in Table IV on the following page. These results are primarily used as a robustness check, and will be discussed more thoroughly in the Discussion section. It is worthwhile to note that these results include players who have played less than 500 minutes during the season (which is the cutoff to be considered on the end of season statistical leaderboards). Results with players who did not reach the 500-minute cutoff are included in Appendix 1D and 1E. These results will be discussed further in the discussion section.

Table IV Estimates of Contract Year on Player Performance
Dependent Variables: Standardized Performance Metrics

	(All Players)	(Highly Overvalued)	(Marginally Overvalued)	(Marginally Undervalued)	(Highly Undervalued)
Dependent Variable:	Contract Year Coefficient				
Player Efficiency Rating	0.0580**	-0.0165	0.154	0.172	0.0161
	(0.0274)	(0.0420)	(0.123)	(0.146)	(0.0354)
Rebound Percentage	0.0495***	0.0376	-0.0306	0.145	0.0181
	(0.0186)	(0.0287)	(0.0839)	(0.141)	(0.0261)
Steal Percentage	0.0674**	0.000853	0.289***	0.0967	0.0666
	(0.0282)	(0.0482)	(0.0979)	(0.233)	(0.0432)
Block Percentage	0.0419**	0.0804**	0.108	0.295	0.00828
	(0.0200)	(0.0356)	(0.0829)	(0.249)	(0.0323)
True Shooting Percentage	0.0776**	0.00620	0.256**	0.0400	-0.00741
	(0.0310)	(0.0607)	(0.116)	(0.254)	(0.0429)
Free Throw Rate	0.0254	-0.0616	0.0632	-0.248*	0.0512*
	(0.0345)	(0.0842)	(0.0742)	(0.123)	(0.0295)
Assist Percentage	0.000193	-0.0409	0.0738	0.0297	-0.0298
	(0.0172)	(0.0319)	(0.0594)	(0.107)	(0.0374)
Turnover Percentage	-0.0360	-0.0473	-0.0129	0.0775	0.00216
	(0.0301)	(0.0523)	(0.107)	(0.187)	(0.0375)
Observations	3,330	1,306	948	374	700

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Notes: These regressions included player, year and team fixed effects. Control variables are excluded for ease of presentation

Discussion

The results of this study support the hypothesis that loss-aversion is a primary factor in the contract year effect within the NBA. Players who are underperforming relative to their current contract, but are still within reasonable grasp of attenuating their loss are the primary drivers of the contract year effect. Players who are highly underperforming do not show any significant contract year effect, nor do players who are outperforming their contracts, regardless of how much they are outperforming those contracts. The presence of a team option eliminates any significant contract year effects.

This study did find evidence of a general contract year effect in the NBA. Players in the midst of a contract year had an average increase of 8.31% of a standard deviation in box plus minus during a contract year ($p < 0.01$). The main areas of play that appear to be influenced by the contract year effect are rebound percentage (4.95%, $p<0.01$); steal percentage (6.74%, $p<0.05$) and block percentage (4.19%, $p<0.05$). This is supported by previous literature, which also found approximate 3-5 percentile increases in categories like rebounds and steals. Player efficiency rating also showed a significant increase during a contract year (5.80%, $p<0.05$), which is also supported in the literature. Interestingly, I also found evidence for an increase in true shooting percentage (7.76%, $p<0.05$), which is absent from the previous literature in this area.

The increase in true shooting percentage is the most noteworthy of these results, as that has not previously been demonstrated. My intuition suggested that this might be driven by players being more willing to drive to the basket and get “better” shots at the rim, as opposed to settling for jump shots. However, this would also implicate an increase in free throw rate, as driving to the basket involves more contact and leads to more fouls being drawn. No significant increase in free throw rate was found, so it is possible that the increase in true shooting percentage is a skill-based improvement. The relatively small sample size could lead to some of these findings, but the results were statistically significant at the 5% level. This is an interesting contrast to the other areas that are most impacted, which are more hustle based aspects of basketball. Rebounds, steals and blocks are heavily impacted by a player's willingness to aggressively challenge the offensive player they are guarding. A player who is increasing their effort would be more willing to put their body on the line in order to play strong, aggressive defense, and that would naturally impact these areas of play the most heavily. Shooting percentage is not necessarily directly tied to being willing to expend more effort, but it could be linked to players having a greater willingness to create good shots as opposed to settling for what the defense gives them. Players in a contract year might also be more focused off the court, which could involve more practice hours or less outside distractions, which could lead to increases in true shooting percentage.

