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An Analysis of the Contract Year Phenomenon in the NBA: Do Players Perform Better or Worse

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Better or Worse?

SUBMITTED TO

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Abstract

The present study uses a novel measure of over performance (percent deviation from career average) to analyze the contract year phenomenon in the NBA. Historically, the literature has pointed toward over performance across almost all statistical measures of performance. However, previous research has assumed that all players are universally affected by the presence of a contract year in the same manner. The present study finds significant results that contradict previous research by dividing the sample of players into subgroups by age, career PER and position. Furthermore, the results of this paper's statistical analysis illustrate the first examples of systematic underperformance in a contract year. More specifically, this study finds that for certain subsets of players, shooting percentage, usage percentage and field goal attempts decrease in the presence of a contract year.

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1. Introduction

Long-term guaranteed contracts are believed to facilitate opportunistic behavior by incentivizing systematic variation of effort levels (Alchian & Demsetz, 1972). This behavior can manifest itself either in increased effort directly before contract negotiations (*ex ante* strategic behavior) or decreased effort immediately after (*ex post* opportunistic behavior or "shirking"). For example, if an employee in an organization knows his salary is going to be renegotiated in the near future, he has added motivation to perform well in that time period. In order to boost his performance, the employee is likely to raise his effort level. Correspondingly, once his contract is set and income is guaranteed, his incentives work the opposite way. His motivation to perform well decreases, thus his effort level falls as well. While *ex post* opportunistic behavior is undoubtedly an important subject, this paper focuses exclusively on the existence and forms of *ex ante* strategic behavior. In sports, strategic behavior in the last year of a current contract is known as the contract year phenomenon.

Sports provide a unique forum for analyzing this type of strategic behavior. In organizations it can be difficult to directly and accurately measure performance and obtain contract data on the subject. Conversely, sports provide a variety of statistics that can be used to analyze performance. Furthermore, contract lengths and amounts in sports are publicly available, allowing researchers to analyze performance relative to the contract cycle.[1]

This paper explores strategic behavior in the National Basketball Association (NBA) for a variety of reasons including contract structures, player involvement, variety

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[1] The contract cycle refers to the stages of a player's current contract. The last year of the contract is called the contract year. The years following the signing of a contract up until the start of the last year represent the remaining portion of the contract cycle.

of performance measurements and depth of previous research. While some research has been conducted on the NBA, much of the literature on strategic behavior in professional sports focuses on Major League Baseball (MLB). This is presumably a result of the intermittent, pitch-by-pitch nature of baseball, which lends itself to simple and accurate measurement. Also, the sabermetrics revolution in baseball has provided economists with more thorough measurements of performance, which allows statisticians to quantify a greater proportion of the game.[2] While baseball performance is relatively simple to measure, basketball is much more complex and provides numerous challenges for empirical testing.

Basketball by nature is more continuous and individual performance is more difficult to assess numerically. NBA players constantly impact the game both on offense and defense in ways that presently cannot be calculated. To illustrate this point, imagine a basketball player in a game situation. He helps his team by setting a screen to create an easy shot for a teammate. Defensively, he rotates to help his teammates and contest a shot, thereby decreasing the probability that the offensive player scores. While this player is clearly impacting his team in a positive manner on both offense and defense, neither of these contributions factor into any performance measures.

These examples not only highlight the difficulty in trying to accurately measure player performance but also reveal the importance of effort. In basketball (more so than in baseball) effort plays an important role in determining performance. While giving maximum effort in baseball will no doubt boost player performance in some ways, it's arguable whether trying harder will help you hit a curveball (Jean, 2010). Baseball

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[2] Another added bonus for empirical research in MLB is the widely agreed upon performance measures. As will be discussed later, some of the ambiguity that has arisen in studying strategic behavior in the NBA is due to varying measures of performance.

players are rarely physically pushed to limits where effort plays a defining role in determining performance. Rather, skill and talent control performance to a greater degree. In basketball, effort's impact is much more obvious. In the earlier example of a player in a game, both of his contributions are directly related to effort level. By playing harder, the player can set a more effective screen and make his opponent's shot more difficult.

While it is possible to look at a basketball player and visually assess how hard he is playing, we cannot directly measure effort. As a result, most researchers resort to using player performance statistics as a proxy for effort. In doing so, they make the assumption that increased effort leads to better performance. However, the degree to which effort and performance are correlated is debatable. While exploring the strength of this correlation, Fort (2003) raised the question of how effort levels actually manifest themselves in performance. Berri and Krautmann (2006) highlighted two ways in which a conscious change in effort could be expressed: during games and outside of games. They understood that for strategic behavior to exist, players must be able to deliberately manipulate their effort level. When considering on court changes in effort level, it is unclear to what degree players realistically have control over their effort (Fort, 2003). For example, it is dubious whether increased effort allows a player to make a greater percentage of fade-away jump shots or convert free throws at a higher rate (Berri and Krautmann, 2006). On the other hand, the degree of control over effort outside of games intuitively seems to be much greater. Players have the choice to work hard in their offseason preparation, practices, weight room activities and dietary habits. Berri and Krautmann (2006) use the example of Vin Baker to highlight the effect of work ethic outside of games. Baker was a perennial NBA All-Star from 1995 to 1998. After signing

an $87 million contract in 1999, his production deteriorated quickly. His per game scoring averages fell from 16.2 to 12.2 to 5.2 in the following successive seasons. Paul Westphal, Vin Baker's coach during his decline, attributed this drop off to a "lack of professionalism off the court" (quoted in O'Neil, 2003). While this example illustrates how a reduction in effort outside of games affects performance, the same idea can be applied to increases in effort.

