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Statistical Analysis of 2008-09 NHL Season

Season Overview and Format

The season I chose was the 2008-09 NHL season. A major event of this season was that it was the first season since the 2004-05 lockout in which every team played each other at least once. I chose this season because it is the earliest memory I have of cheering on a professional sports team. It's also a legendary season for the Penguins since they got their revenge on the Red Wings for losing to them in the finals during the 2007-08 season. Also, I want to see if the Penguins, who won the cup, were truly the best team in the league. There were strong teams that year and I especially remember teams like the Capitals and the Red Wings being equally or even stronger than the Penguins. The number of teams that competed in the 2008-09 season was 30. There are six regional divisions with five teams each, and then an eastern and western conference which both have 3 divisions.

Statistical Summary of Relevant Statistics

The first statistic that will be measured for each of the teams is PDO. This statistic sums the shot percentage and the save percentage and is essentially a measure of how lucky a team is during a season. The higher the PDO, the luckier a team is and vice versa. The best way to see which teams were truly lucky or unlucky is to create a scatterplot that measures PDO versus points earned:

Figure 1: PDO vs Points
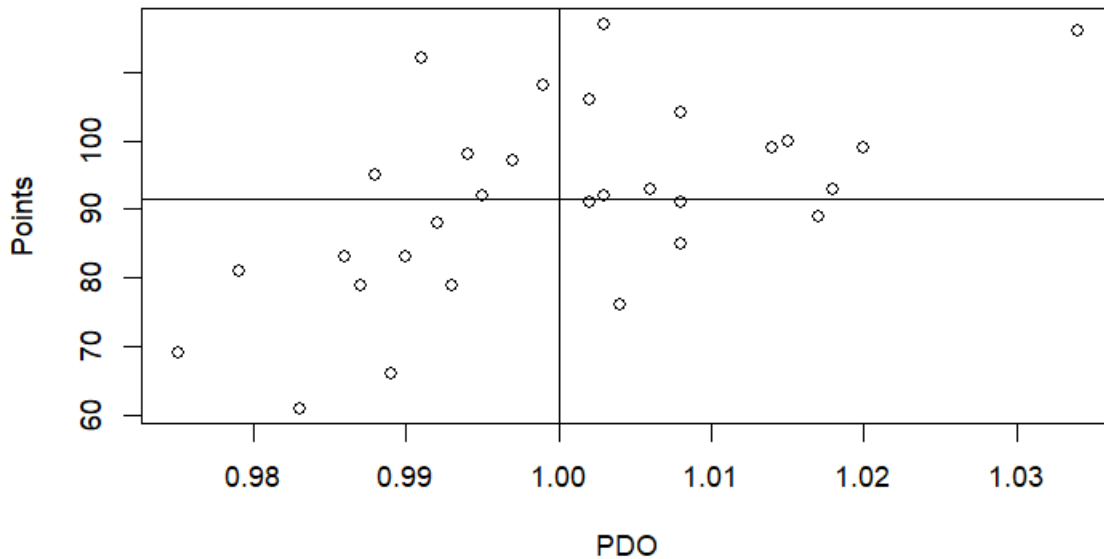
The horizontal and vertical lines represent the averages of each. This scatterplot reveals the teams who earned points with and without the help of luck. The team that earned the most points with the greatest help of luck is the Boston Bruins. They had a PDO of 1.034 and earned 116 points. The team who earned the most points and was only slightly lucky was the San Jose Sharks. The team who earned the most points even though they were unlucky was the Detroit Red Wings. This coincides with the results of the season since the Red Wings were finalists. As for the Penguins, they earned 99 points and had a PDO of 1.014 which means they were luckier on average and earned more points than the average team.

The second statistic that is of interest is the Corsi statistic. This statistic measures all shot attempts by a team during even strength situations, and it can be

used to measure possession. A boxplot can show reveal potential outliers which would

reveals teams with outstanding or terrible possession:

Figure 2: Corsi Percentage Boxplot
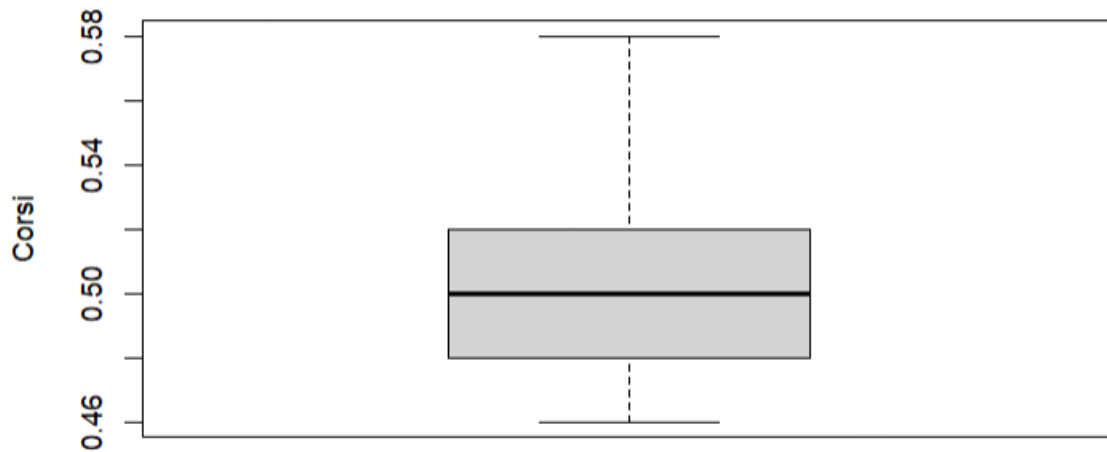
This boxplot reveals that the average Corsi percentage is .5 which makes sense

given the statistic has zero sum qualities. The distribution is even, but there is an outlier

in the upper tail. The team that achieved a Corsi percentage of .58 was the Detroit Red

Wings, which means they had the greatest possession ability in the league. This once

again coincides with their performance. Some other teams that achieved great

possession were the San Jose Sharks and the Chicago Blackhawks, with Corsi

percentages of .55 and .54 respectively. The Penguins had a Corsi percentage of .48

which was slightly below average for possession ability.

Discussion of Relevant Statistics

The two statistics above, PDO and Corsi percentage, reveal the teams that were especially good during the season and vice versa. A common theme that was found was the excellence of the Detroit Red Wings, who had a low PDO but still had a very high amount of points, and had the highest Corsi percentage in the league. The Red Wings were an experienced team and had the highest average age for any team during this season which means that they had a lot of players who had composure on the puck during the games. This would carry over into their high Corsi percentage since they would possess the puck more. This is reinforced by the fact that they were below average in total giveaways. Another team that was good according to PDO and Corsi were the San Jose Sharks. They had the second highest Corsi percentage and their PDO was around 1 which means they were not reliant on luck. The Penguins had a below average Corsi percentage, and a higher PDO which means that they had a bit of luck in achieving the number of points that they did.

Creation of Scoring Distributions
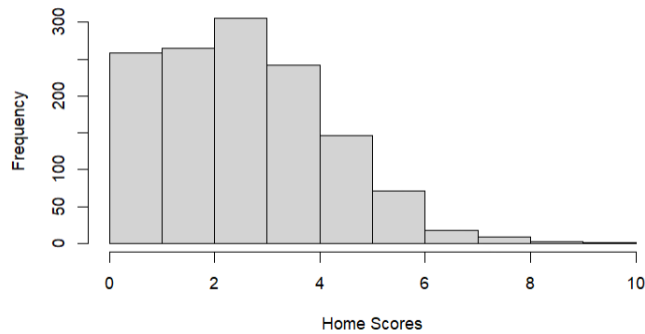
Figure 3: Home Score Distribution

Figure 4: Away Score Distribution
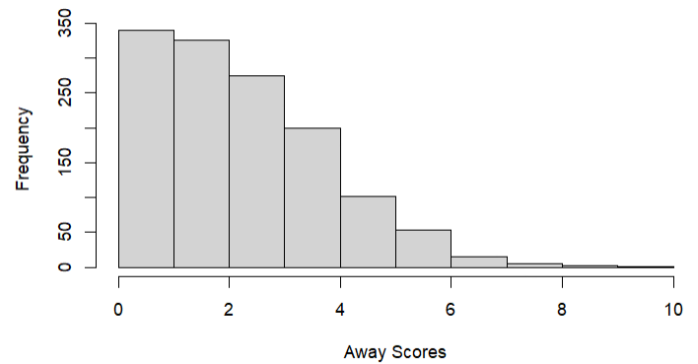
Home Score Mean	3.012
Home Score Standard Deviation	1.68
Away Score Mean	2.67
Away Score Standard Deviation	1.65
Correlation	.029

