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MSDS 456
Assignment 2

The purpose of this assignment is to study the measurement of plus minus, adjusted plus minus, and win probability adjusted plus minus ratings in the National Basketball Association. Through this exercise, we will be able to see how effective these ratings are in analyzing a team's success in the NBA, not only in the regular season, but also in the playoffs. For this specific study, we will select two teams that faced each other in the 2018 NBA Playoffs and compare their success this season using these ratings, while also using these regular season ratings to predict which team should have been more successful in their playoff matchup. The two teams that were chosen for this analysis were the Philadelphia 76ers and the Boston Celtics, who are not only Atlantic Division rivals in the Eastern Conference, but also faced each other in the NBA Eastern Conference Semifinals this year. The Boston Celtics and Philadelphia 76ers both had tremendous seasons. The Celtics finished as the second seed in the East, with a 55-27 record, while the Sixers finished right behind them as the third seed in the East, with a 52-30 record. Neither team won the Atlantic Division though, as the Raptors clinched that, as well as the East's first seed, with a 59-23 record. The Sixers-Celtics conference semifinals matchup was decided once the Sixers defeated the Miami Heat and the Celtics defeated the Bucks, both in the quarterfinals round. The Sixers were heavily favored by Vegas odds and most experts to win this series against the Celtics, however the Celtics, with home court advantage due to their higher seeding, stunned the basketball world and won the series four games to one to advance to the Eastern Conference Finals against the Cleveland Cavaliers. The series was closely fought, and many games could have gone either way, but the Celtics found a way to edge the Sixers out when it mattered most. Through this assignment, we will be able to see if the plus minus, adjusted plus minus, and win probability adjusted plus minus ratings lend any accuracy to the final result of this series.

To elaborate, we used 2017-2018 NBA regular season play-by-play data to prepare the dataset that was used for our analysis. The play-by-play data was read into R and prepared using a series of codes. Playoff play-by-play data was also read into R. This play-by-play data was exported into csv files for further study and comparison. To clarify, the regular season data was what was used to compute the plus minus, adjusted plus minus, and win probability adjusted plus minus ratings and then predict what should have occurred in the playoff series between the Sixers and Celtics using these ratings as our only basis. The playoff data is in place just to use for comparisons to the regular season data but was not used for any ratings calculations.

First, we computed plus minus ratings, which was done by calculating how the score changes for each play for both the home and away team of every game this regular season. That sum was then aggregated over each player and each game, depending on the player column they were in (A1-A5 are the 5 players on the court for the away team, while H1-H5 are the 5 players on the court for the home team). Then, the ten data frames of players (the 5 away players and the 5 home players) were combined into just one data frame and aggregated over each player and each game again. This process, once completed, yielded plus minus ratings and total seconds played for every player in every game this season. We used this same data frame to also calculate adjusted plus minus ratings per 48 minutes for every player in every game this season. To focus on only the Sixers and Celtics data, we subset the data into a data frame that only consisted of ratings computations for these two teams.

Next, to begin the process of developing win probability adjusted plus minus ratings, we needed to develop a model that could produce these probabilities. A logistic regression model was built to produce the probability of the away team winning a game, given how much time is left in the game and the score difference at that time in the game. This reflects the importance of a plus minus rating given the varying situations in a game. The idea is that score differential means more to us late in a game rather than earlier in a game. This model accounts for the degree of importance of the game situation in

relation to its outcome of the game. Therefore, the win probability adjusted plus minus ratings that were calculated are more reflecting of what a player does in “clutch time” or when “the game is on the line,” or when the importance of the game situation is at its highest. This model’s output and accuracy can be seen in Figure 1.0 below, and plots of the model can be seen in Figure 2.0 below.

