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An Econometric Analysis Of The 2016-2017 Nba Regular Season

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NBA REGULAR SEASON

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Dedication

My thesis is dedicated to my wife, Ana Jaeger. You have given up so much and allowed me time to study, while you took care of our family. To my daughter, Daniela Jaeger, not only did you keep me on my toes through this process, I read you a lot of economic journals, which I hope will stick for the future. Daniela, thank you for showing me how many much I can accomplish on many sleepless nights. And to our new baby arriving in spring 2019, you will not know the pain and suffering I endured to get to this point.

AN ECONOMETRIC ANALYSIS OF THE 2016-2017 NBA REGULAR SEASON

by

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Abstract

This study examines the on-court performance of the thirty National Basketball Association (NBA) teams during the 2016-17 NBA basketball season. Cross sectional data are employed to analyze the wins for the 2016-17 NBA basketball season. Although the results are inconclusive, there is one notable outcome in the negative variable for human capital payroll. Field goal percentage is favored over other in game statistics. Replication of this study for the 437 teams in National Collegiate Athletics Association provides and intriguing opportunity for further research.

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Chapter 1: Introduction

The National Basketball League produces an increasingly popular product in the United States and abroad. Games are watched or attended by millions every year, especially as the league continues to expand its market across the globe. However, lost among the hype is attention paid to the empirical analysis of the sport, specifically, the influences of the win-loss records of the regular season. Many have looked at the variables of the glitzy post season (Berri and Eschker, 2005; Wallace, Caudill and Mixon, 2013; Zimmer and Kuethe, 2009), but little has been analyzed regarding the plodding long regular season.

The following study examines the potential impacts of both on-court performance measures and several management variables, such as salaries on win-loss records for the 2016-2017 NBA season. The analysis is similar to what has been used in recent studies of Major League Baseball (MLB) regular season outcomes (Fullerton et al., 2014; Peach et al., 2016; Fullerton and Peach, 2016). There are no guarantees, however, that what works for empirical post-mortems of one spectator sport will be applicable to another segment of the entertainment athletics complex.

The study is structured as follows: section two provides an overview of related studies; section three details the data and methodology; and, section four discusses empirical results. The analysis is summarized in the concluding section. A statistical data appendix is included at the end of the document.

Chapter 2: Literature Review

Many different studies examine the impacts of payroll dispersion on team success. Jewell and Molina (2004) focus on different aspects of MLB and document an inverse correlation between salary dispersion and victories. More recently, Fullerton et al. (2014) provides evidence that payroll dispersion may not affect team win-loss performances. The difference from the highest paid player to the lowest paid player is not found to hurt the team records. As hypothesized, on-field performances are important to the win-loss column. Peach et al. (2016) notes that each season should be looked at "in isolation from predecessors," due to parameter heterogeneity. That outcome is confirmed by Fullerton and Peach (2016).

Beri (1999) looks at the NBA regular season statistics and team wins, but does not include salaries in the analysis. The empirical results of this study show there is a correlation between player performance and team wins. That study cautions that player performances can be affected by trades, free agent acquisitions, and/or minutes played. Roster changes may require adjustments to new playing styles and reduced playing times. Berri and Eschker (2005) examines NBA post-seasons from 1994-2003. That study finds no evidence of player performances being enhanced during the playoffs. The widespread claim of "Prime-Time Players" found to be fictional.

Katayama and Nuch (2011) analyzes panel data for the NBA seasons from 2002 to 2006. Outcomes in that effort indicate that a smaller spread between player salaries positively affects team performance and win-loss records. More specifically, a smaller pay gap is better than paying one-to-three players most of the salary cap and filling the rest of the team with low-paid players. Due to the small number of players on the court compared to the MLB and National Football League (NFL), salary dispersion may not be a factor in causing infighting among NBA teams. In an effort to maximize profits rather than wins, teams may, nonetheless, purchase superstar players to sell more tickets.

Chapter 3: Data and Methodology

Data for the 2016-17 NBA season are analyzed in this study. Regular season team wins are the variable of interest. The regular season has eighty-two games for each of the thirty NBA teams. Because all teams do not reach the playoffs, post season games are excluded from the analysis.

Variables for this study are listed in Table 3.1. The left-hand dependent variable is WINS17, the number of wins from the eighty-two games played during the regular season. PTS17 is the average points scored per game during the season. FGPCT17 is the successful percentage of baskets made by each team. PT3PCT17 indicates the percentage of baskets made beyond the 23 foot 9-inch arc. FTPCT17 signifies the percentage of completed shots at the free throw line following fouls. These four variables summarize team offensive output and are expected to be positively correlated with victories.

Many coaches state offense wins games, but defense wins championships. Defensive variables included in the sample are DREB17, STL17, and BLK17, which are also expected to be positively correlated with victories. DREB17 is the average number of times per game a defense successfully gains possession of the ball following an opposing team missed shot. STL17 is the times per game a defense takes the ball away from the opposing team. BLK17 is the average number of times a defense obstructs the ball from going into the hoop. Although, BlK17 does not insure taking possession of the ball, it generally helps reduces scoring by the opposing team.

A statistic many coaches monitor is the assist-to-turnover ratio. In this study, assists and turnovers are both included in the sample. Assists, AST17, is the number of times per game that a pass from one teammate to another results in a basket. Turnovers, TOV17, indicate the number

of times per game that the ball is given to the other team via a foul or violation before a shot is taken.

Table 3.1: Variables and Units

Variable Names	Description	Data Source
GP	Games Played	http://www.espn.com/
WINS17	Games won by the team, a total of 82 games played	http://www.espn.com/
L17	Games lost by the team, a total of 82 games played	http://www.espn.com/
PTS17	Season average of points scored by team per game	http://www.espn.com/
FGPCT17	Season average of successful field goal percentage, any points scored within the 3-point arc, not including free throws	http://www.espn.com/
PT3PCT17	Season average percentage of successful 3-point attempts, any shot beyond the 3-point arch	http://www.espn.com/
FTPCT17	Season average percentage of successful free throws made at the free throw line	http://www.espn.com/
OREB17	Season average of rebounds on offensive side per game	http://www.espn.com/
DREB17	Season average of rebounds on defensive side per game	http://www.espn.com/
REB17	Season average of total rebounds per game	http://www.espn.com/
AST17	Season average of total assist per game	http://www.espn.com/
TOV17	Season average of turnovers per game	http://www.espn.com/
STL17	Season average of steals per game	http://www.espn.com/
BLK17	Season average of blocks per game	http://www.espn.com/
COACH17	The salary for the head coach during the 2016-2017 season in dollars	http://www.basketballinsiders.com/

COACHEXP17	The total number of years as a head coach	http:/www.basketball-reference.com/
TOTFINE17	The total of all player fines per team in dollars	http://www.espn.com/
AGE17	The average age of players per team in years	http://www.basketballinsiders.com/
AGE17SQ	The average age of players per team in years squared	Author Calculations
EXP17	The average number of years the players on the team have played in the NBA	http://www.basketballinsiders.com/
PYRL17	Total payroll paid out to all players per team in the 2016-2017 season in dollars	http://www.basketballinsiders.com/
PSD17	The standard deviation of the payroll for each team in dollars	Author Calculations

COACH17, the head coach salary, is hypothesized to be positively correlated with WINS17. COACHEXP17, number of years as a head coach, as the related series. T0TFINE17 are total fines is assessed to each team during the season. The highest 2016-2017 fine is $3,282,364, assessed against New York Knicks Joakim Noah for violating the league drug policy. TOTFINE17 is expected to be inversely correlated with WINS17 because fines frequently include loss of playing time and likely impair team effectiveness. AGE17 and EXP17 are used to measure team intangibles such as greater insight and maturity that experienced and older players are expected to provide. To allow for negative returns, AGE17SQ is the average age of each team raised to the second power. An inverse correlation between WINS17 and the standard deviation of the team payrolls, PSD17, is hypothesized (Katayama and Nuch, 2011).

