Strategies to Raise the First Contract Price for New Unrestricted Free Agents in the NBA

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Abstract

This paper analyzes how National Basketball Association (NBA) rookies should perform in their initial four seasons to maximize their fifth-season salaries. I decided to research this topic because NBA rookies are like new workers in an industry who have enormous potential to get promoted. Additionally, this paper can help me to determine what is the effect of performance on wage is for rookies. The reason to choose rookies as the sample is because the new free agent contract usually represents a significant shift in a player's career. By using the player data from the 2005-2010 NBA draft players, this paper builds a regression model to analyze how a rookie’s fifth-year salary is affected by both personal characteristics and performance during the first four seasons of his career. By constructing a wage equation model for each position, the results suggest that players in different positions can apply different strategies to maximize their fifth-season salary. Additionally, the players’ initial draft ranking is not a significant factor for their fifth season contract; however, teams do prefer younger rookies to the older ones.

1. Introduction

If we analyze the NBA (National Basketball Association) as any other labour market, the skills and ability of players are considered to be human capital in professional sports. The players with higher productivity have higher chances of getting promoted, just like other workers in other job markets. However, both the variables of the ability and the performance of players are easier to measure compared to the analysis of regular job market, and there are no monitoring problems. The nature of workers' rewards in the league or in other organizations may differ, but the primary reward is the remuneration.

Pay for performance is an efficient remuneration scheme when it is easy to observe and monitor players' performance levels. Their marginal product is measured with very little error according to a scheme which almost everyone recognizes and accepts as accurate. Similar to the way children may be encouraged using candy and chocolate to accomplish something challenging, the players may have different reactions in response to changes in remuneration; the incentive mechanism is not always compatible in eliciting the optimal level of effort in all situations. In this case, sub-optimally rewarded people may be less motivated to work at their highest capacity and might in return perform with less effort. In contrast, optimally rewarded staff will be motivated to work harder when they are properly incentivized. However, in the job market, the most substantial reward is the pay. For a long time, management scholars have always advocated linking compensation to performance as a means of stimulating higher performance. Thus, one of my assumptions is the marginal revenue product that the player with better performance will be better paid, and the performance will be indicated in the box score, which is a is a structured summary of the results from a sport competition. This assumes that salaries strongly and positively correlated with marginal product. The purpose of this paper is to analyze the different factors can make National Basketball Association (NBA) rookies receive a higher-value contract after their trial periods based on their first four seasons' performance, which include their rookie seasons plus their restricted free agency seasons. Their salary during the first two seasons are determined by the rookie contract, while their salaries during the third and fourth seasons are the restricted free agency contract. Their salaries during the fifth-season which is the first season of the unrestricted free agency, are determined by that contract.

There are papers are that analyze how pay correlates with player performance, but only a few of them focused their research on the performance of rookies. The player performance of a rookie is worth investigating for the determination of their wage, because there is a wide range of salaries that a rookie could eventually earn as his career progresses. In contrast, the determination of wages for veteran players does not have a wide distribution because it is hard for them to experience a significant improvement in performance; therefore, there will likely not be a sharp change in their salary until their current contract expires. For rookie players, the first contract stipulating their salary for their first two years is determined by their draft rank, and their salaries for the restricted free agency contract for the third and fourth season also mainly based on their draft rank; the variation in salary distribution of these two periods is restricted. Therefore, all the players have an enormous potential to receive a jump in salary when they are past the rookie and restricted-free-agency seasons, which is the reason for which I choose the fifth-season for the wage equation. As indicated in the Benjamin's (2017) discussion of age-earning profiles, productivity is typically ascertained at a reasonably early stage of a person's career. This is especially true for athletes, as it is rare to have a "late bloomer" in all the major sports.

Similar to all other sports leagues, the monopsony power of the NBA has decreased substantially since the league was formed. A monopsony is the mirror image of a monopoly: as a monopolist is the only seller in the output market, while a monopsonist is the only buyer in the labor market. In this case, the only buyer is the team within the league. The decline of the monopsony gave rise to the provisional salary cap and the regime change of the restricted free agent. However, to keep the competitive balance among the performance of teams, the league still enforces the reserve clause for all the rookies. The reserve clause means that once a rookie signs with a team, this rookie must stay on the team for two years' salary determined by rank when drafted and subsequently will become a restricted free agent. When a player becomes a restricted free agent, the player can have the right to join another team B if team B offers a contract, and the present team decides not to meet the terms of that offer. In other words, in the first two contracts, the salary differences between rookies and non-rookies are not large, since their draft position mostly decides their wages at this point. However, once the player turns into an unrestricted free agent, he may experience a sharp salary increase. During this fifth-season, the huge wage gap between players tends to be more evident.

Using the most relevant statistics on the 2011 draft from ESPN NBA, the maximum payment for the new unrestricted free agent was to Anthony Davis with a five-year, $127,171,313 contract with the New Orleans Pelicans at the age of 22. This contract includes $127,171,313 guaranteed, and an annual average salary of $25,434,263. Anthony Davis was the first pick in the 2012 draft with an average of 20.75 points, 10.1 rebounds, and 1.8 assists during the rookie seasons from 2012-2015. The lowest salary in the NBA is $0 for those rookies that left the league. This paper will discuss the factors that generate this large difference between the players with same level of experiences after the first four seasons.

Thus, as a rookie just being drafted to the league, the question of how to raise the salary that is specified in the first contract after the reserve clause no longer applies is worth analyzing; this is the research question that this paper is going to discuss. This paper is also going to examine how a player can increase the potential contract value by playing on the court more pointedly, which means developing a very specialized skill set for both on-court strategies as well as off-court training in the first four seasons. The players will choose which skills to develop, for the reason that they might be endowed certain skills, or they have an incentive to choose which skills to develop, assuming that he is originally equally talented in all. The regression model can produce estimates of the performance factors that the player can concentrate on and which skills to work one, both of which can be determined upon entering the league

The structure of this paper is as follows: section two consists of a review of the relevant literature. Section three will introduce the data used to estimate the regression model. Section four will present the model the paper is going to estimate for this question. Section five will be an analysis of the results generated by the regression model. Section six contains the conclusion regarding strategies to maximize future salary.

2. Literature Review

2.1 Studies about League Structure

The team or the sports team's owner is the one who pays for the service of the players. Thus, we need to know how the revenue is determined from the team's perspective. From a sports team owners' perspective, the club can also be considered to be a profit maximizing firm. Leeds' (2014) presented the sports team's revenue as:

$$\mathrm{TR} = R_G + R_B + R_L + R_V + R_T$$

in which R_G represents the revenue generated through gate receipts which is ticket sales. R_B is the broadcast revenue, which is the national media or local media payments. R_L is the licensing revenue. R_V is the venue revenue. R_T is the transfer of revenue from other teams.

