Event-Based Statistical Analysis of the 2016-17 San Antonio Spurs

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Table of Contents

Methodology		
	Statistical Significance as a Measure of Performance Change	pg. 2
	Overview of Team Statistics	pg. 3
	Overview of Player Statistics	pg. 5
	The Statistical Significance Matrix	pg. 7
Team Report		
	Statistical Significance Matrix	pg. 8
Individual Rep	orts for the 2016-17 San Antonio Spurs	
	LaMarcus Aldridge	pg. 10
	Kyle Anderson	pg. 11
	Dewayne Dedmon	pg. 12
	Pau Gasol	pg. 13
	Manu Ginobili	pg. 14
	Danny Green	pg. 15
	David Lee	pg. 16
	Kawhi Leonard	pg. 17
	Patty Mills	pg. 18
	Tony Parker	pg. 19
	Jonathan Simmons	pg. 20

Methodology

Statistical Significance as a Measure of Performance Change

Using game log data from Basketball-Reference, one can measure the effect of different events on player and team performance. The events in question are how players perform <u>against</u> teams that ended the season with a top-ten win percentage, against teams that ended the season with a middle-ten win percentage, against teams that ended the season with a bottom-ten win percentage, in the Playoffs, after the Allstar Break, and against Division opponents. The statistics measured as indicators of team performance are OffRtg, DefRtg, NetRtg, Pace, eFG%, FT%, AST%, TOV%, TRB%, BLK%, STL%, Opponent eFG%, Opponent TOV%. The statistics measured as indicators of player performance are OffRtg, DefRtg, NetRtg, USG%, PTS/36, PF/36, BLK%, STL%, DRB%, ORB%, eFG%, and FT%.

The primary tool for accomplishing that goal is the Z-test of significance. The Null Hypothesis (H_0) is that $B_1 = B_2$ where B_1 is the mean for a statistic (eg. USG%) where the event has occurred (eg. Player plays a Playoff game) and B_2 is the mean for a statistic where the event has not occurred (eg. Player plays a Regular Season game). The Alternative Hypothesis (H_A) is $B_1 \neq B_2$, which suggests the means of those statistics are not equal and the change in event causes a change in the statistic. We reject H_0 in favor of H_A if the Z-test statistic is above the threshold set by our significance level, which in this case is $\alpha = 0.05$ and $Z = \pm 1.96$. In other words, the event change causes a statistically significant change to the 5% level if the Z-test statistic is either above 1.96 or below -1.96.

In order to calculate the Z-test statistic we need B_1 , B_2 , the standard deviation of B_1 (σ_1), and the sample size of B_2 (n_2). We calculate the Z-test statistic using the following formula:

$$Z = \frac{B_2 - B_1}{\frac{\sigma_1}{\sqrt{n_2}}}$$

The Z-test statistic is calculated for the team and each player on the Spurs roster with the underlying assumption their statistics are normally distributed.

In summary, this report is not about how a team or its players perform but how their performance changes during certain scenarios.

Overview of Team Statistics

The sample size of the team statistics includes every game, including playoff games, the Spurs have played from the 2013-14 season until the 2015-16.

OffRtg

This statistic measures how many points a team scores in 100 possessions.

DefRtg

This statistic measures how many points a team yields in 100 possessions.

NetRtg

This statistic combines both OffRtg and DefRtg and is the difference between the two statistics.

Pace

This statistic measures how many possessions a team has in a game.

eFG%

eFG% takes into account the added point value of making a three-point field goal compared to a two-point field goal. The formula for eFG% is (FG + 0.5 * 3P) / FGA.

FT%

FT% is the number of Free Throws a player makes divided by the number of Free Throws a player attempts.

AST%

AST% estimates the percentage of team possessions that end with a player assisting a made Field Goal.

TOV%

TOV% estimates the percentage of team possessions that end in a turnover.

TRB%

TRB% measures the percentage of total rebounds that a team accrues during a game.

STL%

STL% estimates the percentage of opposing possessions that end with a player stealing the ball.

BLK%

BLK% estimates the percentage of opposing 2-point Field Goals a player blocks while on the court.

Opp. eFG%

Opp. eFG% measures the eFG% of the opponent in a game.

Opp. TOV%

Opp. TOV% measures the TOV% of the opponent in a game.