Because of the wide variety in rosters across the thirty teams in the NBA, a test for heteroscedasticity is necessary. The White (1980) test is used for this purpose. If the null hypothesis of homoscedasticity is rejected, the standard errors of the parameter estimates have to be re-calculated.

Table 3.2 reports summary statistics for all of the data included in the sample. The standard deviation for WINS17 is 11.88. The maximum number of wins is 67 by the Golden State Warriors. The smallest number of victories is 20 by the Brooklyn Nets. Skewness for WINS17 is 0.252, which is slightly asymmetric and right-skewed. Kurtosis, or the fourth moment, for WINS17 is 2.58, which indicates the data are somewhat platykurtic relative to a normal distribution, and the coefficient of variation is 0.273.

Table 3.2: Summary Statistics

Variable	**Mean**	**Std. Deviation**	**Maximum**	**Minimum**	**Skewness**	**Kurtosis**	**Coefficient of Variation**
WINS17	41.0	11.2	67	20	0.252	2.580	0.273
PTS17	105.6	4.1	115	97.9	0.773	3.462	0.039
FGPCT17	45.7	1.4	49.5	43.5	0.610	3.095	0.030
PT3PCT17	35.7	1.8	39.1	32.7	-0.015	1.949	0.050
FTPCT17	77.2	2.8	81.5	70.6	-0.560	2.552	0.036
OREB17	10.1	1.2	12.2	7.9	0.197	1.899	0.122
DREB17	33.4	1.2	35.1	30.7	-0.474	2.553	0.035
REB17	43.5	1.7	46.6	38.6	-0.572	4.041	0.039
ASTAV17	22.6	2.2	30.4	18.5	1.323	6.309	0.098
TOV17	14.0	1.3	16.7	12.0	0.252	2.737	0.091
STL17	7.7	0.7	9.6	7.0	0.490	3.452	0.085
BLK17	4.7	0.7	6.8	4.0	0.776	3.611	0.150
COACH17	$4,833,017	$2,486,781	$11,000,000	$2,000,000	0.931	3.219	0.515
TOTFINE17	$234,177	$591,875	$3,282,364	$12,000	5.049	25.117	2.527
AGE17	26.5	1.3	29.90	24.6	1.128	3.461	0.051
AGE17SQ	705.2	73.4	894.0	605.2	1.166	3.652	0.104
EXP17	4.7	1.4	8.50	2.1	1.235	4.266	0.303
PYRL17	$98,443,474	$11,226,639	$127,254,579	$80,598,193	0.383	2.802	0.114
PSD17	$6,017,705	$1,376,395	$8,883,651	$3,385,426	-0.227	2.330	0.229

The mean points scored in a game is 105.6. The standard deviation is 4.1. PTS17 ranges from a maximum of 115.9 for the Golden State Warriors to a minimum of 97.9 for the Dallas

Mavericks. The skewness is 0.773 making it right tailed, with a kurtosis of 3.462 meaning that the distribution of PTS17 is somewhat leptokurtic, and the coefficient of variation is 0.039.

The average field goal percentage is 45.7 with a standard deviation of 1.37. FGPCT17 maximum is 49.5 by the Golden State Warriors, while the minimum is 43.5 by the Memphis Grizzles. The skewness of FGPT17 is 0.610, skewed to the right, while the kurtosis is 3.095, and the coefficient of variation is 0.030.

The mean for the percentage of successful three-point shots is 35.7 with a standard deviation of 1.8. The variable ranges from a maximum of 39.1 by the San Antonio Spurs to a minimum by the Oklahoma Thunder of 32.7. The skewness is -0.015, reflective of a largely symmetric distribution. The three-point percentage data have thick tails and the kurtosis is 1.95, and the coefficient of variation is 0.050.

The average free throw percentage for the season, FTPCT17, is 77.2 with a standard deviation of 2.8. The most accurate team on the free throw line is the Charlotte Hornets with a maximum of 81.5 percent. The least accurate team on the free throw line is the Miami Heat with a minimum of 70.6. FTPCT17 is left skewed with a skewness of -0.560 and slightly platykurtic with a kurtosis of 2.552, and the coefficient of variation is 0.036.

The average for offensive rebounds per game is 10.1 in Table 3.2. The standard deviation for OREB17 is 1.2, with a maximum of 12.2 and minimum of 7.9. The skewness coefficient is 0.197, indicating it is slightly positively skewed and the coefficient is found to be 0.273. The kurtosis is 1.899, implying thick tails, and the coefficient of variation is found to be 0.122. DREB17 has a mean of 33.4 and a standard deviation of 1.2. The maximum season average for DREB17 is 35.1 and the minimum is 30.7. The skewness for defensive rebounds is -0.474 indicating that it tails off to the left. DREB17 is platykurtic with a fourth moment of 2.553, and

the coefficient of variation is 0.035. Total rebounds have a mean of 43.5 with a standard deviation 1.7. The maximum season average is 46.6, and the minimum season average is 38.6. The skewness is -0.572, indicating that REB17 data are asymmetric and skewed to the left. The kurtosis is 4.041, which is leptokurtic with thin tails relative to Gaussian distribution, and the coefficient of variation is 0.039.

Average assists per game, AST17, is 22.6 with a standard deviation of 2.2. The maximum season average is 30.4 and the minimum season average is 18.5. The third moment of AST17 is 1.323, which is skewed to the right, and the kurtosis is 6.309, which indicates the data are leptokurtic, and the coefficient of variation is 0.098. The mean for the season average of turnovers is 14.0 with a standard deviation of 1.3. The maximum value is 16.7 and a minimum of 12.0. The skewness for TOV17 is 0.252. With a kurtosis of 2.737, TOV17 has somewhat thick tails, but the coefficient of variation is 0.091.

The mean for steals per game is 7.7 with a standard deviation of 0.7. The maximum for STL17 is 9.6 and the minimum is 7. The skewness for STL17is 0.490 and the kurtosis is 3.452, and the coefficient of variation is 0.085. The season average for blocked shots is 4.7 per game with a standard deviation of 0.7. The maximum for BLK17 is 6.8 and the minimum is 4.0. The skewness is 0.776 and the fourth moment is 3.611, and the coefficient of variation is 0.150.

The average salary for a coach in the NBA is $4,833,017 with a standard deviation of $2,486,781. The maximum salary is $11,000,000, paid to Gregg Popovich of the San Antonio Spurs. The minimum is $2,000,000, paid to Mike Budenhoizer of the Atlanta Hawks, Steve Clifford of the Charlotte Hornets, Michael Malone of the Denver Nuggets, and to Brett Brown of the Philadelphia 76ers. The skewness is 0.931, indicating that these data are moderately right-skewed, and the kurtosis for COACH17 is 3.219, and the coefficient of variation is 0.515.

The average fines per team is $234,177 with a standard deviation of $591,875, which indicates that these data are widely dispersed. The maximum for TOTFINE17 is $3,282,364 and the minimum is $12,000. Because these data are strongly right-skewed, the third moment is 5.049. The fourth moment of TOTFINE17 is 25.117, indicating that these data are exceptionally leptokurtic, but the coefficient of variation is 2.527.

The mean for AGE17 is 26.5 with a fairly compact second moment of only 1.3. The Cleveland Cavaliers holds the maximum average age at 29.9. The Portland Trail Blazers have the minimum average age of 24.6. The skewness for AGE17 is 1.128 indicating the distribution is positively skewed, with a kurtosis of 3.461 indicating the data are leptokurtic, and the coefficient of variation is 0.051.

The mean for age squared, AGE17SQ, is 705.2 with a standard deviation of 74.3. The maximum for AGES17SQ is 894.0 and the minimum is 605.2. The skewness is 1.166 the kurtosis coefficient is 3.652, and the coefficient of variation is 0.104.

The mean for years spent in the NBA, EXP17, is 4.7 with a standard deviation of 1.4. The maximum is 8.50 and the minimum is 2.1. The skewness for EXP17 is 1.235, which indicates that the distribution tails off to the right, and the kurtosis is 4.266, indicating that these data are leptokurtic, and the coefficient of variation is 0.303.