Figure 1.0: Model Output and Accuracy

```
Call:
glm(formula = away_win ~ score_diff:game_elapsed_time, family = binomial,
    data = working_season_pbpdf)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.6936  -0.9869  -0.2286   1.0044   2.5627

Coefficients:
              Estimate Std. Error z value Pr(>|z|)
(Intercept)   -1.448e-01  8.576e-03  -16.88  <2e-16 ***
score_diff:game_elapsed_time  8.741e-05  8.112e-07  107.76  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

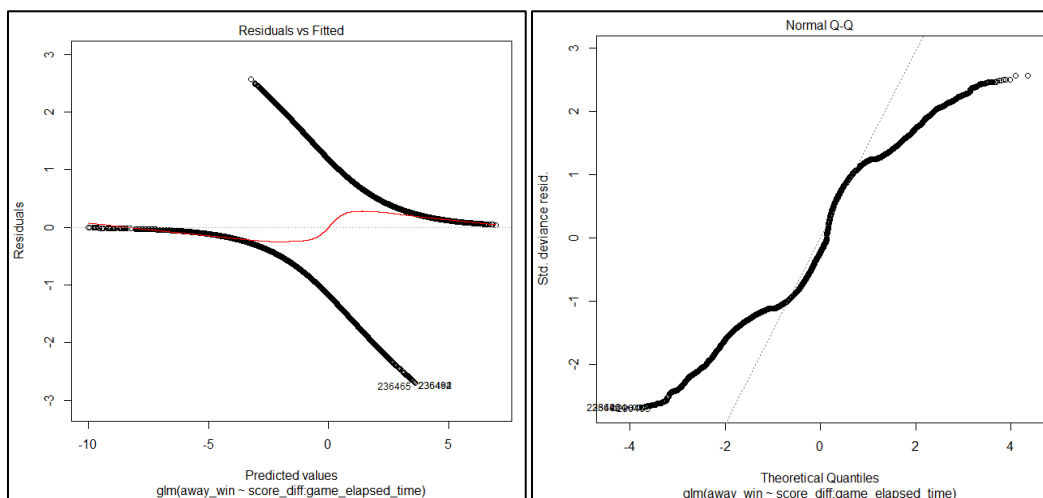
(Dispersion parameter for binomial family taken to be 1)

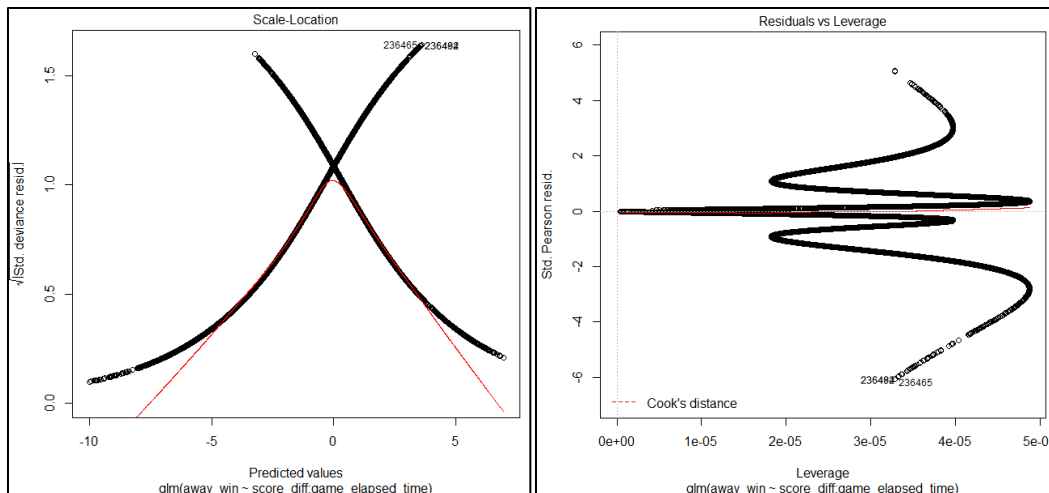
    Null deviance: 102408  on 74507  degrees of freedom
Residual deviance:  79571  on 74506  degrees of freedom
AIC: 79575

Number of Fisher Scoring iterations: 5

              ME      RMSE      MAE    MPE  MAPE      MASE
Training set -1.08878e-11 0.426867 0.3647587 -Inf   Inf  0.7382379
```