While some of the literature has used various individual statistics as dependent variables, virtually all of the research has ignored what different performance statistics reveal about how increased effort is manifested. To illustrate this point, imagine two small forwards: Player X and Player Y. In their respective contract years, Player X's shooting percentage increases significantly, while Player Y's rebounding rate increases. Since shooting percentage is based more on skill than on effort, it follows that Player X's boost in effort was likely reflected in more hard work outside of games. Player X presumably spent extra time in the offseason working on his shooting or took more shots in practice in order to prepare for games. On the other hand, rebounding is more closely tied to effort and physical fitness. Player Y's increase in rebounding proficiency could be either a result of increased effort during games, which would directly increase his rebounding output, or working harder on his physical conditioning in the offseason, which would allow him to put forth more effort during games and therefore grab more rebounds. Although Jean (2010) and Stiroh (2007) used a variety of individual statistics as dependent variables they did not consider the implications on how a change in effort level is expressed. Both Jean (2010) and Stiroh (2007) implicitly assumed that changes in effort were universally expressed the same way for all players. The bulk of research on

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strategic behavior in the NBA focuses on a composite performance measure, which is appropriate for analyzing general performance but clouds the deductive power of individual statistics.[3]

Another reason why the NBA was chosen as the research area for this paper was the prevalence of long-term guaranteed contracts and scarcity of performance-based incentives. The possibility of obtaining a long-term contract provides an ideal setting to study strategic behavior. The financial incentives to perform well are tremendous, as performance in the last year of a player's contract can generate a substantial guaranteed contract for the future. Furthermore, performance-based incentives are not used frequently and are generally limited to 25% of a player's contract value (Heubeck & Scheuer, 2003). This limits financial incentives during the remainder of the contract cycle (other than incentives to engage in shirking behavior in the year after signing a long term contract). The lack of financial incentives in other years allows researchers to tease out the individual effect of how added incentives in the contract year influence performance. On the other hand, NFL contract structures are laden with performance incentives, thereby decreasing the likelihood of revealing any strategic behavior.

Compared to baseball or football players, basketball players undoubtedly have a greater impact on the game. Basketball teams are much smaller, which allows each player to have a greater influence on the outcome of the game. Moreover, each player is continuously influencing the game on both offense and defense. This is very different than baseball, where each player only directly participates for a fraction of the time, and football, where the vast majority of players just play offense or defense. As such, out of

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[3] The performance measure used in contract year phenomenon research varies, but tends to either be the NBA efficiency measure or a calculation of marginal productivity. Both will be discussed in depth in the literature review section.

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the three major professional American sports, individual player performance in basketball has the greatest impact on outcome. Since effort level is related to performance, the existence of strategic behavior is incredibly important in the NBA. Moreover, NBA general managers must analyze players' performance to decide whether or not to sign players to long-term contracts. In order to do so they must assess a player's value and anticipate how they will perform in the future. Since we have established that each player has a crucial role in determining wins and losses, each general manager decision has great significance. It would be extremely helpful for NBA front offices to know that performance might be artificially inflated in the last year of the contract before deciding to sign a player to an expensive long-term contract.

2. Literature Review

The history of the contract year phenomenon is riddled with anecdotal evidence of professional athletes who have had monster statistical seasons in the last year of their contract. Furthermore, in the bulk of these cases the players regress back to their average performance (or worse) the following year. The most commonly cited example in the NBA is Erick Dampier (Engber, 2012). In the last year of his contract with the Golden State Warriors, Dampier's rebounding totals per game skyrocketed from 6.6 to 12 and his points per game increased by 50%. The following year however, after signing a long-term contract with the Dallas Mavericks, Dampier's totals returned almost completely to his pre-contract year numbers. Despite this anecdote from the NBA, the majority of studies analyzing the relationship between effort and contract structure use data from

Major League Baseball (MLB), which has contracts that generally include more incentives and bonuses (Rice & Sen, 2008).

While individual examples are appealing, the empirical evidence for the contract year effect as a whole is inconclusive. Some studies have found that professional athletes do strategically alter their effort level to optimize their financial gain from contracts (Lehn, 1982; Scoggins, 1993; Stiroh 2007) while others find a definite lack of strategic behavior (Krautmann, 1990; Maxcy, 1997; Maxcy, Krautmann & Fort, 2002). One of the underlying reasons for this discrepancy lies in the differences in modeling player performance. Multiple studies have uncovered contradictory evidence depending on the player performance model used (Berri and Krautmann, 2006; Krautmann & Donley, 2009). In exploring shirking behavior in the NBA, Berri and Krautmann (2006) explored two separate models of player performance. The first of these models is similar to that of Stiroh (2007) in that a player's performance is measured by total performance statistics like points, rebounds and steals. However, as Berri and Krautmann noted, their first model (which is based on the NBA's performance measure) fails in a number of specific ways.[4] First it does not adjust for playing time. Second, it does not provide weights for each statistic, which would indicate that an assist is worth the same as a point. However, assists always generate two or three points for the team.

Berri and Krautmann's alternative method builds off the work performed by Scully (1974) and involves computing the marginal product. Each individual statistic is measured not simply by its total but by the marginal value it adds to the team. Berri and Krautmann's (2006) conclusion varied considerably depending on which performance

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[4] The NBA efficiency measure = (pts + reb + ast + stl + blk – missed fg – missed ft – to)/gm

measure was used. These results indicate the importance of using a reliable measure of player performance when analyzing the contract year phenomenon.

While many papers have explored the disincentives involved directly after a long term contract is signed, relatively little research has concentrated on how the prospect of an expiring contract influences performance and effort (Krautmann and Solow, 2009). In order to provide more research in this area of the literature, this paper looks exclusively at over performance in the final year of a contract.

Despite narrowing the field of research to *ex ante* strategic behavior, previous studies still have yet to come to a reliable conclusion supporting or disproving over performance in the contract year across sports. Some research has rejected the existence of ex ante strategic behavior (Maxcy, Fort & Krautmann, 2002) while other studies have found significant indicators of over performance in players' contract year (Stiroh, 2007; Rice and Sen, 2008; Jean, 2010; Sen & Rice, 2011). However, it is important to note that Maxcy et al. used MLB data where all others used NBA data. Only when the research topic is confined to NBA players do all studies demonstrate significant *ex ante* performance increases.