Leeds' (2014) states that the gate receipts (R_G) are the largest source of revenue for a sports team. Among the major sports leagues in North America, the MLB has a much higher ticket revenue than the NFL, NBA, and the NHL. One major cause for this receipts difference is the size of the stadiums that hold the game, the NFL among these three has the largest stadium equipped with more seat, also the number of games that they play. In contrast, the NFL evenly distributes the gate receipts because of their revenue-sharing policy. Additionally, the broadcast revenues(R_B), which are collected from local and national channels, generate substantial revenue streams for all four major sports leagues. Furthermore, licensing agreements for all four major North American leagues have created licensing arms, which are known as MLB Properties, NBA Properties, NFL Properties, and NHL Enterprises; these organizations oversee the sale of "official" team paraphernalia to fans. Finally, venue revenue, or non-ticket revenue from the stadium (R_V), includes revenue from parking and concessions; more importantly, however, it also includes revenue from special seating such as the luxury suites, only a small portion of which counts as ticket revenue. Based on the configuration of the revenue sources above, we can learn how star players can increase both the ticket revenue and the licensing revenue for the teams. Since team managers are the profit maximizers, how do these revenue sources correlate with the salaries of or a single player? One crucial factor is the star power of single or several players; the extremely high popularity of these star players can generate more than the average audience to purchase tickets.

Thus, the league has attributes which are similar to those of a monopoly firm with output (q) and using input capital (K) and labour (L). In such a setting, leagues maximize profit by choosing the amount of labour (L) that will maximize the difference between revenue and cost. At this point, a team manager operating in this market needs to balance spending money on the right players in order to increase revenue while also spending less money on player salaries in order to save costs. According to standard labour demand theory, the labour market values employees based on their marginal revenue product, which is defined as the extra benefit or revenue created per hour by adding one extra worker. The marginal cost of working more than one hour is the wages of workers (w). The benefit of employing more workers is the extra income generated by workers. Therefore, the company only employs the right number of workers so that the marginal cost (w) is equal to the marginal benefit (MRP_l).

Players do not directly generate items for sale. Instead, players are the direct input generating ticket sales which in turn are determined in part on a team's performance. If the team's profits are maximized, then we must establish a relationship between performance and profit. For example, the team's winning rate may increase the ticket sales at home, which raises the ticket revenue. Since the pioneering work, economists have made numerous estimates of the output value of professional athletes. I present a relatively intuitive measure developed by Berri (2007), who calculated the marginal revenue product of professional athletes. Within the NBA, they first assume that the team wins with the player as input. Berri's (2007) defines the value of the player as

$$\mathrm{MRP} = \mathrm{MR}_{wins} \times \Delta\ \mathrm{Wins}$$

This win equation rewards players for positive contributions, such as scoring and rebounding, and punishes them for negative contributions, such as mistakes and fouls. MR_{wins} is the marginal revenue of wins which is explained as increase the ticket revenue with one more win team generates.

However, in my paper I adapt the definition of the marginal revenue product of labour as the marginal revenue for one more game the player plays multiplied by the player's performance marginal product:

$$\text{MRP} = \text{MR}_{game} \times \text{ Performace marginal product}$$

In which, the performance marginal products are the independent variables of the wage equation. According to the method of winning, Berri et al. determined that LeBron James, Chris Paul and Tyson Chandler were the most productive players in the NBA during the 2011-2012 season. James was credited with winning 17.3 games, Paul was credited with winning 14.2 games, and Chandler was credited with winning 13.3 games. Interestingly even according to the equation here, in which winning plays a primary role sometimes star players did not contribute just to their team, because star players attract many fans to other teams' home arenas as well. As NBA teams do not yet share gate revenue, star players can generate substantial positive externalities for other teams. Nevertheless, since this paper focuses more on the agent's side than the team's side, the wins equation by Berri et al. is worth researching and can also be applied in the NBA reference stats.

2.2 Studies about Determination of Player Salary

However, Berri's (2007) pointed out that the success of the playoffs is different from the success of the regular season, and using a more extended data set, the correlation between wages and the attribution of victories is found to be rather weak. A fortunate team can get a very talented player, such as Dwight Howard, with a competitive edge. This means that the importance of height and muscle in the determination of wage, as well as those less athletic players with stronger skill sets, may be underrated. Which suggest that the team's win factors are not crucial for the player's wage equation; however, the players' talents is a significant factor to investigate.

The literature focusing on the analysis of the performance of professional athletes is quite developed, with most studies focusing on a particular season among all players. The purpose of the Berri's (2007) article is to examine how marginal labour productivity is determined and to consider players as human capital using two empirical models. The model suggests that the number of points scored by the player is critical when measuring the player's performance, while the variables related to defense measurement and negative actions like turnovers are not included in the regression model. In this paper, the regression model will be similar to Berri's model, but mine will only focus on rookies. However, unlike Berri, who used only box scores as the explanatory variables, the factors of the draft and age problem will also be considered in this paper based on Kahn's (2005) finding, and the negative actions of turnovers and fouls will be among the variables in the model. Drawing from Kahn's (2005) paper, which was couched in the framework of the contract system of the NBA, the monopsony power from the league and the rules of the free agency, I will also include these factors in the analytical framework of my paper These rules can help readers with little knowledge of professional sports to have an idea of the contract structure.

Other elements that need to be explored can be seen in Abidin's (2013) study, which indicates that the percentage of body fat and jumping ability may be important factors consider when evaluating a player's potential to be an excellent defensive player. Additionally, lateral quickness appears to be a critical measurement for a player's ability to steal the ball. Regarding grabbing offensive rebounds and blocking shots, other factors such as timing and positioning may be more crucial than jumping ability. General athletic prowess is a crucial component of a player's playing style and their performance. Since the athletic ability is not stable and which is hard to measure over the years, this paper will not include direct measures for the athletic prowess. The original indicator for athletic ability and sports genetics is their draft rank when they entered the league.

Louivion's (2017) analyzed which factors affect the salary for basketball players in the NBA, and whether the salary cap has achieved its purpose of maintaining competition. The results generated by their model attained an explanatory level of 57.4%. For the players who played as the point guard in the league, their age, as well as the number of offensive rebounds, scores, assists, steals, defensive rating are the main criteria that determined their salary. Among all of the above variables, the scores are the most statistically significant. The method Louivion's (2017) use to analyze the results is to compare the Eta Squared, standard error and p-value. The conclusion from the literature analysis shows that the salary cap fails to achieve everything it is supposed to fulfill of maintaining the competition, which is not as efficient as implementing the luxury tax.

Rosen's (2000) looked at the labor markets in professional sports. He compared different promotion and punishment policies to maintain competitive balances across different major sports leagues in Europe and North America. The study also analyzed pay and marginal value product, and noted that the rent maximization problems for the players have been improved after the elimination of the reverse clause. The reserve clause rule states that the owner of the team has the primary right to negotiate the contract. Rosen stated that players are usually able to reach their full rent after they become unrestricted free agents, which for the NBA is in the fifth-year contract. Both the rookie contract and the restricted free agency contract are usually discounted for those talented players. Since these contracts are mainly determined by draft rank and have little space to change, the first four seasons' salaries will not be included in my model.