The mean for PYRL17 is $98,443,474 with a standard deviation of $11,226,639. The team with the highest payroll of $127,254,579 is the Golden State Warriors, the champions of the 2016-2017 season. The Utah Jazz has the lowest payroll of $80,598,193 in Table 3.2, but did not finish in last place for the season. The skewness coefficient is 0.383, and the kurtosis is 2.802, indicating that the PRYL17 data basically follow a normal distribution.

The mean for payroll standard deviation is $6,017,705 with a standard deviation of $1,376,395. The maximum for PSD17 is $8,883,651.61 and the minimum is $3,385,426. The skewness is -0.277 the kurtosis coefficient is 2.330, indicating somewhat thick tails, and the coefficient of variation is 0.229.

The specification below is used to model wins during the NBA 2016-2017 season:

$$
\begin{aligned}
LnWINS17 = {} & \beta_0 + \beta_1 \text{LnPTS17} + \beta_2 \text{LnFGPCT17} + \beta_3 \text{LnPT3PCT17} \\
& + \beta_4 \text{LnFTPCT17} + \beta_5 \text{LnOREB17} + \beta_6 \text{LnDREB17} \\
& + \beta_7 \text{LnREB17} + \beta_8 \text{LnASTAV17} + \beta_9 \text{LnTOV17} + \beta_{10} \text{LnSTL17} \\
& + \beta_{11} \text{LnBLK17} + \beta_{12} \text{LnCOACH17} \\
& + \beta_{13} \text{LnTOTFINE17} + \beta_{14} \text{LnAGE17} + \beta_{15} \text{LnEXP17} \\
& + \beta_{16} \text{LnPYRL17} + \beta_{17} \text{LnPSD17} + \varepsilon_t
\end{aligned} \tag{1}
$$

Equation (1) specifies WINS17 as a function of all of the variables from Table 3.1 and a stochastic error term. The hypothesized parameter signs for most of the parameters are positive. The exceptions are the coefficients for TOV17, TOTFINE17, and PSD17 which are expected to be negative.

Chapter 4: Empirical Results

The Indiana Pacers do not publish coaching salaries. Regression analysis and in-sample simulation are used to estimate the missing data point for that variable (Friedman, 1962). The number of years of NBA and college head coaching experience is used as the explanatory variable in Equation (2). Estimation results for Equation (2) are summarized in Table 4.1. Inputting the head coach Nate McMillan of the Indiana Pacers experience of 12 years yields $5,426,275 as the salary estimate.

$$\text{COACH17} = \beta_0 + \beta_1 \text{COACHEXP17} + \varepsilon_t \qquad (2)$$

Table 4.1: OLS Regression With In-Sample Simulation Results

Dependent Variable: COACH17 **Method: Least Squares** **Included Observations: 30**				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Probability**
Constant	2,938,879	623119.2	4.716	0.001
COACHEXP17	207,283	54157.81	3.827	0.001
R-squared	0.352		**Mean Dep. Var.**	4,833,017
Adjusted R-Sq.	0.328		**S.D. Dep Var.**	2,486,781
Std. Err. Reg.	2,038,988		**Akaike Info Crit.**	31.960
Sum. Sq. Resid	1.12E+14		**Schwart Info Crit.**	32.055
Log-likelihood	-461.424		**Hannan-Quinn Crit.**	31.990
F-statistic	14.649		**Prob(F-statistic)**	0.001

Estimation results for Equation (1) appear in Table 4.2. This equation includes sixteen variables. Two of the computed t-statistics in Table 4.2 satisfy the 5-percent significance criterion and several coefficients exhibit illogical arithmetic signs. Part of the reason for the parametric insignificance is the small number of sample observations. Multicollinearity may also be present in the sample. The White (1980) test rejects the null hypothesis of homoscedasticity.

Table 4.2: OLS Regression Results with White (1980) Homscedasticity Test Summary Table

Dependent Variable: LNWINS17 **Method: Least Squares** **Heteroskedasticity Test: White** **Included Observations: 30**				
F-statistic	1.051645		Prob. F(18,11)	0.4812
Obs*R-squared	18.97413		Prob. Chi-Square(18)	0.3934
Scaled explained SS	3.050038		Prob. Chi-Square(18)	1.0000
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Probability**
C	18.281	18.323	0.998	0.338
LNPTS17	-0.658	1.504	-0.437	0.670
LNFGPCT17	3.223	2.712	1.188	0.258
LNPT3PCT17	2.051	1.391	1.475	0.166
LNFTPCT17	-0.096	1.103	-0.087	0.932
LNOREB17	11.890	7.165	1.659	0.123
LNDREB17	40.956	23.489	1.744	0.107
LNASTAV17	0.107	0.490	0.218	0.831
LNTOV17	-0.826	0.603	-1.368	0.196
LNSTL17	0.777	0.493	1.576	0.141
LNBLK17	-0.232	0.271	-0.856	0.409
LNCOACH17	-0.022	0.071	-0.306	0.765
LNTOTFINE17	-0.019	0.034	-0.572	0.578
LNAGE17	0.237	1.553	0.152	0.881
LNEXP17	-0.173	0.299	-0.578	0.574
LNPYRL17	-1.307	0.471	-2.777	0.017
LNPSD17	0.936	0.318	2.945	0.012
R-squared	0.891		**Mean Dep. Var.**	3.676
Adjusted R-Sq.	0.736		**S.D. Dep Var.**	0.285
Std. Err. Reg.	0.147		**Akaike Info Crit.**	-0.719
Sum. Sq. Resid	0.258		**Schwart Info Crit.**	0.122
Log-likelihood	28.779		**Hannan-Quinn Crit.**	-0.450
F-statistic	5.748		**Prob(F-statistic)**	0.002

$$LnWINS17 = \beta_0 + \beta_1 Ln\text{FGPCT17} + \beta_2 Ln\text{FTPCT17} + \beta_3 Ln\text{OREB17} + \beta_4 Ln\text{DREB17} + \beta_5 Ln\text{TOV17} + \beta_6 Ln\text{COACH17} + \beta_7 Ln\text{PYRL17} + \beta_8 Ln\text{PSD17} + \varepsilon_t \quad (3)$$

Given those outcomes, an alternative specification with fewer explanatory variables is employed, next. Estimation results for Equation (3) appear in Table 4.3. Eight regressors are

included in the specification. Three of the eight coefficients have computed t-statistics that satisfy the 5-percent significance criterion. Similar to the results of Peach et. al. (2016) and Fullerton and Peach (2016), the signs for most of the parameter estimates are as hypothesized. To correct for heteroskedasticity, the White (1980) method is employed.

The parameter for field goal percentage is positive with a magnitude 5.812 and significant at 5.377. A one-percent increase in field goal percentage will result in a 5.8 percent increase in wins. Because the winner of the game is determined by who scores the most points, this result is expected. As shown in Figure 4.1, victories are positively correlated with field goal percentage and that correlation is easily discernible.