Overview of Player Statistics

The sample size for each player's statistics includes every game, including playoff games, they have played in the last two seasons (2014-15 and 2015-16 seasons).

OffRtg

This statistic measures how many points a team scores in 100 possessions.

DefRtg

This statistic measures how many points a team yields in 100 possessions.

NetRtg

This statistic combines both OffRtg and DefRtg and is the difference between the two statistics.

USG%

USG% is an estimate of the percentage of team plays used by a player while he was on the floor. It is a powerful indicator to how important a player is to the team's offense.

PTS/361

PTS/36 could have simply been PTS/G but it is necessary to extrapolate one game's point total to 36 minutes to normalize the boxscore data.

PF/36

Similar to PTS/36, PF/36 allows us to extrapolate personal fouls to 36 minutes.

BLK%

BLK% estimates the percentage of opposing 2-point Field Goals a player blocks while on the court.

STL%

STL% estimates the percentage of opposing possessions that end with a player stealing the ball.

AST%

¹ I would prefer to use PTS/100 possessions but Basketball-Reference boxscore data does not have per possession data

AST% estimates the percentage of team possessions that end with a player assisting a made Field Goal.

DRB%

DRB% estimates the percentage of available defensive rebounds a player rebounds.

ORB%

ORB% estimates the percentage of available offensive rebounds a player rebounds.

eFG%

eFG% takes into account the added point value of making a three-point field goal compared to a two-point field goal. The formula for eFG% is (FG + 0.5 * 3P) / FGA.

FT%

FT% is the number of Free Throws a player makes divided by the number of Free Throws a player attempts

The Statistical Significance Matrix

Event	OffRtg	DefRtg	NetRtg	USG%	PTS/36	PF/36	BLK%	STL%	AST%	DRB%	ORB%	eFG%	FT%
Top 10	-3.97	+6.79	-10.76	+1.30	+0.47	+0.36	-0.11	+0.26	+0.21	-2.97	-0.82	-0.017	-0.003
Middle 10	+4.54	-5.15	+9.70	-0.99	-0.39	-0.19	-0.16	-0.32	-1.28	+0.32	+1.32	+0.013	+0.023
Bottom 10	-1.72	-1.27	-0.44	-0.13	-0.10	-0.14	+0.35	-0.55	+0.54	+2.58	-1.11	0.000	-0.027
Playoffs	-1.15	+3.54	-4.69	+0.39	-0.72	+0.11	+1.13	-0.36	-2.70	-2.97	+0.84	-0.033	+0.046
Post Allstar	+2.79	+3.28	-0.49	+0.69	+0.71	-0.29	-0.12	+0.05	-0.93	+0.55	-0.89	+0.010	+0.012
Division	+5.44	-1.84	+7.28	+0.91	+1.48	+0.20	+0.97	+0.17	-2.27	-1.97	+2.54	+0.013	+0.022

The table above is LaMarcus Aldridge's Statistical Significance Matrix which visualizes how certain events affect his performance. The number inside each cell is the raw difference in the means of the statistic shown in the column headers. The cell is colored red or green depending on whether there is a statistically significant change in a negative direction or positive direction respectively for each event in the row headers². For example, the highest cell in the DefRtg column and Top 10 row indicates LaMarcus Aldridge's DefRtg is 6.79 points higher when he is playing against a team who ended the season with a top-ten win percentage compared with a playing against any other team. That positive change is statistically significant to the 5% level. The lowest-right corner of the matrix is the shows LaMarcus Aldridge's FT% increases by 0.022 percent but that change is not statistically significant and is more likely due to randomness.

² One consideration is made for the color of cells within the DefRtg, TOV%, Opp. eFG% columns. The colors are reversed, so a statistically significant increase in those statistics is red and a statistically significant decrease is green. I made this change in order to reflect that an increase in DefRtg, TOV%, Opp. eFG% is almost always bad and a decrease is almost always good.