Hausman's (1997) study analyzed the effect of superstars in the NBA. They found that the superstars in the league may not only bring business values to their own team, but also add values to the other teams and to the whole league. They pointed out that Michael Jordan doubled the average home attendance for the Chicago Bulls after he joined team for the first year. Also, he pointed out that the player in a large market team may accumulate his value in less time compared to a similar capacity player in a smaller market team. They demonstrated that the salary cap put the smaller market teams in a worse situation, which is not efficient compared to the tax to maintain competitive balance. Thus, the team fixed effects should be controlled in my model when treating these 320 players from different teams.

Li's (2014) study analyzed the determinants of salary and overpayment in the year of signing a new contract, which is similar to my question focusing on the contract for new unrestricted free agents. The results show that the player's salary depends not only on the player's performance in the contract year but also that the year before the contract year is an important consideration. Li's (2014) research on the determinants of the salary to sign a new contract uses the data for the season before the signing of the new contract. His research focuses on all the players generally, but this paper will only concentrate on the problem for rookie players. The results also suggest that players with more All-Star titles and better offensive performances tend to receive a higher payment. While Li's (2014) paper focuses on the rookie players, only minor rookie players can earn the All-Star title in the first four years; thus, this will not be a reliable variable to construct the model. Since this paper aims to provide strategies to rookie players, different position players should be handled differently as well. Thus, this article will construct a separate regression for rookies who play different positions in order to help find the best solution for each circumstance, as well as a pooled one for a general solution.

3. Data

The data used to construct the wage equation model are drawn from the Basketball Reference Player Season Finder and the ESPN NBA website. The process of selecting the data will involve each rookie's name from 2005-2010 and filtering out their performance statistics and salary payment after their rookie seasons. This model uses the per game box score stats instead of the total score sum in the regression model because the per game stats are closer to the other estimators. For instance, usually, there are accumulative statistics summed up from four seasons the player will be over one thousand, while there are average statistics are double-digit numbers which are consistent to the other estimators.

Table 1: Data Summary for All Players

Variable	Sample Size	Mean	Standard Deviation	Max	Min
Fifth-Season Salary	302	$3,263,292	4194585.11	$17,632,688	$0
Age	302	21.46	1.37	25	18
Pick of Draft	302	27.07	16.35	60	1
PER	302	12.53	5.68	35.3	-48.6
Offense Box Plus Minus	302	-1.98	3.67	6.8	-46.4
Defense Box Plus Minus	302	-0.46	1.74	6.8	-7.2
Points	302	7.00	4.68	25.9	0
Rebounds	302	3.08	1.96	12	0
Assists	302	1.43	1.59	9.9	0
Steals	302	0.55	0.39	2.4	0
Blocks	302	0.39	0.39	2.4	0
Turnovers	302	1.04	0.67	3.6	0
Personal Fouls	302	1.70	0.75	3.9	0

The ESPN reported the amounts specified in player contracts for each season. As shown on Table 1. In the NBA drafts from 2005 to 2010, there were a total of 302 players. Among these players, 120 of them played in the Guard position (as Point Guard or Shoot Guard), 131 played in the Forward Position (as Small Forward or Power Forward), and 51 played in Center position. The average of these new free agents' first contract was $ 3,263,292. The maximum wage a player received was $ 17,632,688 for Derrick

Rose, and the minimum wage a player earned was $0 (for those who left the league or suffered injuries in their fifth-season). By using the above wage equation model, the summary table provides descriptive statistics for the variables that are included in the regression model.

4. Model

The paper will develop a linear regression model regarding player salaries. The model aims to discover which of the skills-related variables has the most substantial influence on the wage; these measures were included as independent variables in Ordinary Least Squares Regressions of the players' salary.

Since a basketball team has different positions within the game, the various performance measures depend on the position that the player plays. A strong performance according to one criterion for one position might not translate into a strong performance for other positions on the court. In order to address this concordance issue, I estimate three separate regressions that are categorized by player position. As such, within these samples, the estimates corresponding to performance measures can be compared with some accuracy. That is to say, the shoot guard and small forward tend to earn highest points per game, the power forward and center have more rebounds, and the point guard has the most top assists. Because some positions involve similar functions on the court and tended to generate close statistics, the model will separate these five positions into three categories; the Guard, the Forward and the Center. Thus, to keep the wage equation more precise and more targeted, three separate regressions will be estimated according to the three above categories.

Consider the case of the human resources manager who decides to offer a formal contract for an intern. Usually, the contract will be determined mainly by performance during the internship and the educational degree. For the rookies in the NBA, their performance is recorded in the box score, and the draft order is the counterpart for the education level or certificate of other workers. Thus, constructing the wage equation for free-agents in positions will be as follows: the explanatory variables in this multiple regression model will be the box score of scores, rebounds, assists, turnovers, and fouls, as well as draft order and the age of signing the first free agent contract.

The estimation equation specifies that the estimated variable as the player's fifth-season salary, and the exogenous variables consist of two sets of variables, for which the first set represents player personal attributes which are determined once they entered the league. The second set is the measures of player performance, which correspond to the differentiated skills.

The formal mathematical expression is specified as:

$$W_i = \boldsymbol{\beta}_0 + \sum_{K=1}^{2} \boldsymbol{\beta}_k \, personal\ arributes_{ki} + \sum_{j=1}^{10} \boldsymbol{\beta}_j on - court\ performance_{ji} + \varepsilon_i$$

However, in this model, since we are regressing the income as the dependent variable, what we can do here is to take the natural logarithm of the salary as the regression equation of log income is specified as:

$$\ln(W_i + 1) = \boldsymbol{\beta}_0 + \sum_{K=1}^{2} \boldsymbol{\beta}_k \, personal\ arributes_{ki} + \sum_{j=1}^{10} \boldsymbol{\beta}_j on - court\ performance_{ji_{ji}} + \varepsilon_i$$

There are several reasons to take the natural log on the dependent variable salary. Taking the log would make the distribution of the transformed variable appear more symmetric, which is more normal. Additionally, applying the log can also help transform a non-linear regression into a linear one, but this is not a concern in this model. The main reason here is that it can reduce the degree of heteroscedasticity and may eliminate it. With this specification, the estimated coefficients are interpreted as the percentage changes in the wage that corresponds to a unit change in the exogenous variable. When we are dealing with incomes and wages especially for these high earning groups, the upcoming results of the coefficient will also be huge in magnitude, which can be shown on the raw model results table. The reason for which I add unity to the wage level is to solve the problem for those zero salary players.

i = subscript i for individual i

$ln(\mathrm{W}_i + 1)$= Natural log of fifth-season salary

$\boldsymbol{\beta}_0$= Intercept of this equation, which is the constant term

$\boldsymbol{\beta}_k$= The slope parameter for the corresponding regressor of personal attributes