The main interest of this study was in exploring the differential contract year effect between several subgroups of players: highly overvalued, marginally overvalued, marginally undervalued and highly undervalued players. Marginally overvalued players were found to be the most significant drivers of the contract year effect (31.6% of a standard deviation increase in box plus minus, $p<0.01$), with no evidence of a contract year effect for highly overvalued players, or either of the groups of undervalued players.

Loss-aversion appears to be a primary determinant of which players will show contract year effects, but these results can be further understood using tournament theory. Tournament theory applies to competition where standings in relation to the other competitors at the conclusion of the competition are the determinant of the final reward, which is true of the NBA. Tournament theory posits that when the agents involved have heterogeneous skill levels and skill levels are common knowledge, then individuals of the lowest talent optimally give up, those with the highest talent are able to coast to victory, and thus those agents that fall on the margin are the most affected by situational factors such as reward incentives. Tournament theory was developed by Lazear and Rosen (1981), and for a comprehensive review, see Connelly et al. (2014). The marginally overvalued players are motivated by loss-aversion, whereas the highly overvalued players instead give up. The undervalued players are already expecting a pay raise, and have no strong additional incentive to improve performance beyond their trend.

I next explored the area of contract options. Unfortunately, the sample size for these options was not strong, and thus the results may not hold up with further research. However, preliminary conclusions can be drawn. There was no significant effect in any subgroup of players for either a player option or an ETO. These options, once controlling for the general contract year effect, do not seem to provide an additional boost to performance. However, the team option did show significant effects. Players who are in the midst of a contract year that is not a team option year have a 10.6% ($p<0.01$) of a standard deviation increase in box plus minus. Those who are in the midst of a team option have this effect reduced by 11.2% ($p<0.01$) of a standard deviation, resulting in an insignificant, but negative contract year effect. This is replicated within the marginally overvalued players, with a 22% ($p<0.01$) increase for non-team option contract years, which is reduced by 7.6% by the presence of a team option, resulting in an insignificant effect for the players in the midst of a team option ($F = 0.86$). The result of a positive interaction for the marginally undervalued players is odd, and worthy of further examination in future research. However, this effect is only marginally significant ($p = 0.086$), and the sample size may be a factor for the subgroup of marginally undervalued players.

Overall, these results are very intuitively appealing. The presence of a team option eliminates the extra financial benefit from outperforming a current contract, as the team will simply accept the team option and keep the player for an additional season. With the incentive gone, the contract year effect goes with it. The negative impact of the team options also suggests that the results for model 1 are understating the true contract year effect, as they do not separate the players in the midst of a team option from the players in a true contract year. This further strengthens the evidence for a positive contract year effect in the NBA.

One area worth additional discussion is the presence of fringe players in the sample. Players who have not played for 500 minutes during the season are not considered for end of season awards, but they are included in the sample for this project. The reason for this is two-fold. Sample size issues are a factor here, and excluding these players leads to weak sample sizes for several of the subgroups of interest. Further, this study is concerned with the contract year effect for the marginal players in the NBA. Many of the players who are marginally overvalued are fighting for their minutes, and are considered fringe NBA players. This study shows that these players are the ones with the strongest contract year effect. Appendix 1D shows the main results when I exclude players who did not reach the 500-minute threshold. These further specifications suggest that it is the players who are fighting for their place in the NBA who will be the most motivated to improve their output and fight their way back to their reference point. There is no significant effect of being in a contract year on box plus minus when players with less than 500 minutes are excluded. However, Appendix 1E suggests that there are still significant increases in Player Efficiency Rating (4.04%, $p<0.05$), True Shooting Percentage (4.2%, $p<0.05$), Free Throw Rate (3.22%, $p<0.05$), and Rebound Percentage (5.11%, $p<0.01$).