Team Report

Event	OffRtg	DefRtg	NetRtg	Pace	eFG%	FT%	AST%	TOV%	TRB%	BLK%	STL%	Opp. eFG%	Opp. TOV%
Top 10	-1.99	+6.84	-8.83	-0.25	-0.015	-0.032	-3.97	-0.26	-1.34	-2.07	+0.37	+0.041	+0.94
Middle 10	-0.45	-3.70	+3.25	-0.37	+0.001	+0.012	+0.52	+0.54	+0.32	+0.60	-0.49	-0.022	-0.24
Bottom 10	+2.92	-4.34	+7.26	+0.70	+0.017	+0.025	+4.28	-0.27	+1.29	+1.88	+0.08	-0.026	-0.89
Playoffs	+2.82	+3.06	-0.24	-1.55	+0.008	-0.032	-4.84	-1.38	-0.87	-0.88	+0.30	+0.010	-0.20
Post Allstar	+2.46	+1.81	+0.65	+0.18	+0.004	+0.012	-3.02	-1.01	-0.20	-0.02	+0.49	+0.009	-0.11
Division	-1.01	+0.73	-1.74	-1.27	+0.001	+0.004	-2.19	+0.54	-0.16	+0.54	-0.50	-0.008	-0.74

Individual Reports for the 2016-17 San Antonio Spurs

LaMarcus Aldridge

$Biography^3\\$

Age: 31

Experience: 10 years

Height: 6'11" Weight: 240 lbs. Position: PF

College: University of Texas at Austin

Salary: \$20,575,005



Statistical Significance

Event	OffRtg	DefRtg	NetRtg	USG%	PTS/36	PF/36	BLK%	STL%	AST%	DRB%	ORB%	eFG%	FT%
Top 10	-3.97	+6.79	-10.76	+1.30	+0.47	+0.36	-0.11	+0.26	+0.21	-2.97	-0.82	-0.017	-0.003
Middle 10	+4.54	-5.15	+9.70	-0.99	-0.39	-0.19	-0.16	-0.32	-1.28	+0.32	+1.32	+0.013	+0.023
Bottom 10	-1.72	-1.27	-0.44	-0.13	-0.10	-0.14	+0.35	-0.55	+0.54	+2.58	-1.11	0.000	-0.027
Playoffs	-1.15	+3.54	-4.69	+0.39	-0.72	+0.11	+1.13	-0.36	-2.70	-2.97	+0.84	-0.033	+0.046
Post Allstar	+2.79	+3.28	-0.49	+0.69	+0.71	-0.29	-0.12	+0.05	-0.93	+0.55	-0.89	+0.010	+0.012
Division	+5.44	-1.84	+7.28	+0.91	+1.48	+0.20	+0.97	+0.17	-2.27	-1.97	+2.54	+0.013	+0.022

Notes:

³ Data from Basketball-Reference

Kyle Anderson

Biography

Age: 22

Experience: 2 years

Height: 6'9" Weight: 230 lbs. Position: SF

College: University of California, Los Angeles

Salary: \$1,192,080



Statistical Significance

Event	OffRtg	DefRtg	NetRtg	USG%	PTS/36	PF/36	BLK%	STL%	AST%	DRB%	ORB%	eFG%	FT%
Top 10	+4.75	+5.77	-0.84	+0.60	+1.57	-0.48	-0.61	+0.40	-4.72	+4.58	-0.21	+0.071	-0.042
Middle 10	+2.81	-1.11	-1.10	+0.77	+0.12	+1.00	-0.78	+0.19	+4.29	-3.05	+0.74	-0.036	+0.184
Bottom 10	-10.68	-3.53	-2.93	-0.55	-1.23	-0.75	+1.42	-0.55	-0.99	-1.27	-0.26	-0.023	-0.190
Playoffs	-12.25	+0.53	-19.90	-2.61	-2.52	+1.06	-0.65	+1.45	-7.97	-6.72	-1.42	-0.083	-0.071
Post Allstar	-10.87	+0.09	-7.10	+0.25	-0.46	+0.59	-0.87	+1.47	-3.60	+4.21	-1.69	-0.010	-0.001
Division	+11.45	-1.14	+20.43	+1.68	+1.73	+0.86	0.00	-0.35	+1.84	-1.83	-2.06	-0.002	+0.028