$\text{personal attributes}_{\text{ki}}$= k regressors as the player personal attribute explanatory variables

$\text{on} - \text{court performance}_{\text{ji}}$ = j regressors as player performance explanatory variables

$\boldsymbol{\beta}_j$= The slope parameter for the corresponding regressor as player performance

ε_i= The error term (disturbance)

The detailed format is

$$\mathbf{Ln(5th\ Season\ Salary + 1)} \\ = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\mathbf{AGE} + \boldsymbol{\beta_2}\mathbf{PICK} + \boldsymbol{\beta_3}\mathbf{PER} + \boldsymbol{\beta_4}\mathbf{OBPM} + \boldsymbol{\beta_5}\mathbf{DBPM} + \boldsymbol{\beta_6}\mathbf{PTS} + \boldsymbol{\beta_7}\mathbf{TRB} \\ + \boldsymbol{\beta_8}\mathbf{AST} + \boldsymbol{\beta_9}\mathbf{STL} + \boldsymbol{\beta_{10}}\mathbf{BLK} + \boldsymbol{\beta_{11}}\mathbf{TOV} + \boldsymbol{\beta_{12}}\mathbf{PF} + \varepsilon$$

Dependent variable: The natural log of the fifth-season salary

Explanatory variables:

Age – The age of the player when drafted

Pick – The draft position

PER – Player Efficiency Rating

OBPM – Offensive Plus Minus per game

DBPM – Defensive Plus Minus per game

PTS – Points per game (during the first four seasons)

TRB – Total rebounds per game (during the first four seasons)

AST – Assists per game (during the first four seasons)

STL – Steals per game (during the first four seasons)

BLK – Blocks per game (during the first four seasons)

TOV – Turnovers per game (during the first four seasons)

PF – Fouls per game (during the first four seasons)

ε – Error term

This model is estimated by the OLS technique. Since the wage is only the fifth-year wage, there is no intertemporal variation. Only the multicollinearity problem will be incurred, no auto-correlation exists of any type. The Age (age when drafted) and Pick (the draft order) are the pre-determined variables that players cannot change when they play in their rookie seasons. From the documentation on found in Calculating PER's (2017) explanation, the PER (which is the player efficiency measurement developed by John Hollinger) converts the player performance into a number. The OBPM (Offensive Box plus minus), PTS (points per game), the TRB (total rebounds per game), and the AST (assists per game) are the offensive performance measurement for the player. In contrast, DBPM (defensive plus and minus), the STL (steals per game), BLK (blocks per game) are the defense-side measurements. The TOV and PF are the negative performance measures. These aspects are significant factors taken into consideration when determining the salary that is stipulated in the contract.

The reason to choose these variables to estimate my model is that all of these estimators can be summarized into two major categories. The first aspect is the player's attributes; these personal characteristics cannot change once the player enters the league, but nevertheless they still have a strong influence on the contract. For example, age is one of the personal attributes that players cannot change since obviously they cannot control when they were born. However, team managers tend to have different requirements on age. For instance, if the team wants a more experienced player to provide leadership in the playoffs, the manager might prefer an older player all other factors held constant. In contrast, if the team wants a player to form part of a new core for a team that is in the rebuilding phase, a younger player would be preferred.

Similarly, rookies cannot change their draft position when entering the league. The order of the draft is primarily based on a player’s college performance and their body strength; thus, the player’s height or weight will not be included in this model, because they are taken into consideration when determining draft position. The rank of the pick, in this case, will determine the base contract for a rookie; these contract prices are references for the subsequent salaries the players can receive. Thus, the draft ranking is determined by body fat and weight, and while it in turn determines the value of the two contracts. However, a higher draft position does not guarantee a higher salary during the free-agency phase. This is because performance is also a persuasive measurement to set the salary for an employee. The rookies’ performance in the first four seasons is another aspect which is represented by box scores.

5. Results

Regression model: $\ln(W_i + 1) = \boldsymbol{\beta}_0 + \sum_{K=1}^{2} \boldsymbol{\beta}_k PA_{ki} + \sum_{j=1}^{10} \boldsymbol{\beta}_j PP_{ji} + \varepsilon_i$

When I estimate the regression model directly, I discovered some troubles in the outcome summary table. Based on the Gauss Markov theorem, the estimators are BLUE as a linear regression satisfying the usual set of assumptions, there are a number of assumptions made in order for the OLS estimators to be BLUE. The crucial assumption:

$$\mathrm{E}(\varepsilon|\mathrm{X}) = 0$$

$$\mathrm{E}(\varepsilon\varepsilon'|\mathrm{X}) = \sigma^2\mathrm{I}$$

To ensure to the model meet this assumption and be more efficient on variance I will apply “robust” as an alternative to the least square estimators which deals with the likely heteroskedasticity that exists. The robust estimator can validate the t-test and f-test by generating unbiased estimates of standard errors..

5.1 Test for breakpoints

Since I am analyzing the salaries of players in three different positions but using the same equation analyzes them, we can use the Chow test to test whether the three separate position regressions can be pooled into one regression.

We have our null hypothesis H_0, which states that there are no differences between the vectors of coefficients between three. This means that these three regressions for each position can be represented with a single pooled regression equation.

$$H_0 = no\ break\ point(can\ be\ represented\ using\ one\ regression)$$

The Chow test is calculated using the formula as

$$\mathrm{F} = \frac{(RSS_{restricted} - RSS_{unrestricted})/q}{RSS_{unrestricted}/(n-k)} \sim \mathrm{F[q, N-k]}$$

For this model

$$\mathrm{F} = \frac{(RSS_{pooled} - RSS_{Guard} - RSS_{Forward} - RSS_{center})/q}{(RSS_{Guard} + RSS_{Forward} + RSS_{center})/(N - 3*k)} \sim \mathrm{F[q, N-3k]}$$

Since number of restrictions: q= 2*12=24,

Total number of degrees of freedom: N-3K=301-3*12=265

The RRS results are on the appendix table 4, 5, 6 and 7

Thus we need to evaluate the F Statistics:

$$\mathrm{F} = \frac{(8311.84 - 2838.44 - 1205.73 - 3358.93)/24}{(2838.44 + 1205.73 + 3358.93)/(302 - 3*12)} \sim \mathrm{F[24,265]}$$

After the calculation, we have the value of the F-tested = 1.36

Moreover, we can look at the F-distribution table,

f[24,265]=1.52 with α=0.05

Since our calculated f-value is 1.36, which is smaller than the F-critical of 1.52, we fail to reject the null hypothesis. This test result suggests that though we are estimating these players in three positions, this model can be represented by a pooled one. We can estimate the pooled regression which restricts the coefficients to be the same across the three sub-samples. That will result in a gain of efficiency.