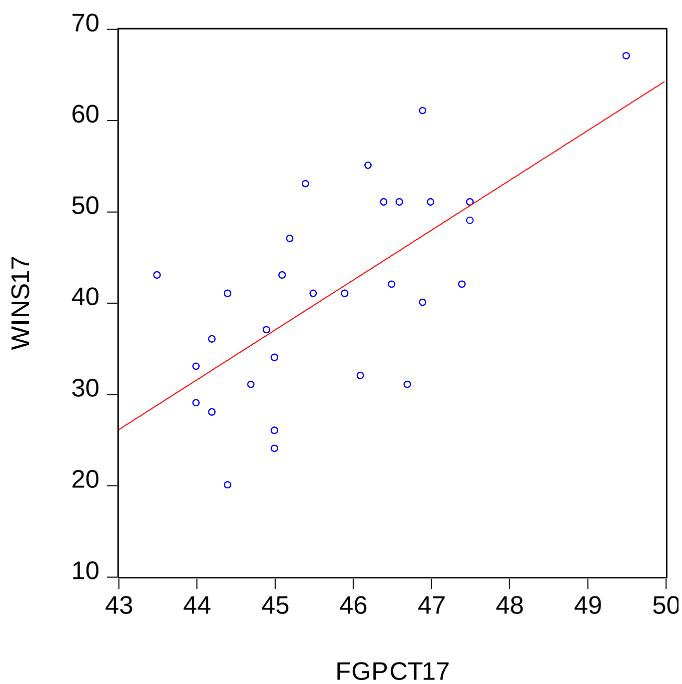

Figure 4.1: 2016-2017 NBA Wins vs. Field Goal Percentage per Game

Table 4.3: OLS Regression With White Standard Errors

Dependent Variable: LNWINS17 Method: Least Squares White Heteroskedasticity-Consistent Standard Errors & Covariance Included Observations: 30				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Probability**
C	-10.817	8.977	-1.205	0.242
LNFGPCT17	5.812	1.081	5.377	0.000
LNFTPCT17	0.099	0.782	0.127	0.900
LNOREB17	-0.191	0.294	-0.650	0.523
LNDREB17	0.305	1.029	0.296	0.770
LNTOV17	-0.524	0.474	-1.106	0.281
LNCOACH17	-0.076	0.088	-0.869	0.395
LNPYRL17	-1.197	0.461	-2.599	0.016
LNPSD17	1.013	0.220	4.612	0.000
R-squared	0.761		**Mean Dep. Var.**	3.676
Adjusted R-Sq.	0.670		**S.D. Dep Var.**	0.285
Std. Err. Reg.	0.164		**Akaike Info Crit.**	-0.538
Sum. Sq. Resid	0.563		**Schwart Info Crit.**	-0.118
Log-likelihood	17.068		**Hannan-Quinn Crit.**	-0.403
F-statistic	8.369		**Prob(F-statistic)**	0.000

The free throw percentage coefficient is positive, but does not satisfy the 5-percent significance criterion. Not surprisingly, it has a low impact on wins. Free throws usually account for a small percentage of total points. Both of the signs for the parameter estimates of natural log of field goal percentage and natural log of free throw percentage are in agreement with the McGoldrick and Voeks (2005) findings. As shown in Figure 4.2, wins and free throw percentage in 2016-2017 are weakly correlated.

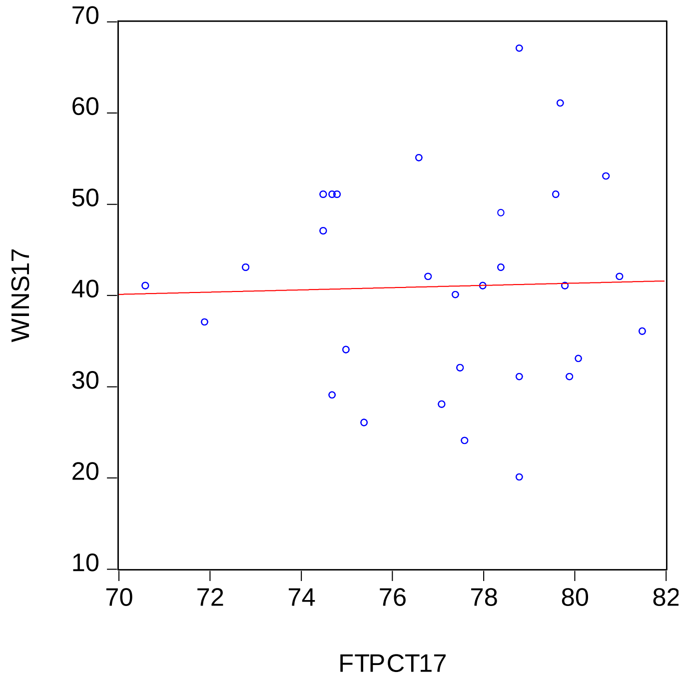

Figure 4.2: 2016-2017 NBA Wins vs. Average Free Throw Percentage per Game

The coefficient for offensive rebounding does not meet the 5-percent significance criterion. The negative sign for this coefficient is counterintuitive. The data for this variable are grouped together very tightly and do not allow any teams to gain very much of an advantage over the others. As shown in Figure 4.3, victories are negatively correlated with offensive rebounds in 2016-2017, but the relationship is not very strong.

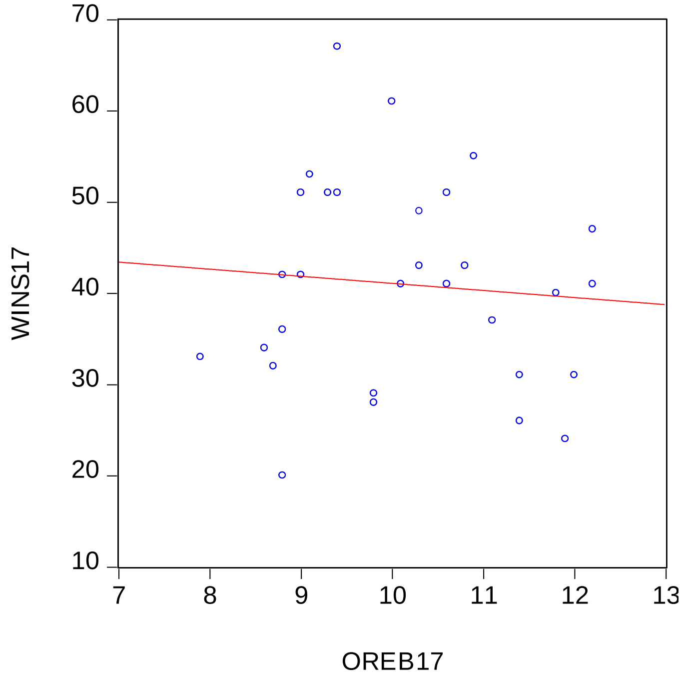

Figure 4.3: 2016-2017 NBA Wins vs. Average Offensive Rebounds per Game

The defensive rebounding parameter is positive with a magnitude of 0.305, but does not satisfy the 5-percent significance criterion. The insignificance is surprising, as defensive rebounds remove possession from the opposing team and reduces opportunities to attempt shots. As shown in Figure 4.4, victories are positively correlated with defensive rebounds. Estimation results for the marginal effects associated with Equation (3) appear in Table 4.4. The marginal effect for the variable defensive rebounding is 0.374. Eleven additional defensive rebounds per game increase total wins by four.

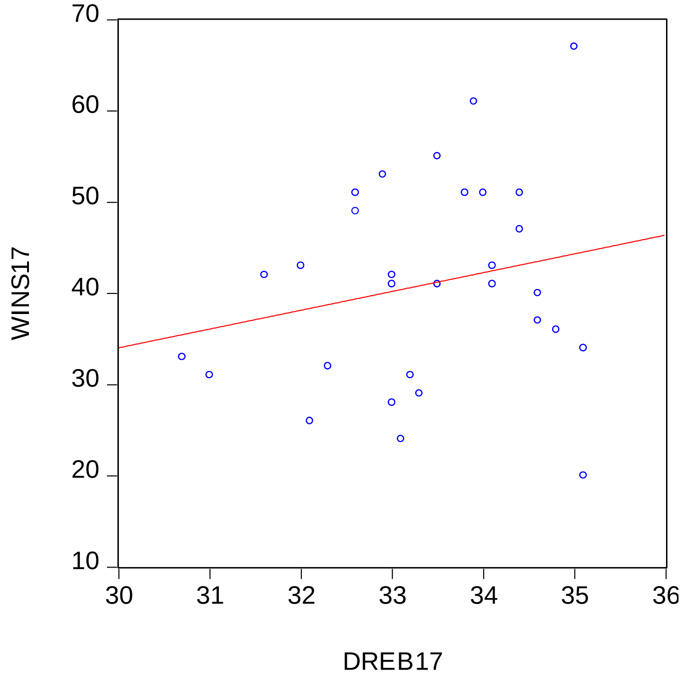

Figure 4.4: 2016-2017 NBA Wins vs. Average Defensive Rebounds per Game

The estimated parameter for turnovers is negative with a magnitude of -0.524, which suggests that a ten percent increase in turnovers will result in a 5.2 percent decrease in wins. Even though it does not meet the 5 percent significance criterion, the coefficient sign is negative as hypothesized. Reducing turnovers allows a team more opportunities to score. It is fairly easy to see in Figure 4.5 that victories are negatively correlated with turnovers.