**Figure 5: Home Score Difference Distribution**
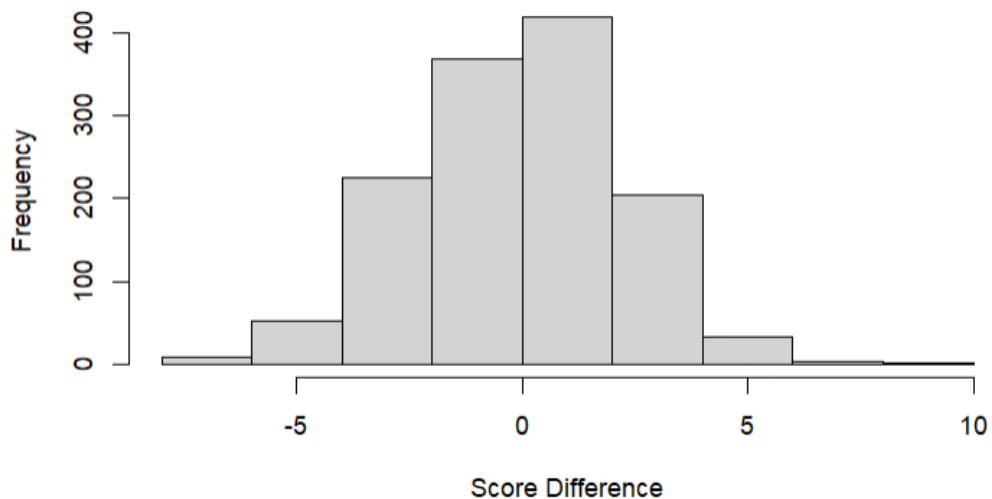
Mean: .342

Standard deviation: 2.32

Discussion of Scoring Distributions

The first thing to take away from figures 3 and 4 is that home scores are on average higher than away scores. This can be seen in their respective means. The standard deviations, however, do not vary as much. Exploring the difference in scores between home and away teams further reinforces the fact that home teams scored more. Figure 5 represents the difference in scores from home versus away teams. The histogram shows that teams who are at home will have a higher score difference than teams that are away. The average score difference of a home team during this season is .342. This indicates that a home field advantage exists.

Calculation of Pythagorean Win Percentages

Figure 6: Pythagorean Point Percentage vs Actual Point Percentage
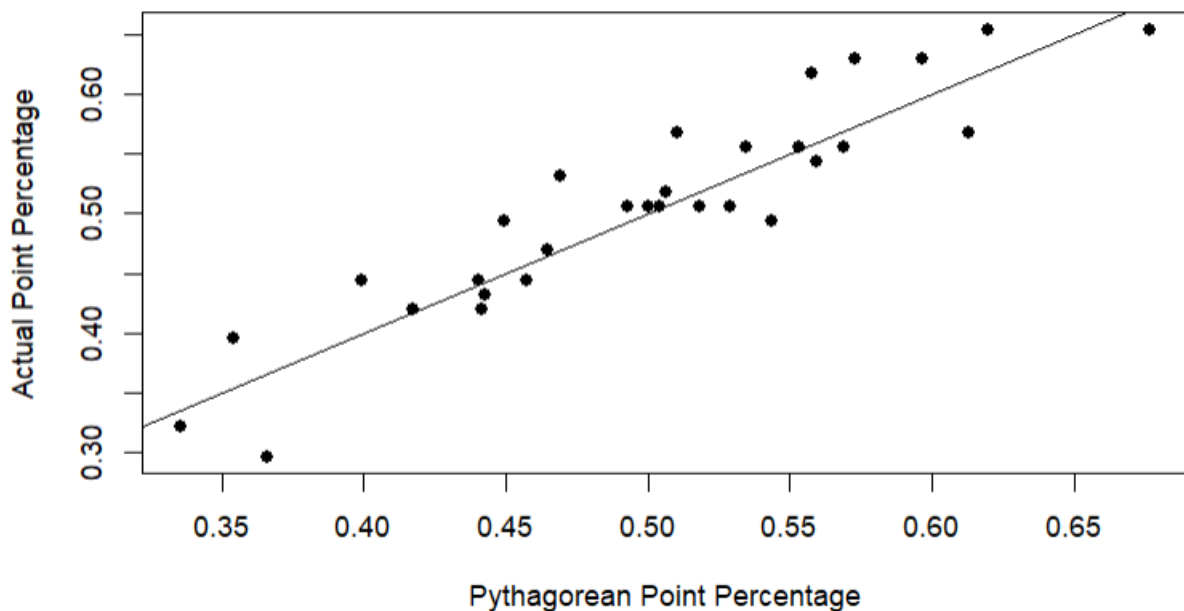
Correlation: .9507