5.2 Two-Way Fixed Effect

Before carrying out the estimators. There are two important variables that need to be included. First these 320 players are from different teams, and players on the bad teams are likely to have totally different performance than the similar players on a good team. Another point is that, these 320 players are drafted from 2005 to 2010, which means their fifth-season salary also spans over six years, and the revenue or salary cap may change during these years. Thus, a two-way fixed effect on both teams and years should be performed. And robust estimator generates unbiased estimates of the standard errors of estimated coefficients, which works as an alternative to the least square estimators.

5.3 Results for Each Regression

Table 2: Regression Results for Guards
(dependent variables: natural log of 5th year salary)

Natural log of 5th year salary	*Coef.*	*Robust Std. Err.*	*t-value*	*P-value*
PICk	-0.071	0.045	-1.560	0.129
AGE	-0.498*	0.534	-0.930	0.036
PER	-0.406	0.366	-1.110	0.277
OBPM	1.282*	0.628	2.040	0.051
DBPM	1.130	0.722	1.570	0.128
PTS	0.556	0.404	1.370	0.18
AST	0.320	0.987	0.320	0.748
TRB	-0.434	1.098	-0.390	0.696
STL	-1.603	2.632	-0.610	0.547
BLK	-4.158	4.493	-0.930	0.362
TOV	-1.194	3.609	-0.330	0.743
PF	0.448	1.106	0.400	0.688
Year				
2006	-0.351	1.907	-0.18	0.855
2007	2.112	1.956	1.08	0.289
2008	0.074	1.771	0.04	0.967
2009	1.463	1.839	0.8	0.433
2010	1.255	3.329	0.38	0.709
_cons	35.513	11.235	3.160	0.002
R-squared	0.5038			

Observations: 120, *significant at 5% level, **significant at 1% level,significant at 0.1% level***

Table 2 above shows the guard position rookies wage equation results with fixed effect for teams and years with robust standard errors. The P-values all increased after the standard errors were corrected.

The R-square for this model is 0.5038, this number indicates that about 50.04% of the fluctuation in the log of salary are explained by joint variation in the set of exogenous variables. AGE and OBPM are two control variables show high statistical significance with a p-value smaller than 0.05.

The variable of Pick (the rank when being drafted) has an estimated coefficient of -0.071, which is not statistically significant because the p-value is 0.126, shows a negative relationship with the salary. The value of the estimated coefficient means that one rank increase corresponds to a 0.071% decrease in the fifth-season salary. The variable of AGE (age when being drafted) has an estimated coefficient of -0.498, which is statistically significant because the p-value is smaller than 0.05. This estimated coefficient shows a negative relationship to salary, indicating that with each additional year of age when the player enters the league, he will lose 0.498% in his fifth-season salary. The variable of PER (player efficiency rating) has an estimated coefficient of 1.282, which is not statistically significant because the p-value is large at 0.277. The variable of OBPM (Offensive plus minus per game) has an estimated coefficient of 1.282, which is statistically significant because the p-value is 0.051. The estimated coefficient indicates with one more unit of offensive plus minus per game, the guard can have a 1.282% increase in his fifth-year salary. The variable of DBPM (defensive plus minus per game) has an estimated coefficient of 1.130, which is not statistically significant because the p-value is 0.128. The variable of PTS (average points per game) has an estimated coefficient of 0.556, which is not statistically significant because the p-value is 0.18.

It is interesting to note that the control variable of AST (assists per game) shows a low level of statistical significance for the guard player with p-value equal to 0.748, which indicate that assists will not be a major salary determinant for the guards. It is also interesting to see that the variable of TRB (total rebounds per game), STL (steals per game), BLK (block per game) all show a negative relationship with the fifth -season salary, while the PF (personal fouls per game) shows a positive relationship with it. However, these estimates all have large p-values indicating low level of statistical significance. The year dummy estimators all illustrate low level of statistical significance based on their p-values, and the coefficients show that the rookies from 2006 enjoy a slight premium on the fifth-season salary.

Table 3: Regression Results for Forwards
(dependent variable: natural log of 5th year salary)

Natural log of 5th year salary	***Coef.***	***Robust Std. Err.***	***t-value***	***P-value***
PICk	-0.053	0.052	-1.02	0.317
AGE	-0.508	0.267	-1.9	0.067
PER	0.706*	0.277	2.55	0.016
OBPM	-0.345	0.533	-0.65	0.523
DBPM	-0.176	0.343	-0.51	0.612
PTS	0.541	0.370	1.46	0.155
AST	-2.576	1.793	-1.44	0.161
TRB	-0.338	0.420	-0.8	0.428
STL	5.585	2.860	1.95	0.061
BLK	-1.831	2.236	-0.82	0.420
TOV	-3.336	3.137	-1.06	0.296
PF	4.356***	1.171	3.72	0.001
Year				
2006	-2.829	1.782	-1.590	0.123
2007	1.507	1.462	1.030	0.311
2008	1.505	1.299	1.160	0.256
2009	-2.268	1.814	-1.250	0.221
2010	0.668	1.691	0.390	0.696
_cons	5.177	8.427	0.860	0.503
R-squared	0.511			

Observations: 131, *significant at 5% level, **significant at 1% level, ***significant at 0.1% level

Table 3 above shows the regression results with fixed effects for teams and years with the robust estimation option applied for the players who play in the forward position. It has R-squared value of

0.511, this number indicates that about 51.1% of the fluctuation in the log of salary are explained by joint variation in the set of exogenous variables. PER and PF are two control variables with a high level of statistical significance with a p-value smaller than 0.05, especially for the PF variable has a p-value smaller than 0.001.

The result suggests that the variable of Pick (draft ranking) will have minor negative influence for the Forward players, it has an estimated coefficient of -0.053, which is not statistically significant because the p-value is 0.317. The variable of AGE (the age when being drafted) has an estimated coefficient of -0.508, which is relatively statistically significant because the p-value is close to 0.05. The variable of PER (player efficiency rating per game) has an estimated coefficient of 0.706, which is statistically significance because the p-value of 0.016. The value of estimated coefficient suggests that with one additional point in PER over the first four seasons, the forward can earn 0.706% more in his fifth-season salary. The variables of OBPM (offensive plus minus per game) and DBPM (defensive plus minus per game) both shows negative relationship to the fifth-season salary, but both of them have quite high p-values, which means low statistical significance. The variable of PTS (points per game) has an estimated coefficient of 0.541, which suggests that with one more point scored per game, the forward can get a 0.541% increase in his fifth-season salary, which is a nice premium. The variables of AST (assists per game) and TRB (total rebounds per game) both show negative relationships with the fifth season salary, while these two variables both have quite high p-values, which indicate low level of statistical significance. The variable of STL (steals per game) has a coefficient of 5.585, which indicates that with one more steal per game for the forward; he can get a raise in fifth-season salary with 5.585%, which is highly rewarded act for the forward players.