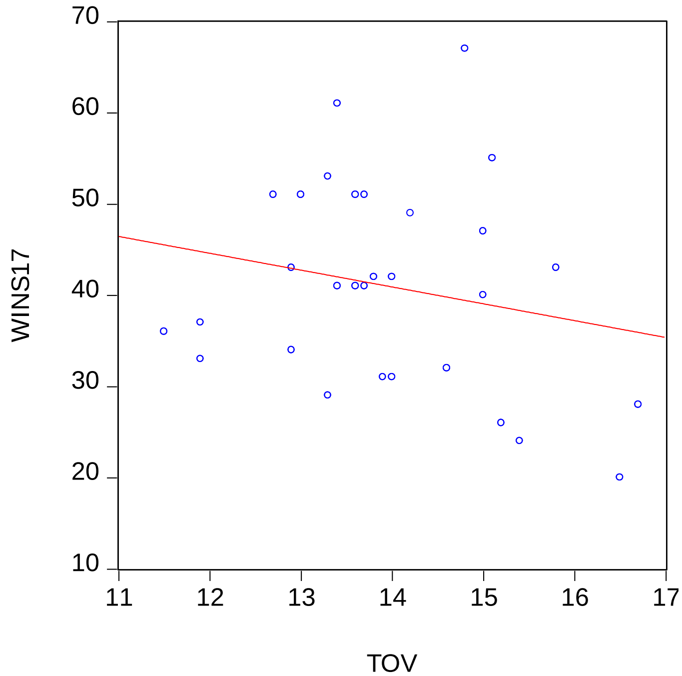

Figure 4.5: 2016-2017 NBA Wins vs. Average Turnovers per Game

The coefficient for coach salaries does not satisfy the standard significance criterion. The parameter is very close to zero and suggests that victories are not affected by coaching compensation. The implication is that spending more on head coaches will not generate additional wins. As shown in Figure 4.6, wins are positively correlated with head coaching salary, but with a fairly large degree of variability.

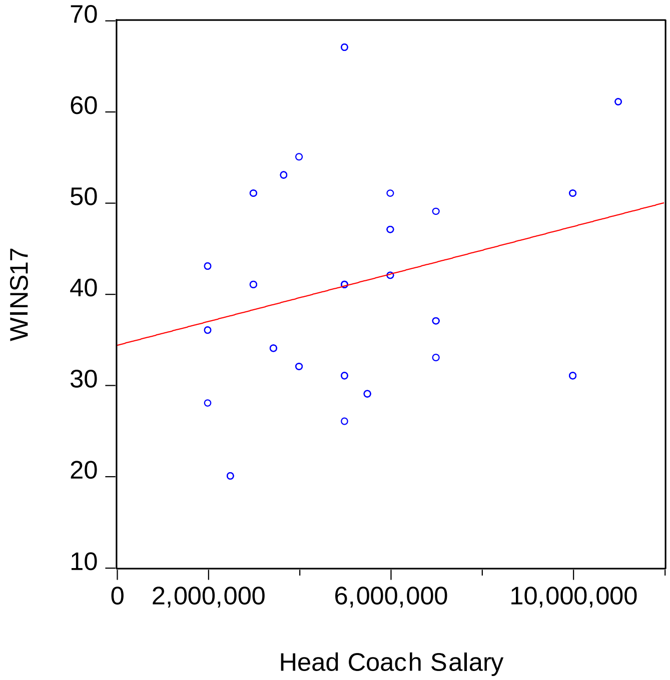

Figure 4.6: 2016-2017 NBA Wins vs. Coaching Salaries

The parameter estimate for natural log of payroll is statistically significant, but it negatively affects wins. That runs counter to what is hypothesized. A one percent increase in payroll will decrease wins by 1.1 percent. However, the marginal effect is 0.0. As shown in Figure 4.7, wins appear to be positively correlated with team payroll.

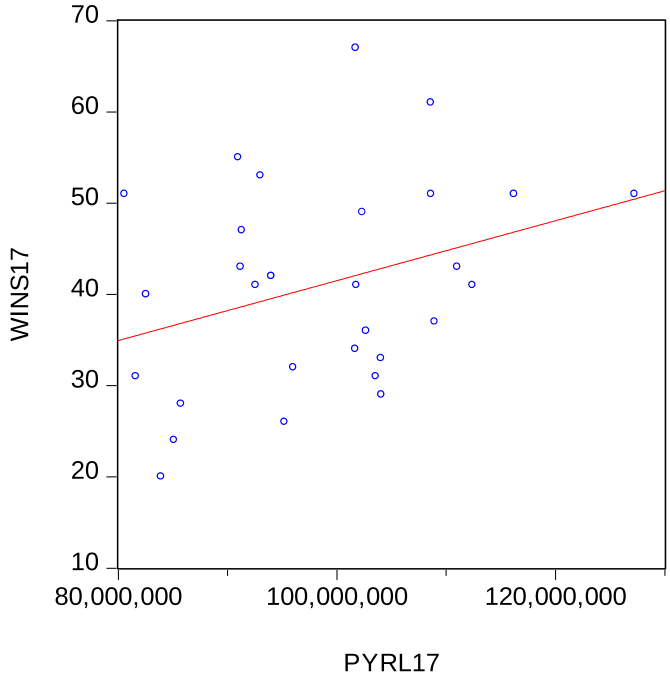

Figure 4.7: 2016-2017 NBA Wins vs. Team Payroll

The natural log of the standard deviation of payroll for a team allows for infighting due to paying a small group a large portion of the salary cap. The estimated coefficient is statistically significant and positive. This is opposite of what Katayama and Nuch (2011) suggest. The result for 2016-2017 suggests that it is better to pay a small number of highly effective players most of the team salary cap. As shown in Figure 4.8, victories are positively correlated with the standard deviation of payroll.

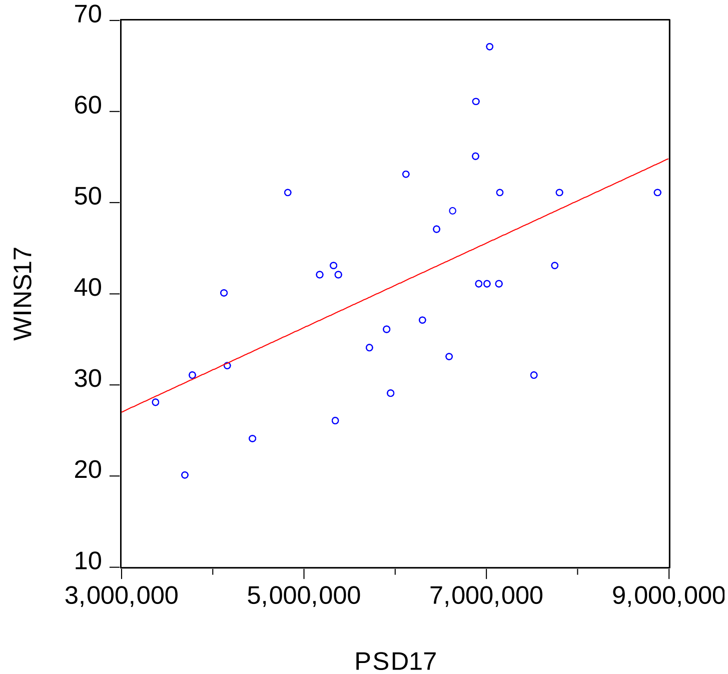

Figure 4.8: 2016-2017 NBA Wins vs. Standard Deviation of Payroll

Table 4.4: Independent Variable Marginal Effects Table

Independent Variable Marginal Effects			
Variable	**Coefficient**	**Mean**	**Marginal Effect**
WINS17	N/A	41.0	N/A
FGPCT17	5.812	45.7	5.214
FTPCT17	0.099	77.2	0.053
OREB17	-0.191	10.1	-0.775
DREB17	0.305	33.4	0.374
TOV17	-0.524	14.0	-1.535
COACH17	-0.076	$4,833,017	0.000
PYRL17	-1.197	$98,443,474	0.000
PSD17	1.013	$6,017,705	0.000

Note: Marginal effects are manually calculated with $\frac{dWINS17}{dx} = \hat{\beta}_x * \frac{\overline{WINS17}}{\bar{X}}$, this calculation was completed for each variable.