Discussion of Pythagorean Win Percentages

In order to determine an accurate version of the Pythagorean point percentages for the NHL, I needed to eliminate the extra point that teams receive when they win in overtime. Therefore, this graph reflects the regulatory point percentages and does not include data relating to overtime. The high correlation of .9507 means that the Pythagorean point percentages and actual point percentages are strongly related. The teams that overachieved the most were the New York Rangers and the Washington Capitals. The Rangers had a Pythagorean point percentage of .469 and an actual point percentage of .531. The Capitals had a Pythagorean point percentage of .558 and an actual point percentage of .617. The teams that underachieved the most were the Tampa Bay Lightning and the Minnesota Wild. The Lightning had a Pythagorean point percentage of .366 and an actual point percentage of .296. The Wild had a Pythagorean point percentage of .543 and an actual point percentage of .494.

Calculation of Poisson Ratings

Offensive Poisson Ratings	
X.Anaheim.Ducks.Off..	-0.04048884
X.Arizona.Coyotes.Off..	-0.18679418
X.Boston.Bruins.Off..	0.05445506
X.Buffalo.Sabres.Off..	-0.04263001
X.Calgary.Flames.Off..	0.01000293
X.Carolina.Hurricanes.Off..	-0.08413061
X.Chicago.Blackhawks.Off..	0.05211438
X.Colorado.Avalanche.Off..	-0.26472920
X.Columbus.Blue.Jackets.Off..	-0.13387944
X.Dallas.Stars.Off..	-0.09168478
X.Detroit.Red.Wings.Off..	0.14432914
X.Edmonton.Oilers.Off..	-0.08330265
X.Florida.Panthers.Off..	-0.09701419
X.Los.Angeles.Kings.Off..	-0.20687738
X.Minnesota.Wild.Off..	-0.16016203
X.Montreal.Canadiens.Off..	-0.05258220
X.Nashville.Predators.Off..	-0.18015252
X.New.Jersey.Devils.Off..	-0.07907121
X.New.York.Islanders.Off..	-0.22547374
X.New.York.Rangers.Off..	-0.26448706
X.Ottawa.Senators.Off..	-0.16956316
X.Philadelphia.Flyers.Off..	0.02627371
X.Pittsburgh.Penguins.Off..	0.04149057
X.San.Jose.Sharks.Off..	-0.02911597
X.St..Louis.Blues.Off..	-0.10482572
X.Tampa.Bay.Lightning.Off..	-0.18894235
X.Toronto.Maple.Leafs.Off..	-0.01719753
X.Vancouver.Canucks.Off..	-0.02084348
X.Washington.Capitals.Off..	0.05416641
X.Winnipeg.Jets.Off..	NA

Defensive Poisson Ratings	
X.Anaheim.Ducks.Def..	0.20144435
X.Arizona.Coyotes.Def..	0.11140799
X.Boston.Bruins.Def..	0.39842139
X.Buffalo.Sabres.Def..	0.20561223
X.Calgary.Flames.Def..	0.11072938
X.Carolina.Hurricanes.Def..	0.23988938
X.Chicago.Blackhawks.Def..	0.26058760
X.Colorado.Avalanche.Def..	0.10363523
X.Columbus.Blue.Jackets.Def..	0.21084771
X.Dallas.Stars.Def..	0.09572919
X.Detroit.Red.Wings.Def..	0.21649603
X.Edmonton.Oilers.Def..	0.12732140
X.Florida.Panthers.Def..	0.22994035
X.Los.Angeles.Kings.Def..	0.21434914
X.Minnesota.Wild.Def..	0.34524835
X.Montreal.Canadiens.Def..	0.14391495
X.Nashville.Predators.Def..	0.21190683
X.New.Jersey.Devils.Def..	0.30248709
X.New.York.Islanders.Def..	0.02800006
X.New.York.Rangers.Def..	0.29615819
X.Ottawa.Senators.Def..	0.20329991
X.Philadelphia.Flyers.Def..	0.18107161
X.Pittsburgh.Penguins.Def..	0.22143385
X.San.Jose.Sharks.Def..	0.31454678
X.St..Louis.Blues.Def..	0.21262663
X.Tampa.Bay.Lightning.Def..	0.04661574
X.Toronto.Maple.Leafs.Def..	-0.01928183
X.Vancouver.Canucks.Def..	0.25850752
X.Washington.Capitals.Def..	0.14968599
X.Winnipeg.Jets.Def..	NA