Similar to the guards, the variable of PF (personal fouls per game) shows a positive relationship with the salary for the forward; the result suggests that with one additional foul per game for the forward, he can increase his fifth-season salary by 4.356%. The year dummy estimators all illustrate low level of statistical significance based on their p-values, and the estimated coefficients show that the rookies from 2006 and 2009 exhibit penalties compared to other years regarding the fifth-season salary.

Table 4: Regression Results for Centers
(dependent variable: natural log of 5th year salary)

Natural log of 5th year salary	*Coef.*	*Robust Std. Err.*	*t-value*	*P-value*
PICk	0.102	0.091	1.12	0.273
AGE	-2.505*	0.970	-2.58	0.016
PER	0.425	0.574	0.74	0.466
OBPM	-0.638	0.742	-0.86	0.398
DBPM	-0.315	0.883	-0.36	0.725
PTS	-0.448	1.065	-0.42	0.677
AST	11.595*	5.577	2.08	0.048
TRB	0.258	1.813	0.14	0.888
STL	4.303	8.424	0.51	0.614
BLK	7.173	3.898	1.84	0.078
TOV	-11.732	7.622	-1.54	0.136
PF	3.099	5.445	0.57	0.574
Year				
2006	4.044	2.772	1.46	0.157
2007	0.772	5.811	0.13	0.895
2008	4.161	2.800	1.49	0.15
2009	2.110	2.028	1.04	0.308
2010	2.874	2.855	1.01	0.324
_cons	18.142	19.361	0.940	0.355
R-squared	0.545			

Observations: 51, *significant at 5% level, **significant at 1% level, ***significant at 0.1% level

Table 4 above contains the regression results with fixed effects for teams and years with the robust estimation option applied for the players who play in the center position. It has an R-squared value of

0.545, this number indicates that about 54.5% of the fluctuation in the log of salary are explained by joint variation in the set of exogenous variables; this is, the highest R-squared among all of the positions. The variables of AGE (age when drafted) and AST (assists per game) illustrate high level of statistical significance, with p-values both smaller than 0.05. In addition, age seems to affect the centers more than it influences the other two positions, the estimated coefficient of -2.505 shows that if a center joins the league when he is one year older, he will lose 2.505% of his fifth-year salary.

Similar to the previous two positions, it is good to see that the draft ranking has minor effect for the fifth-season salary of a center player. The variable of PER (player efficiency rating) seems not to be a major influence for the centers as it has a large p-value. The variable of OBPM (offensive plus minus per game) and DBPM (defensive plus minus per game) both shows negative relationships with the fifth-season salary, while these two both illustrate low level of statistical significance because the p-value are large. Moreover, the variable of PTS (points per game) has an estimated coefficient of -0.448, which is not statistically significant because the p-value is 0.677.

It is worthwhile to mention that AST (assists per game) seems to be an extremely highly rewarded attribute for the centers, as the AST variable has an estimate coefficient of 11.595, and it is statistically significant because the p-value is 0.048. This implies that one additional assist per game over the first four seasons can increase the fifth-season salary by 11.59% for the players in this position. The attributes of STL (steals per game) and BLK (blocks per game) also seem to be remunerated with high value of estimated coefficients, while the variable of steal shows a low level of statistical significance. It is not statistically significant; however, the value of coefficient of TOV (turnovers per game) is -11.732, indicating a penalty applying to the fifth-season salary. The p-value of PF (personal fouls per game) suggests that personal foul seems not a crucial measurement for the centers. The year dummy estimators all illustrate low level of statistical significance based on their p-value, the estimated coefficients values indicate that the players drafted from 2006 and 2008 enjoy a slight premium on fifth-season salary than others.

Table 5: Regression Results for All Players pooled together (dependent variable: natural log of 5th year salary)

Natural log of 5th year salary	*Coef.*	*Robust Std. Err.*	*t-value*	*P-value*
PICk	-0.020	0.020	-1.01	0.321
AGE	-0.796***	0.220	-3.62	0.001
PER	0.256*	0.123	2.08	0.047
OBPM	-0.186	0.204	-0.91	0.37
DBPM	-0.406	0.289	-1.41	0.171
PTS	0.519**	0.152	3.42	0.002
AST	0.612	0.508	1.21	0.238
TRB	-0.127	0.278	-0.46	0.651
STL	4.059**	1.588	2.56	0.016
BLK	1.039	1.625	0.64	0.528
TOV	-4.451*	1.584	-2.81	0.009
PF	3.158**	0.872	3.62	0.001
Year				
2006	-1.301	1.371	-0.95	0.351
2007	1.370	0.945	1.45	0.158
2008	0.535	0.993	0.54	0.594
2009	0.407	1.203	0.34	0.738
2010	-0.380	1.327	-0.29	0.777
_cons	16.145	6.156	2.620	0.009
R-squared	0.459			

Observations: 302, *significant at 5% level, **significant at 1% level, ***significant at 0.1% level

Table 5 above contains the results of the pooled regression he regression results for all three positions together including two sets of fixed effects and applying robust estimation. The R-squared is equal to 0.459, this number indicates that about 46% of the fluctuation in the log of salary are explained by joint variation in the set of exogenous variables. The estimated coefficients of AGE, PER, PTS, STL, TOV and PF all show high level of statistical significance with p-value all smaller than 0.05, especially the variable of AGE has p-value of 0.001. The variable of PICK (rank when being drafted) has an estimated coefficient of -0.020, which is not statistically significant because the p-value is 0.273. The variable of AGE (age when drafted) has an estimated coefficient of -2.505, this negative value indicates that a player who enters the league one year older than average, he will lose 2.505% in his fifth-season salary. The variable of PER (player efficiency rate) has an estimated coefficient of 0.256, indicating that a player with one additional point in PER over the first four season can earn 0.256% more in fifth-season salary. The estimated coefficients of OBPM (offensive box plus minus) and DBPM (defensive box plus minus) both have large numbers of p-values which indicate low level of statistical significance. The variable of PTS (points per game) has an estimated coefficient of 0.519, which indicates that if the player got each additional point per game over the first four seasons, he can enjoy a 0.519% increase in the fifth-year salary. The variable of STL (steals per game) has an estimated coefficient of 4.059, and it suggests that with one additional steals per game for the players over the first four seasons, he can receive a 4.059% increase for his fifth-season salary. The dummy year estimator still seems not so crucial for a general player based on their p-values.

Based on the final regression results, it is interesting to see that draft ranking is not a significant factor determining salaries for all four regressions. This is a sensible finding because it means that teams are not judging the players by their first impression or origin; instead, what they mainly focus on is their subsequent on-court performance. Defensive performance is represented by the variables DBPM, STL and BLK. The DBPM variable is excluded from all regressions due to its lack of significance. The offensive statistics seem more important for all positions; guard position rookies are not expected to concentrate on much on defense. However, if the player wants to compete with other positions as far as salary aspiration care concerned, it is worthwhile to work hard at developing defense skills. Meanwhile, the dummy year estimators all respect to positions show minor impacts, which suggests that rookies drafted from different years are treated relatively fair on the salary.