The vast majority of the parameter estimates for Equation (3) do not match what is hypothesized. These results are different and depart from the patterns found in Major League Baseball's seasons 2013, 2014, and 2015 (Fullerton et al., 2014; Peach et al., 2016; Fullerton and Peach, 2016). One reason for this may be over valued contracts. During the offseason teams spent record amounts on post players. The following player salaries total more than $365 million, which is approximately 4 times the $94 million salary cap allotted to each team: Los Angeles Laker, Timofey Mozgov; New York Knicks, Joakim Noah; Washington Wizards, Ian Mahimi; Portland Trailblazers, Meyers Leonard; Orlando Magic, Bismack Biyomobo and Charlotte Hornets, Miles Plumlee. These players are all post players whose primary job is to rebound. Those players tend to have low field goal shooting percentages.

It may not be feasible to model the NBA in a manner similar to the MLB or the NFL. The numbers of players on the field in those sports mandates more teamwork among players. (Katayama and Nuch, 2011). In the NBA, one player can change the outcome of the game. For example, the Reggie Miller eight points in nine seconds closed out a game for a playoff victory. During the nine second stretch, Miller, with little help from his teammates, was responsible for a steal, defensive rebound, two successful three-point shots, and two successful free throws (Callahan, 1995). Actions of this magnitude would be difficult to duplicate in either the MLB or the NFL.

Chapter 5: Conclusion

This study examines the on-court performance of the thirty NBA teams during the 2016-17 NBA basketball season. There have not been very many studies that use regular season cross sectional data. In contrast to recent studies for the NFL and MLB, the empirical results for this effort are largely inconclusive. One key departure is the parameter sign for the human capital payroll variable, which is both negative and statistically significant.

The results suggest, that players with high field goal percentages will, as hypothesized help teams win. Other on court performance variables are not found to be reliably linked to team successes. One outcome for payroll dispersion suggests that NBA teams should consider larger salary gaps and allow for one-to-three players to command most of the team payroll.

This study suggests different pathways for further inquiry. Although coaching salaries for the NBA are not all published, coaching salaries for the NCAA are public record. Inclusion of all coaches on staff across all teams may generate additional insights. Replication of this study employing all 437 NCAA teams, may also combat against multicollinearity. It is expected that there is a positive correlation between coaching salaries and wins in the NCAA. Support for the other hypothesis discussed about may also prove less elusive in a study of the NCAA regular season wins.

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Appendix A: Data

Table 1							
Team	**GP**	**WINS17**	**Losses**	**OR17**	**DR17**	**PTS17**	**FGPCT17**
Atlanta Hawks	82	43	39	102.3	103.1	103.2	45.1
Boston Celtics	82	53	29	108.6	105.5	108	45.4
Brooklyn Nets	82	20	62	101.9	108	105.8	44.4
Charlotte Hornets	82	36	46	106.4	106.1	104.9	44.2
Chicago Bulls	82	41	41	104.6	104.5	102.9	44.4
Cleveland Cavaliers	82	51	31	110.9	108	110.3	47
Dallas Mavericks	82	33	49	103.7	106.3	97.9	44
Denver Nuggets	82	40	42	110	110.5	111.7	46.9
Detroit Pistons	82	37	45	103.3	105.3	101.3	44.9
Golden State Warriors	82	67	15	113.2	101.1	115.9	49.5
Houston Rockets	82	55	27	11.8	106.4	115.3	46.2
Indiana Pacers	82	42	40	106.2	106.3	105.1	46.5
LA Clippers	82	51	31	110.3	105.8	108.7	47.5
Los Angeles Lakers	82	26	56	103.4	110.6	104.6	45
Memphis Grizzlies	82	43	39	104.7	104.5	100.5	43.5
Miami Heat	82	41	41	105.2	104.1	103.2	45.5
Milwaukee Bucks	82	42	40	106.9	106.4	103.6	47.4
Minnesota Timberwolves	82	31	51	108.1	109.1	105.6	46.7
New Orleans Pelicans	82	34	48	103.3	104.9	104.3	45
New York Knicks	82	31	51	104.7	108.7	104.3	44.7
Oklahoma City Thunder	82	47	35	105	105.1	106.6	45.2
Orlando Magic	82	29	53	101.2	108	101.1	44
Philadelphia 76ers	82	28	54	100.7	106.4	102.4	44.2
Phoenix Suns	82	24	58	103.9	109.3	107.7	45
Portland Trail Blazers	82	41	41	107.8	107.8	107.9	45.9
Sacramento Kings	82	32	50	104.6	109.1	102.8	46.1
San Antonio Spurs	82	61	21	108.8	100.9	105.3	46.9
Toronto Raptors	82	51	31	109.8	104.9	106.9	46.4
Utah Jazz	82	51	31	107.4	102.7	100.7	46.6
Washington Wizards	82	49	33	108.5	106.9	109.2	47.5

Table 2							
Team	**PT3PCT17**	**FTPCT17**	**OREB17**	**DREB17**	**REB17**	**ASTAV17**	**TOV17**
Atlanta Hawks	34.1	72.8	10.3	34.1	44.3	23.6	15.8
Boston Celtics	35.9	80.7	9.1	32.9	42	25.2	13.3
Brooklyn Nets	33.8	78.8	8.8	35.1	43.9	21.4	16.5
Charlotte Hornets	35.1	81.5	8.8	34.8	43.6	23.1	11.5
Chicago Bulls	34	79.8	12.2	34.1	46.3	22.6	13.6
Cleveland Cavaliers	38.4	74.8	9.3	34.4	43.7	22.7	13.7
Dallas Mavericks	35.5	80.1	7.9	30.7	38.6	20.8	11.9
Denver Nuggets	36.8	77.4	11.8	34.6	46.4	25.3	15
Detroit Pistons	33	71.9	11.1	34.6	45.7	21.1	11.9

Golden State Warriors	38.3	78.8	9.4	35	44.4	30.4	14.8
Houston Rockets	35.7	76.6	10.9	33.5	44.4	25.2	15.1
Indiana Pacers	37.6	81	9	33	42	22.5	13.8
LA Clippers	37.5	74.5	9.0	34.0	43.0	22.5	13
Los Angeles Lakers	34.6	75.4	11.4	32.1	43.5	20.9	15.2
Memphis Grizzlies	35.4	78.4	10.8	32.0	42.8	21.3	12.9
Miami Heat	36.5	70.6	10.6	33.0	43.6	21.2	13.4
Milwaukee Bucks	37	76.8	8.8	31.6	40.4	24.2	14
Minnesota Timberwolves	34.9	79.9	11.4	31.0	42.4	23.7	14
New Orleans Pelicans	35	75	8.6	35.1	43.7	22.8	12.9
New York Knicks	34.8	78.8	12.0	33.2	45.2	21.8	13.9
Oklahoma City Thunder	32.7	74.5	12.2	34.4	46.6	21.0	15
Orlando Magic	32.8	74.7	9.8	33.3	43.2	22.2	13.3
Philadelphia 76ers	34	77.1	9.8	33.0	42.8	23.8	16.7
Phoenix Suns	33.2	77.6	11.9	33.1	45.0	19.6	15.4
Portland Trail Blazers	37.5	78	10.1	33.5	43.7	21.1	13.7
Sacramento Kings	37.6	77.5	8.7	32.3	41.1	22.5	14.6
San Antonio Spurs	39.1	79.7	10.0	33.9	43.9	23.8	13.4
Toronto Raptors	36.3	79.6	10.6	32.6	43.3	18.5	12.7
Utah Jazz	37.2	74.7	9.4	33.8	43.2	20.1	13.6
Washington Wizards	37.2	78.4	10.3	32.6	42.9	23.9	14.2