Dewayne Dedmon

Biography

Age: 26

Experience: 3 years

Height: 7'0" Weight: 245 lbs. Position: C

College: University of Southern California

Salary: \$2,898,00



Statistical Significance

Event	OffRtg	DefRtg	NetRtg	USG%	PTS/36	PF/36	BLK%	STL%	AST%	DRB%	ORB%	eFG%	FT%
Top 10	+13.74	+10.58	+11.17	+0.38	+2.27	+0.46	-2.25	-0.60	-0.32	-1.74	-2.22	+0.082	-0.123
Middle 10	+8.40	-3.35	-1.60	-1.86	-1.01	-2.42	+3.53	+0.27	+1.90	-0.56	+0.19	-0.018	-0.063
Bottom 10	-14.74	-5.95	-4.87	+0.53	-1.17	+2.08	-2.30	+0.63	-2.15	+1.54	+2.74	-0.045	+0.172
Playoffs	NA ⁴	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Post Allstar	+5.64	+2.27	+8.60	-0.84	+1.51	-2.07	-1.81	-0.16	-1.31	+5.62	+0.69	+0.089	+0.027
Division ⁵	+1.04	+2.62	-17.46	-1.92	+0.71	+3.16	-1.82	+0.12	-1.87	-8.17	-4.80	+0.104	-0.227

Dewayne Dedmon did not play in any Playoff games during the 2014-15 and 2015-16 seasons
 "Division" games for players not on the San Antonio Spurs during the 2014-15 or 2015-16 seasons still means games played against teams in the Southwest Division

Pau Gasol

Biography

Age: 36

Experience: 15 years

Height: 7'0"
Weight: 250 lbs.
Position: C/PF
College: None

Salary: \$15,500,000



Statistical Significance

Event	OffRtg	DefRtg	NetRtg	USG%	PTS/36	PF/36	BLK%	STL%	AST%	DRB%	ORB%	eFG%	FT%
Top 10	-5.45	+6.31	-11.76	-1.38	-1.93	-0.14	-0.44	-0.13	+2.25	+1.61	+0.06	-0.026	+0.014
Middle 10	-1.31	-2.89	+1.58	-0.10	-0.53	+0.22	-0.48	-0.01	-0.63	-1.14	+0.64	-0.010	-0.031
Bottom 10	+5.59	-2.55	+8.14	+1.83	+2.50	-0.01	+1.02	+0.24	-1.71	-0.07	-0.66	+0.027	-0.005
Playoffs	-1.64	-3.49	+1.85	-2.42	-2.84	-0.15	+1.02	+0.16	+0.30	-4.59	-1.75	-0.011	+0.007
Post Allstar	-2.03	+1.01	03.04	+0.37	-0.57	+0.11	-0.04	-0.09	+2.47	+0.49	-1.06	-0.007	-0.012
Division	+1.54	-0.33	+1.87	-1.84	-1.67	+0.47	-0.15	+0.04	-1.05	+2.00	+0.61	+0.004	+0.75

Manu Ginobili

Biography

Age: 39

Experience: 14 years

Height: 6'6"
Weight: 205 lbs.
Position: SG
College: None

Salary: \$14,000,000



Statistical Significance

Event	OffRtg	DefRtg	NetRtg	USG%	PTS/36	PF/36	BLK%	STL%	AST%	DRB%	ORB%	eFG%	FT%
Top 10	-4.60	+6.14	-10.75	-1.57	-2.05	+0.71	+0.53	+0.42	-1.72	+0.97	-0.98	-0.040	-0.060
Middle 10	-2.69	-1.71	-0.98	+0.14	-0.85	+0.46	-0.19	-0.72	-3.67	-0.61	+0.53	-0.049	+0.072
Bottom 10	+6.15	-3.97	+10.12	+2.37	+3.54	-1.12	-0.53	+0.28	+5.43	-0.92	+0.87	+0.062	+0.003
Playoffs	+12.98	+3.34	+9.64	-4.82	-2.91	+1.90	+1.30	-0.74	-0.06	+1.96	+0.88	+0.001	+0.041
Post Allstar	-0.026	+2.12	-2.14	-4.23	-3.00	+1.39	+0.99	-0.18	-6.12	+0.01	+0.11	-0.006	+0.033
Division	+6.15	-2.20	+8.35	-0.53	+0.32	+0.77	-0.85	+0.32	-3.94	+1.96	+0.73	+0.055	-0.024