Figure 2.0: Model Plots





After building the logistic regression model, we used the predict function in R to add win probabilities to the data set. We then perform similar operations to our other ratings, aggregating over each player and each game. We then sum the probabilities, as well as the change in win probabilities for the home and away team, and then aggregated that over every player in every game again. This process, once completed, yielded win probability adjusted plus minus ratings, home win probability adjusted plus minus change, and away win probability adjusted plus minus change for every player in every game this season. To focus on only the Sixers and Celtics data, we subset the data into a data frame that only consisted of ratings computations for these two teams.

Once the computation of plus minus, adjusted plus minus, and win probability adjusted plus minus ratings were completed, I created charts for both teams with their totals and averages for these ratings for comparative purposes. We can not only compare the two teams' performances in the regular season, but also use these ratings to project what team should have won the playoff series against each other. First, we will compare the Sixers and Celtics regular season rosters using plus minus and adjusted plus minus ratings. In Figure 3.0 below is a chart of the regular season roster for the Philadelphia 76ers.

Figure 3.0: Philadelphia 76ers Regular Season Roster Plus Minus and Adjusted Plus Minus Ratings

Philadelphia 76ers Regular Season Roster							
Player	Total Games Played	Total Seconds Played	Avg. Seconds Played	Total Plus-Minus	Avg. Plus-Minus	Total Adjusted Plus-Minus	Avg. Adjusted Plus-Minus
Amir Johnson	73	69328	949.7	25	0.34	-109.15	-1.5
Ben Simmons	80	161998	2024.975	376	4.7	595.66	7.45
Dario Saric	77	136817	1776.84	252	3.27	474.97	6.17
Demetrius Jackson	3	1045	348.33	-13	-4.33	-33.76	-11.25
Ersan Ilyasova	22	32166	1462.09	106	4.82	195.1	8.87
Furkan Korkmaz	14	4783	341.64	-46	-3.29	-428.16	-30.58
Jacob Pullen	3	365	121.67	0	0	0	0
Jahlil Okafor	2	1517	758.5	-20	-10	-95.95	-47.97
James Michael McAdoo	3	1077	359	1	0.33	5.98	1.99
James Young	6	3666	611	-26	-4.33	-47.1	-7.85
Jerryd Bayless	39	55470	1422.31	-73	-1.87	-227.44	-5.83
JJ Redick	69	125256	1815.3	291	4.22	585.69	8.49
Joel Embiid	62	112686	1817.52	450	7.26	795.13	12.82
Justin Anderson	38	31110	818.68	-81	-2.13	-403.6	-10.62
Larry Drew II	3	875	291.67	-6	-2	-42.38	-14.13
Marco Belinelli	27	42864	1587.56	171	6.33	309.43	11.46
Markelle Fultz	14	15142	1081.57	22	1.57	80.68	5.76
Nik Stauskas	6	2694	449	-14	-2.33	-134.04	-22.34
Richaun Holmes	48	44772	932.75	-32	-0.67	-364.9	-7.6
Robert Covington	79	149477	1892.11	533	6.75	852.29	10.79
TJ McConnell	75	101273	1350.31	-64	-0.85	-358.56	-4.78
Timothe Luwawu-Caborrot	52	48379	930.37	-21	-0.4	-43.76	-0.84
Trevor Booker	33	29640	898.18	-46	-1.39	-158	-4.79
Totals	828	1172400	24041.08	1785	6	1448.13	-96.28
Average of Totals	36	50973.91	1045.26	77.61	0.26	62.96	-4.19

We can see from the chart above that the Sixers boasted a strong roster in both plus minus and adjusted plus minus. The players who received the bulk of the playing time all graded out well in these metrics. The metrics also justified how the rotation wound up playing out before the playoffs.