With these additional specifications, the results of this study suggest that players who are slightly overvalued by their current contracts, and fighting to earn minutes (< 500 minutes played) are the primary drivers of the contract year effect. However, I also provide evidence that players who have reached the 500-minute cutoff show significant increases in several statistics during a contract year in the areas suggested by previous research. A final point to note is the possibility that the contract year effect is a known phenomenon by the players themselves, and may be more indicative of players' shifting their focus rather than actually upping their game. If players are aware that their contract year is more heavily weighted (which they absolutely are), then they may choose to shift their focus towards statistics that they know will result in maximizing their payoffs while leaving their other areas of play unaffected. Particularly when considering the older players who have spent a large amount of time in the NBA, it may be that teams' and front offices' interest in the contract year effect have led players to realize what areas of play they should focus on, and shift their attention to improving in these areas. This possibility does not diminish the impact of the contract year effect; it simply exists as an alternate explanation as to why we see the effects.

Conclusion

The results of this study support and expand upon previous literature on the contract year effect. NBA players appear to adhere to game theoretic predictions, and increase their output in the midst of a contract season. These results are largely driven by hustle statistics like rebounds, steals and blocks. However, they also show improvement in true shooting percentage and player efficiency rating, which are statistics that measure offensive, as opposed to defensive contributions on the court.

Marginally overvalued players are the significant drivers of the contract year effect; with no significant effects being found for either highly overvalued or undervalued players. Prospect theory supports these conclusions, with the players who are below their reference value, but still within reach of attaining that reference value being the most motivated to perform. Tournament theory can help explain the lack of a contract year effect in the highly overvalued and undervalued players, which also fall within the expectations of prospect theory. The most intuitive explanation for the lack of a contract year effect in the undervalued players is simply that they feel it is unnecessary. They have already earned a new, larger contract, and do not need to exceed their trend in order to increase their earnings. When including a minutes restriction, the results change somewhat, but evidence still exists for a positive contract year effect.

The various contract options suffer from some sample size issues, but they do show some hypothesized effects. Namely, the presence of a team option eliminates the contract year effect, and actually leads to worse performance during the team option season. The positive interaction for marginally undervalued players is an outlier worthy of further research, but is likely due to small sample size. Player options and ETOs have no significant effect in either the positive or the negative direction. Together, these findings broaden our understanding of the contract year effect. Further research should attempt to provide a more rigorous evaluation of the contract options effects, as the sample could be vastly improved by including data from previous seasons. The contract year effect is a known phenomenon in the NBA, but the nuances of exactly what drives it and where we can see the strongest impact are areas of research that are still growing, and will continue to do so for the foreseeable future.

Appendix 1

A: Descriptive Statistics

Table V Descriptive Statistics	(1) N	(2) Mean	(3) sd	(4) Min	(5) Max
All Players (Rookies Excluded):					
Primary Regressors:					
Contract Year	3,330	0.431	0.495	0	1
Player Option	3,330	0.0489	0.216	0	1
Team Option	3,330	0.0309	0.173	0	1
Early Termination Option	3,330	0.0153	0.123	0	1
Performance Metrics:					
Player Efficiency Rating (points)	3,328	12.61	6.394	-48.60	129.1
True Shooting % (points)	3,319	0.513	0.0934	0	1.064
3 Point Attempt Rate (field goal attempts)	3,319	0.234	0.216	0	1
Free Throw Rate (free throw attempts)	3,319	0.301	0.257	0	6
Total Rebound % (rebounds)	3,328	10.08	5.221	0	86.40
Assist % (assists)	3,328	12.61	9.465	0	78.50
Steal % (steals)	3,328	1.541	0.848	0	11.10
Block % (blocks)	3,328	1.572	1.701	0	26.30
Turnover % (turnovers)	3,321	14.16	6.513	0	100
Usage Rate (possessions)	3,328	18.42	5.370	0	47.80
Offensive Win Shares (wins)	3,330	1.390	2.063	-2.700	14.80
Defensive Win Shares (wins)	3,330	1.258	1.216	-0.200	7.700
Win Shares (wins)	3,330	2.650	2.994	-1.500	20.30
Box Plus Minus (points)	3,330	-1.903	4.406	-53.60	26.60
Wins Above Replacement (wins)	3,330	1.739	3.605	-4.320	31.32
Control Variables:					
Year (years)	3,330	2,011	2.637	2,007	2,015
Age (years)	3,330	27.68	3.956	19	44
Games Played (games)	3,330	51.90	24.85	1	83
Minutes Played (minutes)	3,330	1,218	889.9	0	3,424
Relative Value Determinants:					
Salary (dollars)	3,250	4.786e+06	4.966e+06	6,511	3.045e+07
Salary Predicted Win Shares (wins)	3,329	2.823	2.995	0	18.46
Win Shares minus Predicted Win Shares (wins)	3,329	-0.173	2.630	-18.86	15.68
Salary Predicted Wins Above Replacement (wins)	3,329	2.092	2.219	0	13.68
Wins Above Replacement minus Predicted Wins Above Replacement (wins)	3,329	-0.353	2.969	-14.22	25.28