While most of the contract year effect literature makes convincing arguments for the existence of enhanced performance in the contract year, their work assumes the effect of the contract year is universally applied to all types of players (Stiroh 2007; Jean, 2010; Rice and Sen, 2008). Recently, a small portion of research has begun to examine whether the contract year phenomenon impacts some types of players more than others (Singer, 2009; Sen and Rice, 2011). While these two studies have briefly touched on this topic, there is ample room for further research. Sen and Rice (2011) found that performance

fluctuations based on contract structure decrease with experience and are almost entirely mitigated when player experience reaches 10 years. This is due, in part, to shorter contracts being given to older players, whose future performance is expected to decrease. Another possible cause for this phenomenon is the fact that most of the players that are able to play in the NBA for 10 or more years were high-level players during their prime. By virtue of being elite players, they likely obtained lucrative contracts and may be less susceptible to financial incentives as a result. In looking at contract year effects in the NFL, Singer (2009) performed a specialized regression by dividing the NFL player population into thirds based on performance. However, no significant effects were discovered likely because he found no sign of the contract year phenomenon in the NFL at all. These findings are likely a result of NFL contract structures, which, relative to the NBA and MLB, have smaller amounts guaranteed and are based more on performance incentives (Jean, 2010). In general, the NBA limits its performance incentives to a maximum of 25% of player salary and in most cases players' contracts are almost entirely guaranteed (Heubeck & Scheuer, 2003). The guaranteed nature of contracts in the NBA provides fertile ground for strategic behavior.

It is more than likely that contract year effects in the NBA are conditional on some levels other than experience. For example, it is conceivable that the very worst players in the NBA, who are scrounging for consistent playing time, would be giving maximum effort at all times. Since their effort is already at a maximum, the presence of financial incentives (or being in a contract year) would not boost effort any higher. This, however, is only one way to group players to explore the contract year phenomenon. There are many other possibilities for conditionality as well. For example, the presence of

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a contract year could affect players differently based on their position. It is possible that centers and power forwards are more susceptible to the contract year effect than guards and small forwards. There are many possible explanations (behavioral and statistical) why this may be true, but the main point is that these types of variations have yet to be studied.

Another area of weakness in this field is the use of advanced statistics. Most studies have used basic statistics (often the NBA efficiency measure or a slight variation of it) to calculate a composite measure of player performance (Stiroh, 2007; Rice & Sen, 2008; Jean, 2010; Sen & Rice, 2011) While there is no inherent flaw in using basic statistics, there are other realms that ought to be explored and can give a more detailed picture of player performance. In the last few years, the NBA has undergone a statistical revolution, which has resulted in the creation of newer, more intricate player statistics to analyze a player's impact on the game. Rather than focus solely on basic statistics like points, rebounds, assists, steals and blocks, this paper will include some of these advanced statistics like player efficiency rating (PER), total rebound percentage (TRB), win shares per 48 minutes (WS48), usage percentage (USG) and true shooting percentage (TS) (courtesy of Basketball-Reference.com).[5]

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[5] Player Efficiency Rating (PER) is John Hollinger's composite measure that attempts to include all of a player's contributions into one rating. PER is an incredibly complex formula and more information on its calculation can be found at http://www.basketball-reference.com/about/per.html
Total Rebound Percentage (TBR) is an estimate of the total percentage of available rebounds a player grabs while he is on the floor.
Win Shares per 48 minutes (WS48) is an estimate of the number of wins a player contributes per 48 minutes of playing time.
Usage Percentage (USG) is an estimate of the percentage of team plays used by a player while he is on the floor. A play that is considered to be used is one that ends in the player taking a shot or committing a turnover.
True Shooting Percentage (TS) is a measure of shooting efficiency that adjusts for the value of the shot being taken. For example, true shooting percentage weights three point shots differently than it would two point shots or free throws.

PER is a very general measure of player performance. One of the major critiques of PER is its emphasis on offense rather than defense. However, this is most likely due to the inherent lack of defensive statistics. Steals and blocks are the most frequently used defensive statistics and are nowhere near fully indicative of a player's defensive performance.

By analyzing the contract year phenomenon within player types and using advanced statistics, this paper aims to fill the gap in research that has been neglected thus far.

3. Theoretical Framework and Data

The foundation for testing *ex ante* strategic behavior is based on comparing performance in a contract year to performance in all other years of the contract cycle. If the contract year phenomenon is real, we should see significantly increased performance during the last year of a player's contract due to the added incentives of possibly being rewarded with a lucrative new contract.

The data for this paper was extracted from two primary sources: basketball-reference.com and storytellerscontracts.info. The former provided all necessary player performance data while the latter provided player-specific contract information. The data provided was ideal because it provided advanced player performance statistics for the 2012-2013 season and contract information detailed enough to distinguish between whether a team option was picked up before or after the completion of the 2012-2013 season.[6]

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[6] A team option gives the team the option to extend the player's contract one more season. The timing of a team option is relevant because a player will be playing with an uncertain financial future until the team

3.1 Dependent Variables and Conditionality

In order to measure many aspects of player performance, I collected data on a variety of individual performance statistics. The six statistics that I manipulated and used as dependent variables were PER, USG, TS, TRB, WS48 and field goal attempts per 36 minutes (FGA36). This data was collected for every player who played in the 2012-2013 season. For every player in all six statistical categories I also collected career averages. These career statistics serve as a baseline performance measure with which I compare their 2012-2013 statistics. To obtain a measure of over performance, I subtracted each player's career average from his respective 2012-2013 statistic and then converted it into a percentage.[7] Thus, if performance were to increase in the contract year, this percentage deviation from career average (PERdev) would be positive for players in the final year of their current contract.[8]

Measuring over performance based on the deviation from a player's career average is a novel method in the contract year phenomenon literature. Instead of comparing statistics across players, who have different career paths, the present method endogenously accounts for some individual player variability.

3.2 Independent Variables and Controls

I was also able to collect my independent and control variables from basketball-reference.com. The first obvious independent variable that I needed to collect was age.

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option is picked up. Thus, a player who's team option is picked up prior to the 2012-2013 season will not be considered to be in a contract season and a player's team option that is picked up after will be considered to be in a contract year. This topic will be discussed in more depth later in this paper.

[7] For example, if a player's 2012-2013 PER was 11 and his career PER was 10, his new measure of over performance would be .1 or 10% ((11-10)/10).

[8] PERdev = PER deviation measure, USGdev = usage percentage deviation measure, TSdev = true shooting percentage deviation measure, TRBdev = total rebound percentage deviation measure, FGA36dev = field goals attempted per 36 minutes deviation measure, WS48dev = win shares per 48 minutes deviation measure

Age is crucial in controlling for the expected difference between career performance and 2012-2013-season performance. It is expected that older players will perform worse than their career averages due to physical deterioration and therefore must be accounted for.