Specifically, the starting lineup of Ben Simmons, JJ Redick, Robert Covington, Dario Saric, and Joel Embiid, had a positive plus minus and adjusted plus minus as a unit. The bench, which was a weakness of the Sixers initially, was greatly strengthened by the midseason acquisitions of Marco Belinelli and Ersan Ilyasova. Their bench, which also included Amir Johnson and TJ McConnell, also had a positive plus

minus and adjusted plus minus as a unit. Amir Johnson and TJ McConnell were not major liabilities with their ratings, despite them not being overwhelmingly high, and even negative in a few cases. The Sixers' depth players who also received some substantial playing time during the regular season, including Jerryd Bayless (who got hurt and missed the second half of the season), Richaun Holmes, Timothe Luwawu-Caborrot, and Justin Anderson, were justifiably left out of the playoff rotation based on their ratings. Markelle Fultz was the only player with ratings that could have been considered for a spot in the playoff rotation, however he did only have a small sample size which was likely the reasoning for leaving him out. In Figure 4.0 below is a chart of the regular season roster for the Boston Celtics.

Figure 4.0: Boston Celtics Regular Season Roster Plus Minus and Adjusted Plus Minus Ratings

Boston Celtics Regular Season Roster							
Player	Total Games Played	Total Seconds Played	Avg. Seconds Played	Total Plus-Minus	Avg. Plus-Minus	Total Adjusted Plus-Minus	Avg. Adjusted Plus-Minus
Abdel Nader	48	31290	651.88	-104	-2.17	-1239.27	-25.8
Al Horford	72	136653	1897.96	337	4.68	540.28	7.5
Aron Baynes	81	89002	1098.79	183	2.26	309.5	3.82
Daniel Theis	63	56089	890.3	17	0.27	-306.38	-4.86
Gordon Hayward	1	315	315	3	3	27.43	27.43
Greg Monroe	26	29792	1145.85	-64	-2.46	-175.22	-6.74
Guerschon Yabusele	33	14131	428.21	-9	-0.27	-894.6	-27.11
Jabari Bird	13	6882	529.38	16	1.23	-163.41	-12.57
Jarell Eddie	2	338	169	-9	-4.5	-169.96	-84.98
Jaylen Brown	70	129154	1845.06	349	4.99	571.3	8.16
Jayson Tatum	80	146580	1832.25	334	4.18	509.92	6.37
Jonathan Gibson	4	2396	599	2	0.5	23.31	5.83
Kadeem Allen	18	6418	356.56	-16	-0.89	-9076.47	-504.25
Kyrie Irving	60	115936	1932.27	249	4.15	312.63	5.21
Marcus Morris	54	86458	1601.07	8	0.15	45.66	0.85
Marcus Smart	54	96848	1793.48	216	4	364.77	6.75
Semi Ojeleye	73	69041	945.77	-151	-2.07	-966.11	-13.23
Shane Larkin	54	46464	860.44	15	0.28	-330.96	-6.13
Terry Rozier	80	124064	1550.8	93	1.16	136.68	1.71
Xavier Silas	2	449	224.5	1	0.5	6.56	3.28
Totals	888	1188300	20667.57	1470	18.99	-10474.34	-608.76
Average of Totals	44.4	59415	1033.38	73.5	0.95	-523.72	-30.44