Notes: Units are included in parentheses after the variable names. Dummy variables did not have units indicated. Dummy variables were also used for each of the 9 years in the sample, and for each of the teams included in the dataset. The dependent variables used in the regression models were all standardized.

Table VI Descriptive Statistics	(1) N	(2) Mean	(3) sd	(4) Min	(5) Max
Highly Overvalued Players (Rookies Excluded):					
Performance Metrics:					
Player Efficiency Rating (points)	1,306	11.99	5.89	-30.2	88.3
Box Plus Minus (points)	1,306	-2.688	3.882	-36.1	11.2
Wins Above Replacement (wins)	1,306	0.829	2.717	-4.320	27
Control Variables:					
Age (years)	1,306	28.27	3.950	19	44
Games Played (games)	1,306	49.67	23.97	1	83
Minutes Played (minutes)	1,306	1,090.41	824.48	2	3,424
Relative Value Determinants:					
Salary (dollars)	1,283	5.004e+06	4.993e+06	6,511	2.78e+07
Salary Predicted Wins Above Replacement (wins)	1,305	2.20	2.23	0	12.73
Wins Above Replacement minus Predicted Wins Above Replacement (wins)	1,305	-1.369	2.575	-10.82	25.08
Marginally Overvalued Players (Rookies Excluded):					
Performance Metrics:					
Player Efficiency Rating (points)	946	11.28	7.868	-48.60	129.1
Box Plus Minus (points)	948	-3.018	5.194	-53.60	26.60
Wins Above Replacement (wins)	948	0.939	2.854	2.85	27.27
Control Variables:					
Age (years)	948	26.70	3.878	19	40
Games Played (games)	948	44.68	26.73	1	82
Minutes Played (minutes)	948	936.35	850.53	0	3,343
Relative Value Determinants:					
Salary (dollars)	899	3.06e+06	4.063e+06	14,409	2.52e+07
Salary Predicted Wins Above Replacement (wins)	948	1.321	1.842	0	12.08
Wins Above Replacement minus Predicted Wins Above Replacement (wins)	948	-0.382	2.242	-7.368	21.50
Marginally Undervalued Players (Rookies Excluded):					
Performance Metrics:					
Player Efficiency Rating (points)	374	13.09	4.786	-3.3	31.3
Box Plus Minus (points)	374	-1.44	3.692	-26.9	10.7
Wins Above Replacement (wins)	374	1.637	3.142	-3.51	26.19
Control Variables:					
Age (years)	374	27.36	3.971	19	42
Games Played (games)	374	54.16	24.51	1	82
Minutes Played (minutes)	374	1236.23	872.43	3	3,211
Relative Value Determinants:					
Salary (dollars)	366	3.923e+06	4.335e+06	26,917	2.48e+07
Salary Predicted Wins Above Replacement (wins)	374	1.730	1.967	0	11.25
Wins Above Replacement minus Predicted Wins Above Replacement (wins)	374	-0.094	2.423	-6.195	20.15

Highly Undervalued Players (Rookies Excluded)