Table 3							
Team	**STL17**	**BLK17**	**COACH17**	**TOTFINE17**	**AGE17**	**AGE17SQ**	**STL17**
Atlanta Hawks	8.2	4.8	$2,000,000	$186,849	28.4	806.56	8.2
Boston Celtics	7.5	4.1	$3,670,000	$124,000	25.5	650.25	7.5
Brooklyn Nets	7.2	4.7	$2,500,000	$27,000	25.8	665.64	7.2
Charlotte Hornets	7	4.8	$2,000,000	$31,000	26.1	681.21	7
Chicago Bulls	7.8	4.8	$5,000,000	$217,175	26.1	681.21	7.8
Cleveland Cavaliers	6.6	4	$3,000,000	$50,000	29.9	894.01	6.6
Dallas Mavericks	7.5	3.7	$7,000,000	$79,000	27.2	739.84	7.5
Denver Nuggets	6.9	3.9	$2,000,000	$36,000	26.3	691.69	6.9
Detroit Pistons	7	3.8	$7,000,000	$89,899	25.6	655.36	7
Golden State Warriors	9.6	6.8	$5,000,000	$114,000	28.2	795.24	9.6
Houston Rockets	8.2	4.3	$4,000,000	$76,000	26.2	686.44	8.2
Indiana Pacers	8.2	5	$5,426,275	$88,000	26.9	723.61	8.2
LA Clippers	7.5	4.2	$10,000,000	$109,000	29.7	882.09	7.5
Los Angeles Lakers	8.2	3.9	$5,000,000	$120,000	25.8	665.64	8.2
Memphis Grizzlies	8	4.2	$2,550,000	$45,000	27.5	756.25	8
Miami Heat	7.2	5.7	$3,000,000	$101,000	27.3	745.29	7.2
Milwaukee Bucks	8.1	5.3	$6,000,000	$81,000	25.7	660.49	8.1
Minnesota Timberwolves	8	4.5	$10,000,000	$22,000	25.7	660.49	8
New Orleans Pelicans	7.8	5.5	$3,437,500	$214,238	26.3	691.69	7.8
New York Knicks	7.1	5.5	$5,000,000	$3,282,364	27	729	7.1
Oklahoma City Thunder	7.9	5	$6,000,000	$289,095	25.8	665.64	7.9

Orlando Magic	7.1	4.8	$5,500,000	$46,000	25.5	650.25	7.1
Philadelphia 76ers	8.4	5.1	$2,000,000	$47,000	24.6	605.16	8.4
Phoenix Suns	8.2	4.9	$2,500,000	$238,851	25.5	650.25	8.2
Portland Trail Blazers	7	5	$5,000,000	$44,000	24.6	605.16	7
Sacramento Kings	7.6	4	$4,000,000	$730,487	26.1	681.21	7.6
San Antonio Spurs	8	5.9	$11,000,000	$12,000	28.9	835.21	8
Toronto Raptors	8.3	4.9	$6,000,000	$201,364	25.5	650.25	8.3
Utah Jazz	6.7	5	$3,000,000	$57,000	26.3	691.69	6.7
Washington Wizards	8.5	4.1	$7,000,000	$266,000	25.7	660.49	8.5

Table 4				
Team	**EXP17**	**PYRL17**	**PSD17**	**PYRLSQ17**
Atlanta Hawks	6.2	$91,216,857	$5,334,572	$8,320,515,000,958,450.00
Boston Celtics	4.2	$93,035,160	$6,129,341	$8,655,540,996,225,600.00
Brooklyn Nets	3.5	$83,943,358	$3,704,970	$7,046,487,352,316,160.00
Charlotte Hornets	4.4	$102,675,926	$5,914,903	$10,542,345,779,957,500.00
Chicago Bulls	3.9	$92,571,387	$7,017,125	$8,569,461,691,103,770.00
Cleveland Cavaliers	8.5	$127,254,579	$8,883,652	$16,193,727,876,467,200.00
Dallas Mavericks	4.1	$104,042,028	$6,601,351	$10,824,743,590,352,800.00
Denver Nuggets	4.9	$82,573,997	$4,131,973	$6,818,464,980,556,010.00
Detroit Pistons	3.7	$108,967,919	$6,309,190	$11,874,007,371,190,600.00
Golden State Warriors	6.7	$101,725,589	$7,047,165	$10,348,095,457,396,900.00
Houston Rockets	4.7	$90,996,769	$6,891,170	$8,280,411,968,439,360.00
Indiana Pacers	5.7	$94,008,504	$5,181,032	$8,837,598,824,318,020.00
LA Clippers	8.3	$116,237,542	$7,810,465	$13,511,166,170,201,800.00
Los Angeles Lakers	4.4	$95,226,183	$5,355,228	$9,068,025,928,749,490.00
Memphis Grizzlies	5.5	$111,045,893	$7,758,962	$12,331,190,352,167,400.00
Miami Heat	5.1	$101,818,405	$6,925,492	$10,366,987,596,744,000.00
Milwaukee Bucks	4.3	$94,012,121	$5,386,981	$8,838,278,894,918,640.00
Minnesota Timberwolves	3.6	$81,621,379	$3,788,828	$6,662,049,509,861,640.00
New Orleans Pelicans	4	$101,707,386	$5,729,209	$10,344,392,366,953,000.00
New York Knicks	3.9	$103,595,894	$7,529,957	$10,732,109,253,659,200.00
Oklahoma City Thunder	3.7	$91,339,949	$6,464,880	$8,342,986,283,322,600.00
Orlando Magic	3.8	$104,110,336	$5,959,714	$10,838,962,062,032,900.00
Philadelphia 76ers	2.1	$85,763,788	$3,385,426	$7,355,427,332,108,940.00
Phoenix Suns	4.5	$85,115,778	$4,445,831	$7,244,695,664,545,280.00
Portland Trail Blazers	3.1	$112,416,239	$7,144,805	$12,637,410,790,905,100.00
Sacramento Kings	4.5	$96,043,092	$4,170,870	$9,224,275,520,920,460.00
San Antonio Spurs	6.6	$108,640,621	$6,893,417	$11,802,784,531,265,600.00
Toronto Raptors	3.8	$108,664,969	$7,158,464	$11,808,075,487,771,000.00
Utah Jazz	4.7	$80,598,193	$4,835,127	$6,496,068,714,865,250.00
Washington Wizards	3.8	$102,334,382	$6,641,051	$10,472,325,739,321,900.00

Table 5			
Team	Coach	COACHEXP17	COACH17
Atlanta Hawks	Mike Budenholzer	4	$2,000,000
Boston Celtics	Brad Stevens	10	$3,670,000