Another variable for which it was necessary to control was teammate ability. Intuitively, if a player's teammates are perennial all-stars then his role on the team will be diminished, likely impacting his performance in statistical categories like usage percentage and field goal attempts. Initially, winning percentage was used as a control for teammate ability. However, this is not entirely helpful because the player in question has some inherent ability to influence whether his team wins a game. For example, if a player performs well during a season and helps his team wins more games, his teammates are perceived as being better as well. Furthermore, since teammate ability is presumed to be negatively correlated with performance (in certain areas) this player who had a great season would be expected to have less of an impact on the game even though this was clearly not the case. To avoid this pitfall, a statistic called tmwins was created to measure team ability without the individual player by using win shares. Win shares by definition represent how many victories a player contributes to during the course of a season. Tmwins is the difference between total team win shares and the individual player's win shares.[9] Thus, the resulting total represents everyone on the team's win share contribution other than the player in question.

It is important to also control for team and position characteristics. Each team has its own playing style, pace and system, which can shape a player's performance to some degree. Some teams run offensive systems emphasizing the interior presence of dominant

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[9] For example, if a player had 10 win shares during the 2012-2013 season and his team won 40 games, tmwins would equal 30.

post players while others focus on outside shooting. These types differences will undoubtedly have an effect on player performance and must be controlled for. Similarly, player characteristics vary widely by position as guards tend to attempt more perimeter shots and forwards and centers generally grab more rebounds. Dummy variables for team and position were included to account for these differences.

In terms of contract data, I collected whether or not a player was in the last year of his contract and contract length.[10] Along with being in the final year of his current contract, a player was also considered to be in a contract year if his team option for the 2013-2014 season was not picked up or if his team option was picked up after the completion of the 2012-2013season. The rationale behind this decision is based on the player's contractual uncertainty for the 2012-2013 season. If a player has a team option for the 2013-2014 season that is not picked up, the 2012 -2013 season now has the added financial pressures of a contract year. Similarly, the 2012-2013 season has the added weight of contractual possibilities if the team option is picked up after the season's completion.

However, players who had a player option or early termination option (ETO) were not considered to be in a contract season.[11] For these players, their contract situation for the next season was guaranteed unless they chose not to exercise their option. As a result, players with player options or ETO's in 2013-2014 had financial security during 2012-2013. At worst if they played poorly, they could count on a one year continuation

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[10] For the purpose of measuring contract length, I did not include a team option or a player option as part of the contract. While options allow for the possibility of extending a contract for an extra season, they are not guaranteed and are thus not worth including. To illustrate this point, a player in a two-year contract with a player option for the third year would have a contract length of two years.
[11] A player option gives the player the option to extend his contract one more season. An early termination option gives the player the option to terminate his contract at the agreed upon date (usually 1 year prior to the contract's conclusion)

of their current contract. However, for players with team options, these players must prove their worth to their team to have any contractual guarantee. A dummy variable was included to demonstrate if a player was determined to be in a contract year.

Players were removed from the sample for various reasons. Rookies (first year players) were eliminated because their career average would simply match their 2012-2013 output, thereby eliminating any performance deviation. Players who played less than 12 minutes per game or less than 30 games throughout the course of the season were removed to ensure accurate statistical evaluations of player performance. Finally, players with one-year contracts were also removed to ensure that all players were currently engaged in long-term contracts. After removing players that fell into any of these categories, 230 players remained in the sample.

3.3 Data Limitations

The major limitation with regards to my data is simply its quantity. Due to time restrictions and the tedious nature of manually collecting a large quantity of observations, I was only able to collect data for the 2012-2013 season. The vast majority of previous research used a large panel of data spanning greater than 10 years. As such, other studies' conclusions are bound to be more robust simply due to the number of observations.

Another drawback from this data limitation is the inability to control for injuries. Past research has used change in games played from one season to the next as a proxy for injury. Having one season of data makes this type of proxy impossible to calculate.

3.4 Simple Data Analysis

Table 1: Summary Statistics

	Observations	Mean	Standard Deviation	Minimum	Maximum
Contract Data					
Contract Length	230	3.36	1.24	2	6
dum_conyr	230	0.24	0.43	0	1
Player Data					
Age	230	27.07	3.97	20	39
Tmwins	230	39.64	13.18	10.7	66
Career PER	230	15.41	3.44	7.9	27.6

Table 1 gives the summary statistics divided into contract data and player data for all players in the sample. The contract data only reflects those players with multi-year contracts, thus the minimum contract length is two years. The variable "dum_conyr" represents the contract year dummy variable. The longest contract in the dataset is 6 years and was shared by 11 players. The mean contract length is 3.36 years with a standard deviation of 1.24 years. Approximately 24% of the players included in my analysis are in a contract season.

The average career PER is just over 15, which is consistent with the league average because PER is adjusted each season so the mean is 15. After dropping players who played less than 12 minutes a game (likely players with low career PER's) it makes sense that PER is slightly above league average.

Prior to performing any regression analysis I analyzed the basic correlations between each of my dependent variables and the contract year dummy variable. Table 2 displays the results of these correlations.

Table 2: Correlation Matrix

	PERdev	USGdev	TRBdev	TSdev	FGA36dev	WS48dev	dum_conyr
PERdev	1.00						
USGdev	0.67	1.00					
TRBdev	0.27	0.04	1.00				
TSdev	0.60	0.08	0.11	1.00			
FGA36dev	0.64	0.96	-0.01	0.04	1.00		
WS48dev	0.40	0.08	0.10	0.36	0.08	1.00	
dum_conyr	-0.06	-0.13	0.07	-0.09	-0.10	-0.04	1.00

Table 2 gives the correlation matrix between all measures of performance and the

contract year dummy variable. The most striking outcome here is the sign on the

correlation coefficients. One would expect the presence of a contract year—and added

financial incentives—to boost performance. However, five of the six coefficients are

negative, hinting at the possibility of negative contract year effects. While there are

obviously no controls in this correlation and thus these results are not conclusive, they are

noteworthy in that they represent the first time that underperformance in a contract

season is considered.