6. Conclusion

It is always advantageous for players to have more positive performance statistics; however, even professional athletes do not have the energy and ability to maximize all their stats, in part because they reflect diverse skills. Therefore, the above results help identify which performance measure matters most for each position in order to optimize salary. After generating the OLS estimates for separate position player equations, the results show that rookies in different positions have different statistics that most influence their salary. Though there are many variables show low magnitude coefficients or low level of statistical significance, this does not mean that the player should ignore these actions on the court without consequence for their subsequent salaries. These estimators give insight into how players can strategize in order to focus on the actions and plays that might have the higher payoff for subsequent salaries.

Based on the above results, if a player plays a guard position in the league in the first four years, the best strategy is to allocate more training and game strategies towards getting more rebounds and making offensive moves. Getting more points each game is also a primary task at the time of being drafted; thus, shooting practice is also crucial. Though the age gap between rookies is not extensive, with the youngest rookie being 18 and the oldest being 25, a younger age is a substantial benefit for a rookie guard, as shown on regression results. Because the defense statistics is not necessary for them, they can be less concerned about adapting a defensive strategy, and redirect their energy elsewhere. One interesting point is that while the rebound has not traditionally been a major responsibility for a guard in basketball, our results suggest that guard players in the first four seasons who get more rebounds will be highly rewarded regarding their future salary.

For the free agents playing in forward positions, the primary task is to have higher points and to win a higher PER rating. Besides points per game, a forward can focus his training on stealing the ball; this is because steals per game is highly rewarded according to the results. Interestingly, while the personal foul is usually considered to be a negative sign of performance, in our model, it shows a positive relationship with the salary. This result suggests that forwards need to play more aggressively on the defensive side, including getting more steal attempts. These aggressive defensive plays will bring about higher pay in future contracts. Thus, a forward position rookie requires a balanced performance on both offense and defense; their practice should focus more on shooting and defense rather than passing the ball and grabbing the rebound in the paint. Similar to the case of guards, teams prefer younger rookie forwards when offering the fifth-season contract. Additionally, in a box score, the number of personal fouls is usually considered to be a negative indicator; however, the model shows that personal fouls for the rookie forward can be highly rewarded in subsequent salaries. In this case, this indicates that the guard players can and should make more aggressive defensive moves in the game. While this does not mean that they will commit fouls all the time, the fact that players will not be penalized for fouls in future contracts suggests that it is better to perform risky defensive moves in the critical moments of the game than to worry about committing fouls. However, it is worth mentioning that a player who commits six of the personal fouls throughout a game will be disqualified in the remainder of the game, so this aggressive play should be done strategically.

For free agents playing center positions, higher points and offensive plays seem to not be as important to centers as they are to forwards. Instead, the total rebounds the center can grab is the most reliable predictor of a higher future wage. Therefore, as a rookie player, it is more worthwhile for the center to save energy by standing in the right position and jumping more to get rebounds. Through practice they can concentrate a lot more on how to take the best position for rebounds, practice vertical jumps and enhance body size. Additionally, because of the high potential rewards for a block, vertical jump practice is important because it can increase the success rate of a block; based on the Appendix table 3, centers have the highest rate of blocks per game. Another point to mention is that the centers with some assist skills will earn large benefits in the future, practicing passing the ball when it is also worthful. Among all positions, an old rookie center in the league will have the least potential in terms of his fifth-season salary.

The pooled regression gives results for all players thrown into the same estimation. Scoring more points is the primary task, and it will be highly rewarded. Age at them time of draft is a concern for a general player because of its salary penalty; it is better to enter the league at a younger age. Additionally, a player needs to focus on his on-court efficiency from a salary stand point. Practicing in order to have more steals and practicing dribbling are also crucial. In this equation, the personal fouls here still show a positive relationship with the salary, which means it is worthwhile to play more aggressively on defense at certain moments.

As shown in the results, the defensive criteria of the players play less of a role in the wage equation.

This result might have repercussions for other labour markets, in which workers doing tasks that can easily observed and measured will receive higher compensation, while workers doing complementary tasks that re less visible and observable may receive compensation that is not true marginal revenue product. Good defense is crucial for the team to win, but it is hard to observe in after-game statistics; Because of this, it is not remunerated at the same level as other factors for the players.

Overall, it seems logical and appropriate that employers tend to base the player's salary using primarily rookie performance variables instead of using the old impressions of the draft. Additionally, it is also good to see that different years and teams can have a minor effect. This all leads to the fact that the fifth-season salary is mainly dependent on player's performance and age. It is logical and appropriate that players have enormous potential if they play hard, regardless of their initial draft ranking. However, teams do prefer younger rookies as far as fifth-year salaries are concerned. Finally, defensive plays seem to not be as highly rewarded as offensive plays if we measure player performance by stats only.

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Appendix

Table 1: Data Summary for Guards

Variable	sample Size	Mean	Standard Deviation	Max	Min
Salary	120	$3,592,933	4255089.36	$17,632,688	$0
AGE	120	21.48	1.26	25	18
PICK	120	27.24	16.22	60	1
PER	120	12.23	4.42	25.8	-8.6
OBPM	120	-1.14	2.88	6.8	-11.6
DBPM	120	-1.11	1.39	2.2	-4.4
PTS	120	8.00	4.88	21	0
TRB	120	2.43	2.02	9.9	0
AST	120	2.21	1.12	5.3	0
STL	120	0.71	0.45	2.4	0
BLK	120	0.16	0.15	0.7	0
TOV	120	1.29	0.75	3.6	0
PF	120	1.51	0.63	2.9	0

Table 2: Data summary for Forwards

Variable	sample Size	Mean	Standard Deviation	Max	Min
Salary	131	$2,860,349.53	$3,914,968.34	$16,441,500.00	$0
AGE	131	21.57	1.47	25	18
PICK	131	27.11	15.89	58	1
PER	131	12.74	4.21	22.5	-9.1
OBPM	131	-2.02	2.32	3.5	-12
DBPM	131	-0.29	1.56	3.8	-6
PTS	131	6.70	4.41	25.9	0
TRB	131	3.54	2.00	12	0
AST	131	0.82	0.63	3.6	0
STL	131	0.48	0.30	1.6	0
BLK	131	0.46	0.37	2.4	0
TOV	131	0.88	0.53	3	0
PF	131	1.79	0.74	3.3	0.1

Table 3: Data summary for Centers

Variable	sample Size	Mean	Standard Deviation	Max	Min
Salary	51	$3,522,674.53	$4,634,236.92	$14,746,000.00	$0.00
AGE	51	21.10	1.30	24	18
PICK	51	26.57	17.73	60	1
PER	51	12.68	9.93	35.3	-48.6
OBPM	51	-3.81	6.43	1.1	-46.4
DBPM	51	0.63	2.19	6.8	-7.2
PTS	51	5.45	4.31	17.9	0
TRB	51	3.92	2.56	10.2	0.2
AST	51	0.65	0.70	2.5	0
STL	51	0.355	0.27	1.4	0
BLK	51	0.72	0.49	1.9	0
TOV	51	0.87	0.62	3.1	0
PF	51	1.93	0.91	3.9	0.2