Discussion of Poisson Ratings

The Poisson Ratings were run using the Winnipeg Jets as the baseline team. According to the ratings, the team that had the best offense during the season was the Detroit Red Wings with a rating of .1443. This team easily had the best offense during the season since the next highest offensive Poisson ratings were the Boston Bruins at .0544 and the Washington Capitals at .0541. This finding coincides with Detroit's high Corsi percentage. The team with the best defense during the season was the Boston Bruins who had a rating of .3984. The team that had the worst offense was the Colorado Avalanche, who had an offensive rating of -.2647. The team with the worst defense was the Toronto Maple Leafs who had a defensive rating of -.0193. According to the Poisson ratings, the Pittsburgh Penguins were ranked 10th for defense and 5th for offense.

Preseason and Post Season Elo Ratings

team <chr>	starting_elo <dbl>	ending_elo <dbl>
Philadelphia Flyers	1496.741	1523.267
New York Islanders	1451.251	1399.109
Washington Capitals	1497.583	1539.720
New Jersey Devils	1500.613	1532.813
Carolina Hurricanes	1504.338	1527.436
Columbus Blue Jackets	1463.451	1491.234
Chicago Blackhawks	1485.385	1542.784
Dallas Stars	1539.215	1486.424
St. Louis Blues	1458.848	1502.059
Colorado Avalanche	1511.853	1421.485

team <chr>	starting_elo <dbl>	ending_elo <dbl>
Toronto Maple Leafs	1483.538	1449.315
Montreal Canadiens	1519.791	1500.070
Boston Bruins	1484.713	1567.189
Detroit Red Wings	1592.058	1589.514
Buffalo Sabres	1516.954	1507.489
Ottawa Senators	1507.457	1484.621
Tampa Bay Lightning	1450.423	1394.143
Florida Panthers	1488.192	1511.807
New York Rangers	1517.695	1503.034
Pittsburgh Penguins	1541.901	1547.680

| team <chr>	starting_elo <dbl>	ending_elo <dbl>
Nashville Predators	1511.554	1491.685
Winnipeg Jets	1451.784	1447.577
Minnesota Wild	1519.286	1514.390
Los Angeles Kings	1458.490	1452.897
Vancouver Canucks	1503.240	1539.966
Calgary Flames	1512.274	1519.460
Arizona Coyotes	1475.601	1451.047
Edmonton Oilers	1473.980	1467.650
San Jose Sharks	1540.064	1571.741
Anaheim Ducks	1538.361	1519.030

Discussion of Elo Ratings

Going into the season, the best team by a long shot was the Detroit Red Wings since their starting Elo was 1592.058. The next highest starting Elo ratings belonged to the Pittsburgh Penguins at 1541.901, the San Jose Sharks at 1540.064, and the Dallas Stars at 1539.215. Some other teams with high Elo ratings at the start that would have been expected to make the playoffs were the Mjnnesota Wild, Anaheim Ducks, Montreal Canadiens, Buffalo Sabres, and the New York Rangers since they all had starting Elo ratings of over 1515.0. Some of the teams with the worst starting Elo ratings were the New York Islanders, Columbus Blue Jackets, St. Louis Blues, Tampa Bay Lightning, Winnipeg Jets, and Edmonton Oilers since they all had starting Elo ratings of below 1475.0

The team with the greatest improvement in the 2008-09 season was the Boston Bruins. They increased their Elo rating by 82.47 and went from 1484.713 to 1567.189. The team with the biggest decline over the course of the season was the Colorado Avalanche. Their Elo rating decreased by 90.37 and went from 1511.853 to 1421.485.