We can see from the chart above that the Celtics boasted a strong roster in both plus minus and adjusted plus minus. The players who received the bulk of the playing time all graded out well in these metrics. The metrics also justified how the rotation wound up playing out before the playoffs. Specifically, the starting lineup of Terry Rozier, Jaylen Brown, Jayson Tatum, Al Horford, and Aron Baynes had a positive plus minus and adjusted plus minus as a unit. The bench, which included Marcus Morris, Marcus Smart, Semi Ojeleye, and Shane Larkin, had a positive plus minus as a unit but had a negative adjusted plus minus as a unit. Semi Ojeleye and Shane Larkin did not grade out well in this metric but were certainly less of a liability in regular plus minus. Those two players were likely only called into duty due to the loss of star players Kyrie Irving and Gordon Hayward for the season. Ojeleye and Larkin probably would not have cracked the playoff rotation without those injuries to the other two. Hayward only played one game, however he would have likely graded out well in these metrics as he has done in the past. Kyrie Irving was an All Star player again this season but was lost towards the end of the season. The Celtics' depth players who also received some substantial playing time during the regular season, including Abdel Nader, Daniel Theis, Guerschon Yabusele, and late acquisition Greg Monroe were justifiably left out of the playoff rotation based on their ratings.

Next, we will analyze the Sixers and Celtics playoff rotations for their Eastern Conference Semifinals and determine who should have won based on plus minus and adjusted plus minus ratings. In Figure 5.0 below are charts of the Sixers and Celtics 9-man playoff rotations' plus minus and adjusted plus minus ratings in comparison to each other.

Figure 5.0: 76ers and Celtics 9-Man Playoff Rotations Plus Minus and Adjusted Plus Minus Ratings

Philadelphia 76ers 9-Man Playoff Rotation vs Boston Celtics							
Player	Total Games Played	Total Seconds Played	Avg. Seconds Played	Total Plus-Minus	Avg. Plus-Minus	Total Adjusted Plus-Minus	Avg. Adjusted Plus-Minus
Amir Johnson	73	69328	949.7	25	0.34	-109.15	-1.5
Ben Simmons	80	161998	2024.975	376	4.7	595.66	7.45
Dario Saric	77	136817	1776.84	252	3.27	474.97	6.17
Ersan Ilyasova	22	32166	1462.09	106	4.82	195.1	8.87
JJ Redick	69	125256	1815.3	291	4.22	585.69	8.49
Joel Embiid	62	112686	1817.52	450	7.26	795.13	12.82
Marco Belinelli	27	42864	1587.56	171	6.33	309.43	11.46
Robert Covington	79	149477	1892.11	533	6.75	852.29	10.79
TJ McConnell	75	101273	1350.31	-64	-0.85	-358.56	-4.78
Totals	564	931865	14676.41	2140	36.84	3340.56	59.77
Average of Totals	62.67	103540.56	1630.71	237.78	4.09	371.17	6.64

Boston Celtics 9-Man Playoff Rotation vs Philadelphia 76ers							
Player	Total Games Played	Total Seconds Played	Avg. Seconds Played	Total Plus-Minus	Avg. Plus-Minus	Total Adjusted Plus-Minus	Avg. Adjusted Plus-Minus
Al Horford	72	136653	1897.96	337	4.68	540.28	7.5
Aron Baynes	81	89002	1098.79	183	2.26	309.5	3.82
Jaylen Brown	70	129154	1845.06	349	4.99	571.3	8.16
Jayson Tatum	80	146580	1832.25	334	4.18	509.92	6.37
Marcus Morris	54	86458	1601.07	8	0.15	45.66	0.85
Marcus Smart	54	96848	1793.48	216	4	364.77	6.75
Semi Ojeleye	73	69041	945.77	-151	-2.07	-966.11	-13.23
Shane Larkin	54	46464	860.44	15	0.28	-330.96	-6.13
Terry Rozier	80	124064	1550.8	93	1.16	136.68	1.71
Totals	618	924264	13425.62	1384	19.63	1181.04	15.8
Average of Totals	68.67	102696	1491.74	153.8	2.18	131.23	1.76

The Sixers 9-man playoff rotation graded better than the Celtics 9-man playoff rotation in plus minus ratings, with a team average plus minus of 237.78 to the Celtics' team average plus minus of 153.8. The individual player average plus minus for the Sixers was also better than the Celtics, with a 4.09 rating to the Celtics' 2.18 rating. The Sixers also graded better than the Celtics in adjusted plus minus ratings too, with a team average of 371.17 to the Celtics' team average of 131.23. Similarly, the

Sixers individual player average adjusted plus minus of 6.64 was better than the Celtics' 1.76 rating.