4. Empirical Specification

This section specifies the regression model used in testing for over performance in

the contract year. In doing so, I will explain the reasoning behind my model and analyze

its benefits and drawbacks. In order to determine performance deviation from career

averages I estimate an ordinary least squares (OLS) model of the following form

$$P_i = \beta_0 + \beta_1 \text{dum\_conyr} + \beta_2 \text{Age} + \beta_3 \text{tmwins} + \alpha_\mu + \alpha_p + \varepsilon_I \qquad (1)$$

where P represents the measure of performance used. Since I have multiple dependent

variables for which I test for performance deviations, P represents PERdev, USGdev,

TRBdev, TSdev, FGA36dev, or WS48dev. Thus, six models are estimated using

Equation (1). Dum_conyr is a dummy variable that takes the value of 1 when a player is

in the last year of his current contract during the 2012-2013 season. Age is the age of

players in years and tmwins is a team's total number of win shares minus the player in

question's win shares. The α's correspond to team and position dummy variables

respectively to control for unobserved team and position effects while ε_i is an error term

of the usual properties. All standard errors are corrected for heteroskedasticity.

One of the strengths of this model is that it captures the basic observable inputs

with regards to the variables that impact player performance. Moreover, the addition of

tmwins into the regression model explores an important aspect for which previous NBA

research has failed to account. While some research dedicated to shirking in MLB used

total team wins to control for teammate ability (Berri & Krautmann, 2006), empirical

testing in the NBA has largely ignored this concern. When using total team wins,

however, the issue of attributing teammate performance to the individual player arises.

Using total teammate win shares to account for teammate quality solves this

misattribution problem. Tmwins is a novel idea in exploring the contract year

phenomenon and is a definite strength of the model detailed in Equation (1).

Figure 1 (below) represents the relationship between PER in the 2012-2013

season and career PER across different ages. Intuitively, it makes sense that younger

players will over perform relative to their career averages as they gain playing experience

and knowledge. Likewise, older players are expected to perform worse than their career

averages because of the cumulative nature of nagging injuries as well as declining

athleticism. Once they reach a certain age, the drawbacks of physical deterioration begin

to outweigh the benefits of experience. In this sample, players on average reach this point between the ages of 26 and 27 (The approximate age where PERdev equals zero). The graph depicted in Figure 1 demonstrates the importance of controlling for age when analyzing the contract year phenomenon.

Figure 1: PERdev and Age Scatterplot with Line Fit
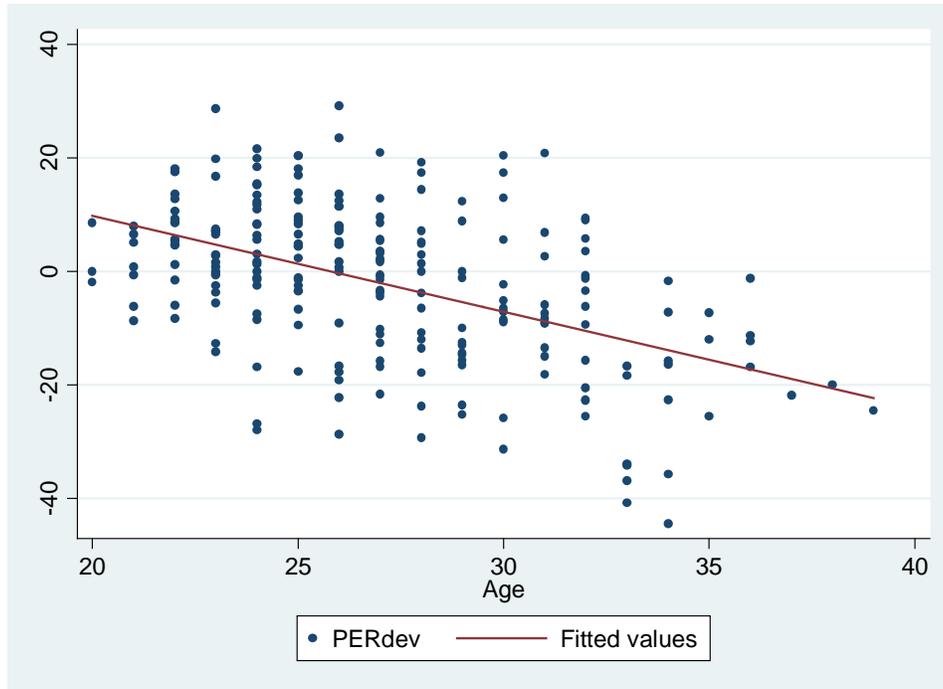
As mentioned earlier, the limited quantity of data eliminates my ability to control for player injury. Since I only have one year's worth of observations, I cannot control for injury in the conventional way, which involves calculating the difference in games played from one season to the next. This is a weakness in my model that derives not from methodology but rather from lack of data.

5. Results

The results section will first examine the regression analysis for each performance measure for the entire sample. Then in order to explore some of the conditionality that likely inhabits the contract year effect, the data will be divided in a few specific ways. First, the dataset will be divided in thirds by age in order to explore any possible differences in contract year performance due to age. To create roughly even numbered groups, players are separated into three categories: low age (24 years or younger), mid age (25 to 28 years) and old age (29 years or older). Second, I will divide my sample by career PER in thirds in order to differentiate by player quality: low PER (13.7 or less), mid PER (13.8 to 16.5) and high PER (16.6 or greater). Lastly, I will divide the sample between guards and post players in the hopes of finding different contract year effects between positions.[12] Ideally, I would separate my dataset by all five positions but my limited amount of data is too restrictive to perform such specific analysis.

In my empirical testing, I used regression analysis for each of the six measures of performance by each of the three aforementioned data subsets. As such, there is too much output to include in this paper. I will include tables and analysis for all regressions where the coefficient on the contract year dummy variable is significant and any other findings that are sufficiently interesting. The team and position effects are excluded from the results tables for space purposes. It is important to note that the same base regression model exhibited in Equation (1) will be used to analyze the data when the sample is divided.