Elo Ratings for One Team: Pittsburgh Penguins

Figure 7: Pittsburgh Penguins Elo Rating During 2008-09 Season
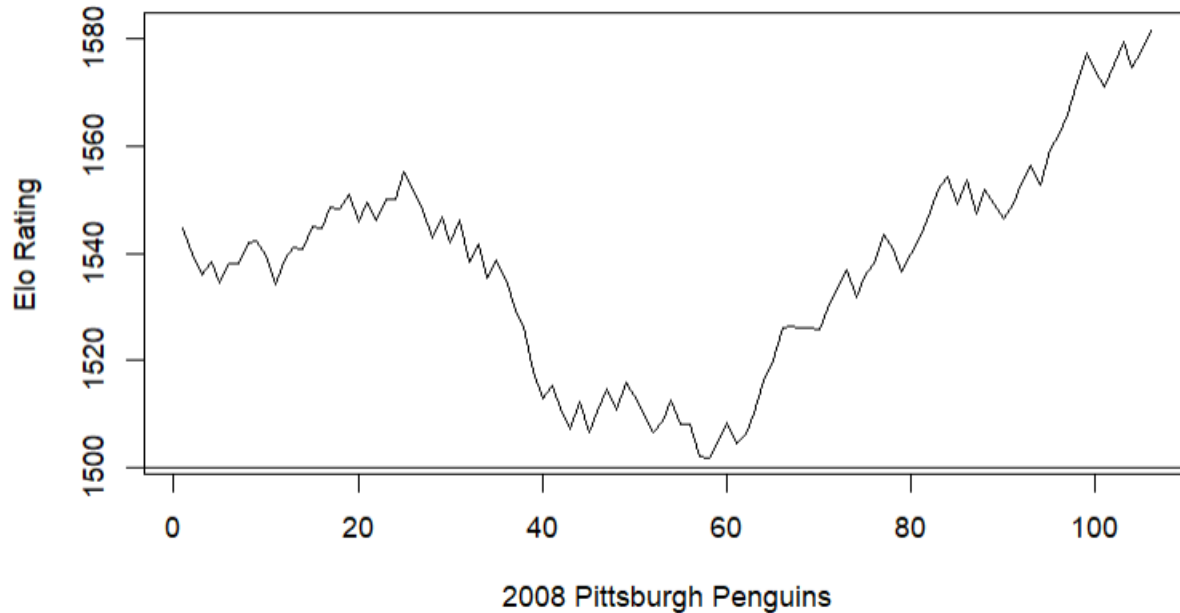
Analysis of Elo Ratings for One Team: Pittsburgh Penguins

The Pittsburgh Penguins started the season with an Elo rating of 1541.901 and ended the season with a rating of 1547.680. They had a slight increase in their rating during the beginning of the season, but then experienced a sharp decline during the middle of the season. This losing streak occurred in January and February, and it was due to a mixture of fatigue and increased competitiveness of other teams according to the documentary released by the Pittsburgh Penguin's YouTube channel. However, they managed to get out of their slump, and this was attributed to the return of Sergei Gonchar, one of the assistant captains and the team's best defenseman. The effect of this can be seen in the increase in the Elo rating until the end of the season.
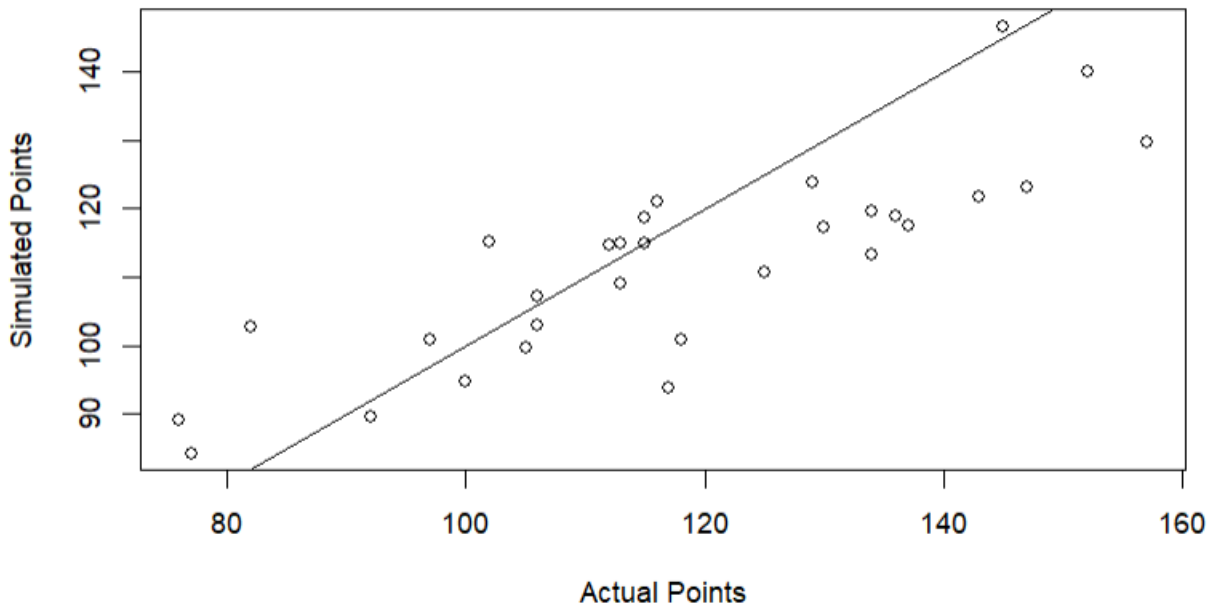
Simulated Regular Season Results