Brooklyn Nets	Kenny Atkinson	1	$2,500,000
Charlotte Hornets	Steve Clifford	4	$2,000,000
Chicago Bulls	Fred Hoiberg	7	$5,000,000
Cleveland Cavaliers	Tyronn Lue	1	$3,000,000
Dallas Mavericks	Rick Carlisle	16	$7,000,000
Denver Nuggets	Michael Malone	4	$2,000,000
Detroit Pistons	Stan Van Gundy	18	$7,000,000
Golden State Warriors	Steve Kerr	3	$5,000,000
Houston Rockets	Mike D'Antoni	21	$4,000,000
Indiana Pacers	Nate McMillian	12	N/A
LA Clippers	Doc Rivers	18	$10,000,000
Los Angeles Lakers	Luke Walton	1	$5,000,000
Memphis Grizzlies	David Fizdale	1	$2,550,000
Miami Heat	Erik Spoelstra	9	$3,000,000
Milwaukee Bucks	Jason Kidd	4	$6,000,000
Minnesota Timberwolves	Tom Thibodeau	7	$10,000,000
New Orleans Pelicans	Alvin Gentry	11	$3,437,500
New York Knicks	Jeff Hornacek	6	$5,000,000
Oklahoma City Thunder	Billy Donovan	23	$6,000,000
Orlando Magic	Frank Vogel	6	$5,500,000
Philadelphia 76ers	Brett Brown	6	$2,000,000
Phoenix Suns	Earl Watson	2	$2,500,000
Portland Trail Blazers	Terry Stotts	9	$5,000,000
Sacramento Kings	Dave Joerger	11	$4,000,000
San Antonio Spurs	Gregg Popovich	28	$11,000,000
Toronto Raptors	Dwane Casey	11	$6,000,000
Utah Jazz	Quin Snyder	13	$3,000,000
Washington Wizards	Scott Brooks	10	$7,000,000

Appendix B: Additional Regression Results

Table 1
Dependent Variable: WINS17
Method: Least Squares
Included Observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Probability
Constant	821.218	834.302	0.984	0.348
PTS17	-0.506	0.710	-0.712	0.493
FGPCT17	1.120	3.777	0.297	0.773
PT3PCT17	3.201	2.043	1.566	0.148
FTPCT17	-0.476	0.836	-0.570	0.582
OREB17	-32.575	50.370	-0.647	0.532
DREB17	-29.660	50.285	-0.590	0.568
REB17	32.779	50.489	0.649	0.531
ASTAV17	0.794	0.895	0.887	0.396
STL17	6.470	4.759	1.360	0.204
BLK17	-2.260	2.524	-0.895	0.392
COACH17	-4.86E-08	1.10E-06	-0.044	0.966
TOTFINE17	-1.74E-06	3.39E-06	-0.514	0.619
AGE17	-70.558	68.091	-1.036	0.325
AGE17SQ	1.323	1.305	1.014	0.335
EXP17	-0.756	4.114	-0.184	0.857
PYRL17	-7.76E-07	3.86E-06	-0.201	0.845
PYRL17SQ	-1.15E-15	1.93E-14	-0.059	0.954
PSD17	8.36E-06	2.23E-06	3.745	0.004
R-squared	0.892		Mean Dep. Var.	41
Adjusted R-Sq.	0.687		S.D. Dep Var.	11.188
Std. Err. Reg.	6.256		Akaike Info Crit.	6.740
Sum. Sq. Resid	391.379		Schwart Info Crit.	7.674
Log-likelihood	-81.095		Hannan-Quinn Crit.	7.039
F-statistic	4.355		Prob(F-statistic)	0.011

Table 2
Dependent Variable: WINS17
Method: Least Squares
Included Observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Probability
Constant	483.253	844.409	0.572	0.575
PTS17	0.346	0.638	0.542	0.596
TREB17	-0.412	1.025	-0.402	0.693
ASTAV17	1.152	0.931	1.238	0.234
TOV17	-1.747	2.359	- 0.741	0.470
STL17	0.931	3.309	0.281	0.782
BLK17	2.624	2.313	1.134	0.274
COACH17	4.48E-07	7.36E-07	0.608	0.551
TOTFINE17	-3.45E-06	2.98E-06	-1.158	0.264

AGE17	- 33.937	60.321	-0.563	0.582
AGE17SQ	0.597	1.127	0.530	0.603
EXP17	3.227	3.860	0.836	0.420
PYRL17	-6.21E-07	3.24E-07	-1.917	0.074
PSD17	6.91E-06	2.35E-06	2.945	0.01
R-squared	0.760		**Mean Dep. Var.**	41
Adjusted R-Sq.	0.559		**S.D. Dep Var.**	11.188
Std. Err. Reg.	7.432		**Akaike Info Crit.**	7.154
Sum. Sq. Resid	883.741		**Schwart Info Crit.**	7.808
Log-likelihood	-93.313		**Hannan-Quinn Crit.**	7.363
F-statistic	3.825		**Prob(F-statistic)**	0.006

Table 3
Dependent Variable: WINS17
Method: Least Squares
Included Observations: 30

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Probability**
Constant	734.910	700.732	1.0488	0.313
FGPCT17	0.009	2.330	0.004	0.997
PT3PCT	3.600	1.600	2.251	0.042
FTPCT	-0.649	0.567	-1.145	0.273
OREB17	-0.073	1.278	- 0.057	0.955
DREB17	2.604	1.402	1.857	0.086
ASTAV17	0.542	0.696	0.779	0.450
TOV17	-3.030	1.876	- 1.616	0.130
STL17	6.080	3.226	1.885	0.082
BLK17	-1.375	2.125	-0.647	0.529
COACH17	2.12E-07	7.39E-07	0.286	0.779
TOTFINE17	-1.57E-06	2.67E-06	- 0.587	0.567
AGE17	-61.315	48.602	- 1.262	0.229
AGE17SQ	1.138	0.905	1.258	0.231
EXP17	-0.609	3.249	-0.188	0.854
PYRL17	-9.02E-07	2.91E-07	-3.098	0.009
PSD17	7.54E-06	1.81E-06	4.157	0.001
R-squared	0.883		**Mean Dep. Var.**	41
Adjusted R-Sq.	0.739		**S.D. Dep Var.**	11.188
Std. Err. Reg.	5.718		**Akaike Info Crit.**	6.622
Sum. Sq. Resid	425.067		**Schwart Info Crit.**	7.416
Log-likelihood	-82.334		**Hannan-Quinn Crit.**	6.876
F-statistic	6.126		**Prob(F-statistic)**	0.001

Table 4
Dependent Variable: WINS17
Method: Least Squares
Included Observations: 30

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Probability**
Constant	683.367	720.650	0.948	0.359

FGPCT17	0.757237	2.331700	0.324758	0.7502
PT3PCT	3.114	1.604	1.942	0.073
FTPCT	-0.481	0.569	-0.845	0.413
TREB17	1.162	0.944	1.231	0.239
ASTAV17	0.781	0.694	1.124	0.280
TOV17	-3.090	1.935	-1.597	0.133
STL17	4.444	3.082	1.442	0.171
BLK17	-0.200	1.999	-0.100	0.922
COACH17	-1.67E-07	7.08E-07	-0.236	0.817
TOTFINE17	-2.92E-06	2.55E-06	-1.145	0.271
AGE17	-58.186	50.014	-1.163	0.264
AGE17SQ	1.099	0.932	1.180	0.258
EXP17	-1.159	3.325	-0.349	0.733
PYRL17	-7.59E-07	2.79E-07	- 2.724	0.017
PSD17	6.67E-06	1.75E-06	3.815	0.002
R-squared	0.866		**Mean Dep. Var.**	41
Adjusted R-Sq.	0.723		**S.D. Dep Var.**	11.188
Std. Err. Reg.	5.889		**Akaike Info Crit.**	6.688
Sum. Sq. Resid	485.466		**Schwart Info Crit.**	7.436
Log-likelihood	84.327		**Hannan-Quinn Crit.**	6.928
F-statistic	6.046		**Prob(F-statistic)**	0.001

Vita

Michael Jaeger was born in El Paso, Texas and an alumnus of the University of Texas at El Paso. In 2006, Michael earned a Bachelor of Arts degree in History and began working toward a Master of Science in Economics in the Spring of 2016.

Michael has been employed by the El Paso Independent School District throughout his graduate studies. Initially hired as a Social Studies teacher, in 2014, he was assigned to teach Economics. During 2014, he designed and implemented an advance placement program in Economics for Austin High School. Before beginning his graduate work, Michael coached high school basketball and also enjoyed his time as a personal trainer during his graduate studies.

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This thesis/dissertation was typed by Michael Lynn Jaeger.