Performance Metrics:					
Player Efficiency Rating (points)	700	15.32	4.819	-8.4	31.7
Box Plus Minus (points)	700	0.821	3.183	-17.3	13
Wins Above Replacement (wins)	700	4.579	4.613	-2.16	31.32
Control Variables:					
Age (years)	700	28.10	3.793	21	39
Games Played (games)	700	64.63	18.28	1	83
Minutes Played (minutes)	700	1,830.90	774.71	5	3,196
Relative Value Determinants:					
Salary (dollars)	700	7.070e+06	5.317e+06	28,834	3.05e+07
Salary Predicted Wins Above Replacement (wins)	700	3.136	2.357	0.0130	13.683
Wins Above Replacement minus Predicted Wins Above Replacement (wins)	700	1.443	3.800	-14.23	25.28

B: Pythagorean Expectation Model:

$$Win\ Pct. = \frac{Points\ For^{13.91}}{Points\ For^{13.91} + Points\ Against^{13.91}}$$

C: Number of Observations

Untrimmed N (including rookie contracts, partial contracts, etc.):

Year	Observations	Contract Year	Player Option	Team Option	ETO
2006-07	459	185	12	52	3
2007-08	452	192	13	47	4
2008-09	446	177	19	49	1
2009-10	443	233	19	55	14
2010-11	453	234	15	81	4
2011-12 (lockout season)	479	194	17	9	8
2012-13	470	229	19	50	9
2013-14	483	219	21	52	6
2014-15	493	243	28	54	2

Note: All option years were also marked as contract years

D: Minutes Played > 500, Controlling for Option Status

Table VII — Estimates of Contract Option Effects on Player Performance, Minutes Played >500
Dependent Variable: Standardized Box Plus Minus

	(All Players)	(Highly Overvalued)	(Marginally Overvalued)	(Marginally Undervalued)	(Highly Undervalued)
Contract Year	0.0181	-0.00211	-0.00667	0.169	0.00562
	(0.0176)	(0.0345)	(0.0758)	(0.216)	(0.0389)
Player Option	-0.0385	-0.0334	0.111	0.125	0.0122
	(0.0324)	(0.0588)	(0.150)	(0.437)	(0.0706)
Team Option	-0.0999**	-0.0821	-0.0209	0.189	-0.143
	(0.0436)	(0.0908)	(0.150)	(0.385)	(0.102)
ETO	-0.0419	-0.00574	-0.111	0.136	0.0162
	(0.0542)	(0.0886)	(0.289)	(1.092)	(0.110)
Player Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Team Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	2,346	890	539	273	643
R-squared	0.823	0.856	0.939	0.972	0.881

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

E: Alternate Dependent Variables, Minutes Played > 500 (Controlling for Option Status)

Table VII	Estimates of Contract Year on Player Performance Dependent Variable: Standardized Performance Metrics				
	All Players	Highly Overvalued	Marginally Overvalued	Marginally Undervalued	Highly Undervalued
	Contract Year Coefficient:				
Player Efficiency Rating	0.0404** (0.0173)	-0.00660 (0.0349)	-0.0150 (0.0759)	0.0926 (0.220)	0.00802 (0.0387)
True Shooting Percentage	0.0420** (0.0195)	0.0473 (0.0399)	-0.0885 (0.0852)	0.112 (0.210)	-0.0276 (0.0424)
Free Throw Rate	0.0322** (0.0141)	0.0127 (0.0288)	0.106* (0.0556)	-0.201 (0.150)	0.0600* (0.0330)
Rebound Percentage	0.0511*** (0.0134)	0.0373 (0.0279)	0.0691 (0.0505)	0.0218 (0.131)	0.0358 (0.0294)
Assist Percentage	0.0117 (0.0185)	-0.0386 (0.0371)	0.0517 (0.0740)	-0.0951 (0.127)	0.0138 (0.0421)
Steal Percentage	0.0328 (0.0203)	0.0162 (0.0403)	0.121 (0.0777)	-0.0519 (0.275)	0.0629 (0.0490)
Block Percentage	-0.00127 (0.0170)	0.0325 (0.0346)	0.0832 (0.0811)	0.126 (0.114)	0.0314 (0.0376)
Turnover Percentage	0.0177 (0.0185)	0.000945 (0.0358)	0.0566 (0.0895)	-0.0102 (0.195)	0.0290 (0.0400)
Observations	2,346	890	539	273	643

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