Danny Green

Biography

Age: 29

Experience: 7 years

Height: 6'6" Weight: 215 lbs. Position: SG

College: University of North Carolina

Salary: \$10,000,000



Statistical Significance

Event	OffRtg	DefRtg	NetRtg	USG%	PTS/36	PF/36	BLK%	STL%	AST%	DRB%	ORB%	eFG%	FT%
Top 10	-2.06	+7.84	-9.90	+0.35	+0.02	-0.14	-0.34	+0.36	-1.29	-2.15	+0.91	-0.015	+0.100
Middle 10	-5.61	-3.80	-1.81	-0.88	-1.82	+0.38	-0.47	-0.30	+0.05	+2.74	-0.78	-0.029	-0.212
Bottom 10	+7.64	-3.50	+11.13	+0.55	+1.68	-0.13	+0.78	-0.01	+1.06	-0.62	-0.29	+0.037	+0.109
Playoffs	+6.87	+1.75	+5.12	-2.35	-1.53	-0.30	-0.04	+1.08	-2.84	-2.44	-1.31	+0.045	-0.062
Post Allstar	+3.98	+2.07	+1.90	-1.43	-0.13	+0.78	-0.20	+0.50	-0.80	-0.76	-0.72	+0.020	+0.017
Division	-0.90	-2.38	+1.47	+1.17	+0.36	+0.15	-0.05	-0.10	+2.04	+1.80	-1.86	+0.021	-0.201

David Lee

Biography

Age: 33

Experience: 11 years

Height: 6'9" Weight: 245 lbs. Position: PF/C

College: University of Florida

Salary: \$14,445,313



Statistical Significance

Event	OffRtg	DefRtg	NetRtg	USG%	PTS/36	PF/36	BLK%	STL%	AST%	DRB%	ORB%	eFG%	FT%
Top 10	-7.96	+5.30	-13.70	+1.09	-0.19	-0.05	-1.47	-0.17	-0.87	-1.78	-0.96	-0.015	-0.028
Middle 10	+5.12	-0.38	+8.06	-0.64	+0.34	+0.25	+0.11	-0.36	-1.84	-0.58	+1.71	+0.024	-0.074
Bottom 10	+9.68	-7.40	+14.15	-1.02	+0.36	-0.18	+1.43	+0.57	+2.63	+4.84	-0.40	+0.006	+0.138
Playoffs	-13.24	+0.64	-19.17	-0.10	-5.09	+0.58	-1.65	-0.05	-6.19	-1.84	+1.25	-0.101	-0.165
Post Allstar	+3.60	+4.25	-4.13	-2.08	-1.58	+0.61	-0.20	-0.49	-6.63	+4.04	+3.38	+0.085	-0.210
Division	-5.24	-2.36	-6.65	-1.46	-3.73	+0.02	-1.28	+0.71	-8.73	-5.13	+6.98	-0.104	-0.145

Kawhi Leonard

Biography

Age: 25

Experience: 5 years

Height: 6'7" Weight: 230 lbs. Position: SF

College: San Diego State University

Salary: \$17,63,063



Statistical Significance

Event	OffRtg	DefRtg	NetRtg	USG%	PTS/36	PF/36	BLK%	STL%	AST%	DRB%	ORB%	eFG%	FT%
Top 10	-9.02	+8.84	-17.86	+2.00	+0.12	+0.34	-1.10	-0.16	+2.51	+0.89	+0.103	-0.038	-0.041
Middle 10	+6.91	-2.40	+9.31	-1.99	-0.05	-0.28	+0.05	-0.29	-3.91	-2.85	-0.60	+0.028	+0.016
Bottom 10	+6.09	-6.42	+12.51	-0.71	+0.25	+0.02	+1.34	+0.62	+2.44	+0.97	+0.28	+0.031	+0.025
Playoffs	-2.01	+5.18	-7.19	+2.47	+1.90	+0.34	+0.37	-0.22	+1.30	-3.04	+0.68	0.000	-0.060
Post Allstar	+2.54	+1.60	+0.94	+2.18	+2.29	+0.26	+0.44	+0.47	+1.14	-0.85	-0.01	+0.019	+0.001
Division	+1.85	-1.36	+3.22	-0.89	-0.28	-0.51	+0.55	-0.22	-1.23	-2.42	-0.59	-0.015	+0.043