Even when breaking each 9-man rotation into starting lineups and benches and then comparing them separately, the Sixers still grade out better in plus minus and adjusted plus minus ratings. Using plus minus and adjusted plus minus as the two metrics, the Sixers 9-man playoff rotation was better than the Celtics 9-man playoff rotation. If we were to only use these metrics as a basis to predict the winner of this playoff series, we would predict that the Sixers would win the series.

Lastly, we will analyze the Sixers and Celtics playoff rotations for their Eastern Conference Semifinals and determine who should have won based on win probability adjusted plus minus ratings. In Figure 6.0 below are charts of the Sixers and Celtics 9-man playoff rotations' win probability adjusted plus minus ratings in comparison to each other.

Figure 6.0: 76ers and Celtics 9-Man Playoff Rotations Win Probability Adjusted Plus Minus Ratings

Philadelphia 76ers 9-Man Playoff Rotation vs Boston Celtics						
Player	Total Win Probability Adjusted Plus-Minus	Avg. Win Probability Adjusted Plus-Minus	Total Home Win Probability Adjusted Plus-Minus Change	Avg. Home Win Probability Adjusted Plus-Minus Change	Total Away Win Probability Adjusted Plus-Minus Change	Avg. Away Win Probability Adjusted Plus-Minus Change
Amir Johnson	5014.8	68.7	2.38	0.03	-2.38	-0.03
Ben Simmons	11797.06	147.46	4.66	0.06	-4.66	-0.06
Dario Saric	9516.3	123.59	7.28	0.09	-7.28	-0.09
Ersan Ilyasova	2573.67	116.98	-0.06	-0.003	0.06	0.003
JJ Redick	8951.63	129.73	5.02	0.07	-5.02	-0.07
Joel Embiid	7905.02	127.5	3.88	0.06	-3.88	-0.06
Marco Belinelli	3312.73	122.69	-0.22	-0.01	0.22	0.01
Robert Covington	10576.42	133.88	5.66	0.07	-5.66	-0.07
TJ McConnell	7638.79	101.85	2.32	0.03	-2.32	-0.03
Totals	67286.42	1072.38	30.92	0.40	-30.92	-0.40
Average of Totals	7476.27	119.15	3.44	0.04	-3.44	-0.04

Boston Celtics 9-Man Playoff Rotation vs Philadelphia 76ers						
Player	Total Win Probability Adjusted Plus-Minus	Avg. Win Probability Adjusted Plus-Minus	Total Home Win Probability Adjusted Plus-Minus Change	Avg. Home Win Probability Adjusted Plus-Minus Change	Total Away Win Probability Adjusted Plus-Minus Change	Avg. Away Win Probability Adjusted Plus-Minus Change
Al Horford	10053.01	139.63	-10.54	-0.15	10.54	0.15
Aron Baynes	6016.77	74.28	-0.04	-0.0004	0.04	0.0004
Jaylen Brown	9352.16	133.6	-8.11	-0.12	8.11	0.12
Jayson Tatum	10728.36	134.1	-7.06	-0.09	7.06	0.09
Marcus Morris	6532.44	120.97	-1.17	-0.02	1.17	0.02
Marcus Smart	7465.25	138.25	-1.13	-0.02	1.13	0.02
Semi Ojeleye	4755.4	65.14	1.49	0.02	-1.49	-0.02
Shane Larkin	3563.78	65.996	-2.92	-0.05	2.92	0.05
Terry Rozier	9595.16	119.94	1.76	0.02	-1.76	-0.02
Totals	68062.33	991.91	-27.72	-0.41	27.72	0.41
Average of Totals	7562.48	110.21	-3.08	-0.05	3.08	0.05