Table 4: All-Players' Fifth-Season Salary

Explanatory Variable	Original	Natural log	FE Robust
PICK	22874.6	0.000	-0.020
	(10481.37)	(0.024)	(0.020)
AGE	-318750***	-0.808***	-0.796***
	(107247.8)	(0.250)	(0.220)
PER	-110890.1	0.200	0.256*
	(56518.8)	(0.132)	(0.123)
OBPM	95815.6	-0.128	-0.186
	(89969.36)	(0.209)	(0.204)
DBPM	208016.5	-0.324	-0.406
	(120660.6)	(0.281)	(0.289)
PTS	647637.7**	0.593**	0.519**
	(83878.05)	(0.195)	(0.152)
AST	735824.2	0.773	0.612
	(205875.8)	(0.479)	(.508)
TRB	496433.9	0.008	-0.127
	(147093.5)	(0.342)	(0.278)
STL	-274480.5*	3.481*	4.059*
	(746468)	(1.737)	(1.588)
BLK	2701595	0.519	1.039
	(608248.4)	(1.416)	(1.625)
TOV	-1027095**	-4.934**	-4.451**
	(649096.9)	(1.511)	(1.584)
PF	-1072857***	3.441***	3.158***
	(365592.2)	(0.851)	(0.872)
R-Squared	0.4561	0.4594	0.4874
RSS		8311.84	
Observations	302	302	302

***Note*: Standard deviations are in brackets. Column original stands for the original salary regression. Natural-log column stands the result for the natural-logged regression. Column FE Robust includes two sets of fixed effects on teams and years applying robust estimation.**

***significant at 5% level,**

****significant at 1% level,**

*****significant at 0.1% level**

Table 5: Guards' Fifth-Season Salary

Explanatory Variable	Original	Natural log	FE Robust
PICK	11620.41	-0.016	-0.070
	(18183.22)	(0.041)	(0.045)
AGE	-499401.9*	-0.910*	-0.498
	(187484)	(0.423)	(0.534)
PER	-152920.4	-0.626	-0.406
	(147183.5)	(0.332)	(0.366)
OBPM	123455.8*	1.464*	1.282*
	(255220)	(0.575)	(0.628)
DBPM	506219.2	0.467	1.130
	(272536.8)	(0.614)	(0.722)
PTS	771167.2	0.415	0.556
	(151291.3)	(0.341)	(0.404)
AST	801628.9	0.407	0.320
	(295681.1)	(0.667)	(0.987)
TRB	-328316	0.789	-0.434
	(500606.5)	(1.129)	(1.098)
STL	-1445802	-1.108	-1.603
	(1182911)	(2.667)	(2.632)
BLK	3664587	-2.791	-4.158
	(1950840)	(4.398)	(4.493)
TOV	-654938.7	-1.717	-1.194
	(1004425)	(2.264)	(3.609)
PF	-974965.2	1.436	0.448
	(668707.1)	(1.508)	1.106
R-Squared	0.7405	0.508	0.5038
RSS		2838.44	
Observations	120	120	120

***Note*: Standard deviations are in brackets. Column original stands for the original salary regression. Natural-log column stands the result for the natural-logged regression. Column FE Robust includes two sets of fixed effects on teams and years applying robust estimation.**

***significant at 5% level,**

****significant at 1% level,**

*****significant at 0.1% level**

Table 6: Forwards' Fifth-Season Salary

Explanatory Variable	Original	Natural log	FE Robust
PICK	17041.26	-0.014	-0.053
	(15329.81)	(0.038)	(0.052)
AGE	-206572.6	-0.591	-0.508
	(145222.6)	(0.358)	(0.267)
PER	-143438.7	0.422	0.706*
	(90095.1)	(0.222)	(0.277)
OBPM	174038.3	-0.476	-0.345
	(170631.3)	(0.421)	(0.533)
DBPM	245480.1	-0.025	-0.176
	(193484.9)	(0.477)	(0 .343)
PTS	801216.1*	0.895*	0.541
	(155221.7)	(0.383)	(0.370)
AST	-656155.8	-1.201	-2.576
	(651224)	(1.605)	(1.793)
TRB	553516.3	0.069	-0.338
	(218503.6)	(0.539)	(0 .420)
STL	1133356*	6.617*	5.585
	(1134225)	(2.796)	(2.860)
BLK	1889679	-0.636	-1.831
	(842925.5)	(2.078)	(2.236)
TOV	-1721370*	-7.408*	-3.336
	(1168731)	(2.881)	(3.137)
PF	-1065359**	4.031**	4.356**
	(530551.5)	(1.308)	(1.171)
R-Squared	0.7246	0.511	0.6044
RSS		1205.73	
Observations	131	131	131

***Note*: Standard deviations are in brackets. Column original stands for the original salary regression. Natural-log column stands the result for the natural-logged regression. Column FE Robust includes two sets of fixed effects on teams and years applying robust estimation.**

***significant at 5% level,**

****significant at 1% level,**

*****significant at 0.1% level**

Table 7: Centers' Fifth-Season Salary

Explanatory Variable	Original	Natural log	FE Robust
PICK	49549.16	0.037	0.102
	(28143.9)	(0.060)	(0.091)
AGE	-254081	-1.276	-2.505*
	(359806.3)	(0.761)	(0.970)
PER	-101889	0.426	0.425
	(161214.3)	(0.341)	(0 .574)
OBPM	93301.58	-0.496	-0.638
	(235401.9)	(0.498)	(0.742)
DBPM	182570.2	-0.728	-0.315
	(309461.2)	(0.655)	(0.883)
PTS	376525.2	0.163	-0.448
	(409110.2)	(0.866)	(1.065)
AST	-1122947	-3.439	11.595*
	(1482095)	(3.136)	(5.577)
TRB	1536551	1.680	0.258
	(543973.9)	(1.151)	(1.812)
STL	570856.3	4.501	4.303
	(3312911)	(7.010)	(8.424)
BLK	3167511	0.287	7.173
	(1547440)	(3.274)	(3.898)
TOV	-4082.99	-4.645	-11.732
	(2756139)	(5.831)	(7.622)
PF	-2243863	3.955	3.099
	(1237587)	(2.619)	(5.445)
R-Squared	0.7541	0.5446	0.7875
RSS		3358.93	
Observations	51	51	51

***Note*: Standard deviations are in brackets. Column original stands for the original salary regression. Natural-log column stands the result for the natural-logged regression. Column FE Robust includes two sets of fixed effects on teams and years applying robust estimation.**

***significant at 5% level,**

****significant at 1% level,**

*****significant at 0.1% level**