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[12] Guards refers to point guards and shooting guards, while post players includes small forwards, power forwards and centers

Table 3: Regressions on Entire Sample

	(1) PERdev	(2) USGdev	(3) TRBdev
dum_conyr	-0.0213	-0.286	0.307
	(-0.01)	(-0.77)	(1.51)
Age	-1.685***	-0.266***	-0.0251
	(-7.70)	(-6.76)	(-1.10)
tmwins	-0.333***	-0.0175	-0.0117
	(-2.93)	(-0.79)	(-0.95)
N	230	230	230
adj. R^2	0.228	0.250	-0.028

t statistics in parentheses
* p<.10, ** p<.05, *** p<.01

	(1) TSdev	(2) FGA36dev	(3) WS48dev
dum_conyr	-0.941*	-0.140	-0.00163
	(-1.71)	(-0.58)	(-0.14)
Age	-0.184***	-0.137***	-0.00407***
	(-3.05)	(-5.42)	(-3.77)
tmwins	-0.0722***	-0.0124	-0.00264**
	(-2.96)	(-0.92)	(-2.06)
N	230	230	230
adj. R^2	0.128	0.216	0.138

t statistics in parentheses
* p<.10, ** p<.05, *** p<.01

Table 3 reports the results of my base regression for all measures of performance for the entire sample. Each coefficient has the same sign as the correlation matrix in Table 2. Given that those coefficients are rather weak, it is not surprising that only one significant result is found in this test. As demonstrated above, only the coefficient on dum_conyr for TSdev is significant. Moreover, the coefficient is negative, which means that true shooting percentage decreases in the presence of a contract season. More specifically, this model asserts that players' true shooting percentage will decline by

.94% in the presence of a contract year. This result is the first evidence of significant underperformance in a contract season. All previous research has pointed to either no change in performance or over performance in a contract year. However, this is the first study that has analyzed shooting accuracy.

As I have discussed previously, it is arguable whether working harder in a game allows a player to make more jump shots. However, if effort manifested itself in offseason workouts or extra practice time, it is possible that shooting accuracy could increase. Given that true shooting percentage declines when effort increases (in a contract year) it seems likely that some changes in effort are expressed during games. Moreover, a significant rise in effort appears to have a negative impact on shooting ability. After discovering that players shooting percentages decreased in contract seasons, I assumed that it was a result of overshooting; in trying to prove themselves to be valuable assets to a team, players were taking bad shots, thereby driving down their percentages. However, FGA36 does not show significant increases in a contract year, illustrating that players do not shoot more in a contract year.

Another interesting conclusion from this regression is the utter lack of significance for PERdev. Considering that all previous research on the contract year phenomenon in the NBA has demonstrated the existence of *ex ante* strategic behavior using composite measures of performance, it would make sense that PER (being a composite measure as well) would also exhibit over performance in the presence of a contract year. However, this is not the case as PERdev is far from being significantly different from zero. These results further the inconclusive nature of research on the contract year phenomenon because they are so divergent from the research. However, it

is possible that the 2012-2013 season was an aberration in terms of player performance for players in contract seasons. While this is a possibility, this paper's outcome should not be dismissed, as the body of research on this topic is not nearly thorough enough to discard any results simply on the basis that they contradict the existing literature.

The coefficient on age is negative in all cases and significant at the 1% level for each performance measure except TRBdev. This result is consistent with previous research that has demonstrated that age and performance are inversely correlated. However, it is interesting that TRB had the least amount of age effects. This suggests the possibility that rebounding may not be as strongly correlated with physical condition as I previously assumed since the major change as players' age is deterioration of physical capabilities. Perhaps positioning or instinct plays a larger role in TRB than expected.

These results suggest that players are not performing better in the last year of their contract and by some measurements, are actually performing worse. However, this does not necessarily imply that players are giving less effort.

5.1 Usage Percentage

While usage percentage in the 2012-2013 season did not significantly deviate from career levels when considering all players, significant results emerged once the dataset was divided in thirds by age.

5.1.1 Age

Table 4: Usage Percentage by Age

	(≤ 24) USGdev	($25 \geq 28$) USGdev	(≥ 29) USGdev
dum_conyr	-3.041***	0.409	-0.0823
	(-3.18)	(0.70)	(-0.09)
tmwins	0.0584	0.00973	0.0406
	(1.31)	(0.34)	(0.65)
Age	0.280	-0.506*	-0.398**
	(0.82)	(-1.91)	(-2.53)
N	70	86	74
adj. R^2	0.052	0.311	0.124

t statistics in parentheses
* p<.10, ** p<.05, *** p<.01

The three models in Table 4 (above) represent the young, middle and old age groups respectively, using the same base regression model. For the young age group, dum_conyr is negative and significant at the 1% level. This indicates that young players' usage percentage decreases in the presence of a contract year. One might expect that younger players trying to make an impact and demonstrate their potential would attempt more shots and try to make more plays (possibly resulting in more turnovers) in a contract year, thereby boosting their USG. However these results suggest that younger players actually reduce their USG in the last year of their contracts. Since USG is a measurement of a players shot attempts and turnovers when he is on the floor, a change in USG can be either a product of limiting turnovers, decreasing shot attempts or some combination of both. While I cannot know definitively with this one statistic, by analyzing the change in FGA36 later in this paper, I aim to specify whether decreasing

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shot attempts or turnovers causes the change in USG for young players in a contract season.

It is important to extract this difference because there are two different interpretations of decreasing USG. Limiting turnovers is a crucial sign regarding the continued advancement of young players, while increased field goal attempts can be a sign of immaturity if a young player is forcing shots to satisfy his ego.[13] Thus, for general managers making personnel decisions, it is extremely important to know whether younger players tend to decrease their field goal attempts or turnovers in their contract season.

Moreover, while the coefficients are not significant for the middle and old age groups, they are positive. This broad discrepancy further supports the notion that the prospect of an upcoming contract year affects young players much differently than older players in terms of their usage percentage.

5.2 Total Rebound Percentage

While not significant for the entire dataset, TRB demonstrated some interesting results for different subsamples.

5.2.1 Forwards/Centers vs. Guards

The results in Table 5 demonstrate that post players increase their rebounding output in the presence of a contract season. More specifically, small forwards, power forwards and centers as a group increase their total rebounding percentage by .7% when in the last year of their contract. That is, post players grab .7% more rebounds during

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[13] Obviously, increased field goal attempts can also be a result of better performance and thus, more offensive responsibility. However, decreased turnovers are unambiguously a positive sign, whereas inflated shot attempts must be interpreted as being positive or negative based on context and situation.

their time on the floor when they are in the last year of their contract relative to non-contract seasons.