This is where our evaluation gets a lot more interesting. The Celtics 9-man playoff rotation graded better than the Sixers 9-man rotation in win probability adjusted plus minus, with a team average of 7562.48 to the Sixers' team average of 7476.27. However, on an individual player's scale, the Sixers individual player average win probability adjusted plus minus was better than the Celtics, with a rating of 119.15 to the Celtics' 110.21. The reasoning for this disparity was more evident when breaking the rotations into starting lineups and benches and analyzing them separately. These charts can be seen in Figure 7.0 and Figure 8.0 below.

Figure 7.0: 76ers and Celtics Playoff Starting Lineups Win Probability Adjusted Plus Minus Ratings

Philadelphia 76ers Starting Lineup vs Boston Celtics						
Player	Total Win Probability Adjusted Plus-Minus	Avg. Win Probability Adjusted Plus-Minus	Total Home Win Probability Adjusted Plus-Minus Change	Avg. Home Win Probability Adjusted Plus-Minus Change	Total Away Win Probability Adjusted Plus-Minus Change	Avg. Away Win Probability Adjusted Plus-Minus Change
Ben Simmons	11797.06	147.46	4.66	0.06	-4.66	-0.06
Dario Saric	9516.3	123.59	7.28	0.09	-7.28	-0.09
JJ Redick	8951.63	129.73	5.02	0.07	-5.02	-0.07
Joel Embiid	7905.02	127.5	3.88	0.06	-3.88	-0.06
Robert Covington	10576.42	133.88	5.66	0.07	-5.66	-0.07

Totals	48746.43	662.16	26.50	0.35	-26.50	-0.35
Average of Totals	9749.29	132.43	5.30	0.07	-5.30	-0.07

Boston Celtics Starting Lineup vs Philadelphia 76ers						
Player	Total Win Probability Adjusted Plus-Minus	Avg. Win Probability Adjusted Plus-Minus	Total Home Win Probability Adjusted Plus-Minus Change	Avg. Home Win Probability Adjusted Plus-Minus Change	Total Away Win Probability Adjusted Plus-Minus Change	Avg. Away Win Probability Adjusted Plus-Minus Change
Al Horford	10053.01	139.63	-10.54	-0.15	10.54	0.15
Aron Baynes	6016.77	74.28	-0.04	-0.0004	0.04	0.0004
Jaylen Brown	9352.16	133.6	-8.11	-0.12	8.11	0.12
Jayson Tatum	10728.36	134.1	-7.06	-0.09	7.06	0.09
Terry Rozier	9595.16	119.94	1.76	0.02	-1.76	-0.02
Totals	45745.46	601.55	-23.99	-0.34	23.99	0.34
Average of Totals	9149.09	120.31	-4.80	-0.07	4.80	0.07

Figure 8.0: 76ers and Celtics Playoff Benches Win Probability Adjusted Plus Minus Ratings

Philadelphia 76ers Bench vs Boston Celtics						
Player	Total Win Probability Adjusted Plus-Minus	Avg. Win Probability Adjusted Plus-Minus	Total Home Win Probability Adjusted Plus-Minus Change	Avg. Home Win Probability Adjusted Plus-Minus Change	Total Away Win Probability Adjusted Plus-Minus Change	Avg. Away Win Probability Adjusted Plus-Minus Change
Amir Johnson	5014.8	68.7	2.38	0.03	-2.38	-0.03
Ersan Ilyasova	2573.67	116.98	-0.06	-0.003	0.06	0.003
Marco Belinelli	3312.73	122.69	-0.22	-0.01	0.22	0.01
TJ McConnell	7638.79	101.85	2.32	0.03	-2.32	-0.03
Totals	18539.99	410.22	4.42	0.05	-4.42	-0.05
Average of Totals	4635.00	102.56	1.11	0.01	-1.11	-0.01