Patty Mills

Biography

Age: 27

Experience: 7 years

Height: 6'0" Weight: 185 lbs. Position: PG

College: Saint Mary's College of California

Salary: \$3,578,948



Statistical Significance

Event	OffRtg	DefRtg	NetRtg	USG%	PTS/36	PF/36	BLK%	STL%	AST%	DRB%	ORB%	eFG%	FT%
Top 10	+1.39	+8.44	-5.93	-1.09	-0.57	+0.77	+0.11	-0.59	-1.83	+1.25	-0.18	+0.020	+0.073
Middle 10	-3.57	-2.94	+0.46	-0.03	+1.20	+0.13	-0.21	-0.31	-0.42	-0.87	-0.47	+0.006	-0.050
Bottom 10	+0.98	-5.24	+3.82	+1.61	-0.48	-0.82	+0.10	+1.08	+2.32	-0.26	+0.64	-0.032	-0.034
Playoffs	+20.63	+3.41	+18.01	-1.46	+2.42	-0.08	-0.21	-0.02	-2.93	+3.59	-0.70	+0.188	+0.046
Post Allstar	-2.88	+4.18	-8.49	+1.58	-0.14	-0.04	-0.10	-0.11	+3.30	+0.08	-0.40	-0.012	+0.015
Division	-16.05	-4.53	-10.61	+1.27	+0.31	+0.52	+0.28	+0.59	+0.74	-0.04	-1.62	-0.033	+0.105

Tony Parker

Biography

Age: 34

Experience: 15 years

Height: 6'2"
Weight: 185 lbs.
Position: PG
College: None

Salary: \$14,445,313



Statistical Significance

Event	OffRtg	DefRtg	NetRtg	USG%	PTS/36	PF/36	BLK%	STL%	AST%	DRB%	ORB%	eFG%	FT%
Top 10	-11.66	+6.51	-18.16	-1.53	-2.66	+0.74	+0.20	+0.07	-6.31	+0.96	+0.43	-0.066	-0.059
Middle 10	+2.69	-2.74	+5.43	+0.52	+0.13	-0.18	-0.08	-0.16	+3.15	-0.48	+0.01	+0.001	+0.040
Bottom 10	+10.33	-3.37	+13.70	+1.49	+3.14	-0.60	-0.11	+0.14	+3.89	-0.19	-0.38	+0.069	0.000
Playoffs	-10.35	+4.48	-14.83	-0.19	-2.79	+0.11	+0.07	-0.41	-3.39	+1.06	-0.01	-0.088	+0.028
Post Allstar	-4.47	+4.06	-8.53	-0.35	-1.57	_0.14	-0.10	-0.23	-0.85	-0.29	-0.38	-0.061	-0.024
Division	-5.12	-0.96	-4.17	-0.78	-1.37	+0.22	+0.02	-0.47	-2.08	+1.36	+0.25	-0.036	0.000

Jonathon Simmons

Biography

Age: 26

Experience: 1 years

Height: 6'6" Weight: 195 lbs. Position: SG

College: University of Houston

Salary: \$874,636



Statistical Significance

Event	OffRtg	DefRtg	NetRtg	USG%	PTS/36	PF/36	BLK%	STL%	AST%	DRB%	ORB%	eFG%	FT%
Top 10	+21.08	+7.93	+17.74	+0.36	+3.26	+2.06	+0.32	+0.03	-4.60	+4.74	-1.82	+0.157	-0.057
Middle 10	-18.86	-4.15	-23.78	+2.50	+0.94	+1.70	+0.86	+0.41	+0.73	-1.18	+1.03	+0.014	+0.019
Bottom 10	+3.14	-0.51	+10.15	-1.98	-2.51	-3.06	-1.00	-0.30	+3.10	-2.01	-0.53	-0.115	+0.022
Playoffs	+2.20	-1.15	-32.61	-1.16	-2.54	-1.88	-0.62	+1.98	-4.10	-7.98	+9.32	-0.107	-0.220
Post Allstar	-7.51	+3.41	-22.14	-2.07	-2.22	-1.50	-0.49	+0.83	-9.08	+0.04	+2.29	-0.074	-0.003
Division	-6.79	-0.18	-19.95	-0.55	-2.27	-0.68	+0.38	+0.02	+8.36	+0.05	+1.20	-0.091	-0.033