Table 5: Total Rebound Percentage by Position

	(Forwards/Center) TRBdev	(Guards) TRBdev
dum_conyr	0.698**	-0.218
	(2.01)	(-1.19)
Age	-0.0361	-0.0265
	(-0.86)	(-1.35)
tmwins	-0.0139	-0.00555
	(-0.86)	(-0.54)
N	138	92
adj. R^2	-0.000	0.036

t statistics in parentheses
* p<.10, ** p<.05, *** p<.01

On the other hand, point and shooting guards' TRBDEV does not significantly differ from zero. Furthermore, the coefficient is negative, and while not significant, it is in stark contrast to the positive statistic demonstrated by post players. This discrepancy gives further credence to evidence of conditionality effects.

Intuitively, it makes sense for TRB to increase more for post players than it does for guards. Rebounding is inherently a more important statistic for post players and more of their overall performance evaluation is based on their rebounding ability. For other positions (point and shooting guards) rebounding does not play as big of a role in overall performance. As a result, it follows that post players in a contract year—who are looking to demonstrate their overall capabilities to potential suitors—focus their efforts on statistics that make up a greater proportion of their value. This effort can manifest itself either in offseason conditioning or in game effort level. However, the important inference

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here is that players are prone to working harder in areas of their game that has a greater impact on their value and thus, their future salary.

5.2.2 Career PER

The regression output in Table 6 indicates that there are significant differences in TRBdev between players of different career PER. Models (1) through (3) represent players with low, middle and high career PER respectively. The coefficient on model (2) is significant and positive, demonstrating that average players grab a higher percentage of rebounds during their time on the floor when they are in a contract season. More specifically, their TRB increases by 1.3% when they are in the final season of their current contract relative to non-contract years.

Table 6: Total Rebound Percentage by Career PER

	($\leq$ 13.7) TRBdev	($13.8 \geq 16.5$) TRBdev	($\geq$ 16.6) TRBdev
dum_conyr	-0.0570	1.298*	-0.0895
	(-0.19)	(1.69)	(-0.24)
Age	-0.0533	-0.0705	0.00319
	(-1.08)	(-1.10)	(0.08)
tmwins	-0.0275	0.00918	-0.0417**
	(-1.11)	(0.33)	(-2.56)
N	78	76	76
adj. R^2	0.075	-0.143	-0.069

t statistics in parentheses
* p<.10, ** p<.05, *** p<.01

My first instinct was that perhaps more average players are post players; therefore position would be the reason for their improvement rather than player quality (given the results in Table 5). Especially since the significance is only at the 10% threshold, it seemed possible that post players dominated the sample and caused this outcome. However, only roughly 16% of the players in the middle career PER section are centers

while point guards, shooting guards, small forwards and power forwards each represent approximately 21% of the group. Thus, this result is independent of any position related effects.

It is possible that historically average players are more likely to be susceptible to contract year effects for a few reasons. First, they have more financial incentives than elite players. The upper third of players (in terms of career PER) are likely to have other sources of income to supplement their current salary. Elite players usually have endorsement deals with clothing companies and act in many commercials. These additional—and quite substantial—sources of income could lessen the impact that financial incentives have on their effort level. Second, players with high career PER's are generally older and thus, likely to have already secured at least one lucrative long-term contract due, not only to their age, but their continued high performance. In my dataset, the average age of high career PER players is 28.2, while the average age of middle and low career PER players is 25.5. This makes sense because players must be very talented and successful to continue to be able to compete at a high level while their body physically wears down. Third, the low career PER group has likely been constantly working hard to receive playing time and carve out a significant role on their team. As a result, these types of players have been giving maximum effort and added financial incentives may not allow them to work any harder.

These three reasons demonstrate why elite and below average players might be less susceptible to the contract year effect. As such, the results—illustrated in Table 6— support the idea that financial incentives increase effort more in average players.

5.2.3 Age

The results in Table 7 show that older players rebound significantly better in the presence of a contract year. More specifically, their TRB increases by almost 1% in the last year of their contract.

Table 7: Total Rebound Percentage by Age

	(≤ 24) TRBdev	($25 \geq 28$) TRBdev	(≥ 29) TRBdev
dum_conyr	-0.177	0.544	0.965*
	(-0.19)	(1.51)	(1.95)
Age	-0.186	-0.484	0.0173
	(-1.28)	(-1.54)	(0.23)
tmwins	0.0217	-0.0307	0.00139
	(0.85)	(-1.25)	(0.05)
N	70	86	74
adj. R^2	-0.111	0.103	-0.213

t statistics in parentheses
* p<.10, ** p<.05, *** p<.01

These results appear to contradict the research of Rice and Sen (2011), which asserts that the contract year effect vanishes once players reach 10 years of experience. However, Rice and Sen (2011) used the NBA efficiency measure as their dependent variable, which takes a multitude of other statistics into account. It is possible that rebounding is unique and that older players rebound better in the final year of their contract.

5.3 True Shooting Percentage

While TSdev is significant for the entire sample, some interesting results also show up when the sample is divided.

5.3.1 Forwards/Centers vs. Guards

Table 8 (below) represents TSdev when the sample is divided between positions. Model (1) represents point guards and shooting guards and model (2) contains only small

forwards, power forwards and centers. The results of this regression, illustrated in Table 8, demonstrate that TSdev is negative and significant at the 1% level for the guards sub sample. More specifically, this model predicts a 2.21% decrease in true shooting percentage for point guards and shooting guards when they enter the final year of their contract.

Table 8: True Shooting Percentage by Position

	(Guards) TSdev	(Forwards/Center) TSdev
dum_conyr	-2.221***	0.239
	(-3.34)	(0.32)
Age	-0.0131	-0.269***
	(-0.17)	(-2.95)
tmwins	-0.0879**	-0.0804**
	(-2.49)	(-2.58)
N	92	138
adj. R^2	0.276	0.106

t statistics in parentheses
* p<.10, ** p<.05, *** p<.01

Similar to the general regression run earlier, TS has a negative and significant coefficient, which enhances the notion that underperformance (for some player subsets) in a contract year, exists. As mentioned previously, overshooting does not seem to cause the drop in TS, because FGA36 does not significantly increase. This discrepancy in shooting percentage between guards and post players during their contract year most likely stems from the types of shots taken in the course of a game. Guards, by nature, attempt more long range jump shots, while post players take the majority of their shots close to the basket. For longer distance shots, a smaller change in a player's form, rhythm or footwork leads to a bigger alteration in outcome since the basketball is in the air for a longer period. As such a 25 foot jump shot is more responsive to changes than say a 6

foot jump hook. Thus, it is possible that the increase that results from a contract year has just enough of an impact on some aspect of shooting to where it affects only long range shots and not closer shots.