Boston Celtics Bench vs Philadelphia 76ers						
Player	Total Win Probability Adjusted Plus-Minus	Avg. Win Probability Adjusted Plus-Minus	Total Home Win Probability Adjusted Plus-Minus Change	Avg. Home Win Probability Adjusted Plus-Minus Change	Total Away Win Probability Adjusted Plus-Minus Change	Avg. Away Win Probability Adjusted Plus-Minus Change
Marcus Morris	6532.44	120.97	-1.17	-0.02	1.17	0.02
Marcus Smart	7465.25	138.25	-1.13	-0.02	1.13	0.02
Semi Ojeleye	4755.4	65.14	1.49	0.02	-1.49	-0.02
Shane Larkin	3563.78	65.996	-2.92	-0.05	2.92	0.05
Totals	22316.87	390.36	-3.73	-0.07	3.73	0.07
Average of Totals	5579.22	97.59	-0.93	-0.02	0.93	0.02

Once divided, we can see where the difference lies between the two teams. The Sixers starting lineup outperforms the Celtics in their team average win probability adjusted plus minus and in their individual player average win probability adjusted plus minus ratings. However, the Celtics bench significantly outperforms the Sixers bench in their team average win probability adjusted plus minus ratings. The Sixers bench only slightly outperforms the Celtics bench in individual average win probability adjusted plus minus ratings. This could suggest that by this metric, the Celtics bench played in more meaningful situations than the Sixers bench. It would make sense considering two of the players on the Sixers bench did not join the roster until the end of the season and did not accumulate as much time in those situations as the Celtics bench did. Overall, the two teams are very close in win probability ratings and they split in many of these categories, which makes it a little harder to predict a winner for the series.

This leads us into analyzing the difference between the two teams in home and away win probability adjusted plus minus change. The Sixers show a positive change in home probability adjusted plus minus but show a negative change in away probability adjusted plus minus. This shows the Sixers performed better at home using this metric. On the other hand, the Celtics show a negative change in home probability adjusted plus minus but show a positive change in away probability adjusted plus minus. This shows the Celtics performed better on the road using this metric. Keeping both of those notes in mind, it is important to consider that the Celtics had home court advantage in this series because they were the higher seeded team. The Sixers starting lineup on the road had a larger negative change in win probability adjusted plus minus than the Celtics at home had. There was minimal difference between the two benches that would affect either team. All of this suggests that a matchup between two closely rated teams would swing in the favor of the team with the lesser of the two negatives in win probability adjusted plus minus change. In this case, that team is the Celtics. In reality, the Celtics were able to win the first two games at home against the Sixers and took a 2-0 lead into

Philadelphia for Game 3. These same ratings would suggest that the Sixers, being that they perform better at home in these metrics, should win the following two games to even the series up. In reality, the Sixers split the two games at home, giving Boston a 3-1 lead going home for Game 5, where the Celtics clinched the series. Using our metrics and reasonings from above, this series would reach 7 games. With win probability adjusted plus minus ratings, the Sixers 9-man playoff rotation and the Celtics 9-man playoff rotation are very close. We would likely give a slight edge to the Sixers in terms of talent, but the Celtics get a slight edge in situational basketball and home court advantage. If we were to only use win probability adjusted plus minus and home/away win probability adjusted plus minus change metrics as our basis to predict the winner of this playoff series, we would predict that the Celtics would win a tight series in 7 games.

As always with sports performance analytics, there is usually not one specifically correct route in making predictions and generating analysis. We learned from this assignment that using different player ratings systems yielded two different predictions for our Eastern Conference Semifinals playoff matchup between the Philadelphia 76ers and Boston Celtics. This does not tell us which rating system is better than the other. The recommendation for the best course of action is to use these ratings systems in addition to all other ratings systems that teams develop, both with traditional metrics and advanced metrics. Then, using a combination of all of these different systems should help teams reach the most fair, well-informed, and well-researched evaluation.