On the other hand, forwards and centers showed no significant change in their true shooting percentage. This sample subset clearly illustrates that guards weighed down the TSdev regression for all players, causing it to be negative and significant. This is a great example of why conditionality is such an important topic to explore with regards to the contract year phenomenon. As I have demonstrated, individual subsamples can be more susceptible to certain effects. If that effect is strong enough to weigh down the entire sample, the researcher may incorrectly conclude that the effect is universal across all player types. As this example indicates, how a contract year alters performance is not always the same for all players because different player subsets are likely to have varying responses to financial incentives.

5.3.2 Age

In Table 9 (below), models (1) through (3) are subsamples of the larger dataset divided into three categories: young, middle and old respectively. Table 9 demonstrates that dum_conyr is significant at the 10% level for both young and old players. The results of this regression assert that, in a contract year, younger players' true shooting percentage increases by 2.25% while older players' true shooting percentage decreases by 2.81%.

Table 9: True Shooting Percentage by Age

	(≤ 24) TSdev	(25 ≥ 28) TSdev	(≥ 29) TSdev
dum_conyr	2.249*	-0.468	-2.806*
	(1.87)	(-0.53)	(-1.71)
Age	-0.321	-0.349	-0.179
	(-0.78)	(-0.87)	(-0.68)
tmwins	-0.0902*	-0.0286	0.0433
	(-1.87)	(-0.80)	(0.55)
N	70	86	74
adj. R^2	0.205	-0.049	0.219

t statistics in parentheses
* $p<.10$, ** $p<.05$, *** $p<.01$

This regression very clearly demonstrates that the presence of a contract year has disparate effects depending on player type. In this case, the presence of a contract year causes true shooting percentage to go in opposite directions for younger and older players. These results again illustrate the importance of conditionality. The detailed differences and nuances between age groups would be left undiscovered if regression analysis were performed only on the dataset as a whole.

5.4 Field Goal Attempts per 36 Minutes

Although FGA36dev was not significant for the entire sample, when divided into subsamples, some interesting results appear.

5.4.1 Age

In Table 10 (below) the three models illustrate the regression results of FGA36dev when the sample is separated into young, middle, and old players respectively.

Table 10: Field Goal Attempts per 36 Minutes by Age

	(≤ 24) FGA36dev	(25 ≥ 28) FGA36dev	(≥ 29) FGA36dev
dum_conyr	-1.633**	0.136	0.0362
	(-2.36)	(0.41)	(0.07)
tmwins	0.0278	0.00256	0.0237
	(1.09)	(0.13)	(0.69)
Age	0.223	-0.268*	-0.235**
	(1.13)	(-1.70)	(-2.30)
N	70	86	74
adj. R^2	0.044	0.308	0.195

t statistics in parentheses
* $p<.10$, ** $p<.05$, *** $p<.01$

These results shed light on the previous analysis using USGdev as the dependent variable. When the population was divided into thirds by age, USG for young players decreased significantly in the contract year. Since USG is a product of both turnovers and shot attempts, I was unsure whether players were shooting less or committing fewer turnovers. Model (1) in Table 10 allows us to conclude that young players shoot less in their contract year. Whether this is a result of better shot selection or decreasing scoring responsibility (caused by poor performance) is up for debate. However, the idea is that younger players may be using greater judgment in choosing which shots to take. This notion is furthered by the results in Table 9, which show that young players' TS increases during a contract year. These two results together suggest that young players are eliminating bad shots in their contract year, thereby raising their accuracy and lowering the number of shots taken. This result is especially interesting given the stereotype that younger players are less coachable, eager to shoot the ball and more prone to engage in poor shot selection.

6. Conclusion

Understanding the contract year phenomenon is an important topic for NBA franchises because its existence causes systematic alterations in performance. Since NBA front offices have to make player personnel decisions based on observed performance (likely using statistics to inform their decision to some degree), grasping how financial incentives impact on-court behavior is crucial. Moreover, this paper demonstrates that performance is likely to deviate in the last year of a player's current contract, which is likely when performance is being most heavily scrutinized.[14] As a result, how the presence of a contract year effects performance is an important topic for NBA general managers to consider during their evaluation process.

The results derived from this paper's regression analysis diverge significantly from the literature on the NBA contract year phenomenon. While one may be quick to blame the lack of data as the cause for this discrepancy, this paper looks at *ex ante* strategic behavior from a different perspective and uses different analysis techniques, thus it makes sense that its results are somewhat different.

The conclusions specified in this paper are by no means an end all answer to the specifics of the contract year phenomenon, however this paper adds to the existing literature in many ways. It provides a new measurement of teammate performance (tmwins), which is based on win shares rather than win totals and avoids accounting for the player in question's performance. This paper also formally introduces the idea of conditionality effects, that is, how different subsets of players react to the presence of a contract year. These subsets include age, position and historical performance (measured

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[14] Stiroh (2007) demonstrated that salary is more heavily weighted on contract year performance than any other year, thus it seems probable that NBA general managers' performance analysis tends to do the same.

by career PER). Moreover, this paper provides the first statistical evidence of underperformance in a contract year. Underperformance was discovered in true shooting percentage, usage percentage and field goal attempts per 36 minutes. However, the present study should be replicated with a bigger sample to ensure its validity.

Since the literature on the contract year phenomenon in the NBA is limited and lacking in creative approaches, there are many possible future studies to consider. It would be interesting to divide the sample into groups by each position types rather than by guards and post players in order to undergo a more detailed analysis of position effects. Another possible study would involve analyzing assist rates to see if guards increase their percentages more than post players. This would be similar to post players increasing their total rebound percentage more than guards and would further suggest that players tend to boost performance in areas that more strongly correlate to their market value. While this paper dealt exclusively with *ex ante* strategic behavior in the NBA, future research should incorporate conditionality and advanced statistics into research examining other sports and *ex post* opportunistic behavior.

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