team <chr>	starting_elo <dbl>	ending_elo <dbl>	actual_points <dbl>	average_points <dbl>	division_titles <dbl>
Toronto Maple Leafs	1483.538	1449.315	97	100.8244	0.0020
Montreal Canadiens	1519.791	1500.070	116	121.0352	0.0380
Boston Bruins	1484.713	1567.189	157	129.5760	0.1296
Detroit Red Wings	1592.058	1589.514	145	146.6156	0.8036
Buffalo Sabres	1516.954	1507.489	112	114.7256	0.0192
Ottawa Senators	1507.457	1484.621	106	107.1816	0.0020
Tampa Bay Lightning	1450.423	1394.143	76	89.1788	0.0000
Florida Panthers	1488.192	1511.807	125	110.7312	0.0056
New York Rangers	1517.695	1503.034	115	114.8484	0.0800
Pittsburgh Penguins	1541.901	1547.680	129	123.8048	0.2768

team <chr>	starting_elo <dbl>	ending_elo <dbl>	actual_points <dbl>	average_points <dbl>	division_titles <dbl>
Philadelphia Flyers	1496.741	1523.267	130	117.2280	0.1160
New York Islanders	1451.251	1399.109	77	84.2756	0.0000
Washington Capitals	1497.583	1539.720	147	123.2080	0.2540
New Jersey Devils	1500.613	1532.813	143	121.7260	0.2028
Carolina Hurricanes	1504.338	1527.436	134	113.3060	0.0632
Columbus Blue Jackets	1463.451	1491.234	118	100.8380	0.0072
Chicago Blackhawks	1485.385	1542.784	137	117.4548	0.3288
Dallas Stars	1539.215	1486.424	102	115.1908	0.2488
St. Louis Blues	1458.848	1502.059	117	93.8576	0.0068
Colorado Avalanche	1511.853	1421.485	82	102.7012	0.0444

team <chr>	starting_elo <dbl>	ending_elo <dbl>	actual_points <dbl>	average_points <dbl>	division_titles <dbl>
Nashville Predators	1511.554	1491.685	113	109.0548	0.1104
Winnipeg Jets	1451.784	1447.577	92	89.5028	0.0012
Minnesota Wild	1519.286	1514.390	113	114.9848	0.2356
Los Angeles Kings	1458.490	1452.897	100	94.7804	0.0012
Vancouver Canucks	1503.240	1539.966	136	118.9844	0.0676
Calgary Flames	1512.274	1519.460	134	119.6916	0.0840
Arizona Coyotes	1475.601	1451.047	105	99.5860	0.0240
Edmonton Oilers	1473.980	1467.650	106	102.9952	0.0028
San Jose Sharks	1540.064	1571.741	152	140.0532	0.7792
Anaheim Ducks	1538.361	1519.030	115	118.6440	0.0652

Figure 8: Simulated Season Points vs Actual Season Points

Comparison of Simulation and Actual Regular Season

One thing to note about the simulated season is that there were more teams who scored more points than what the simulation predicted. The teams that were closest to their expected win total were the Detroit Red Wings, Winnipeg Jets, and the Minnesota Wild. All three of these teams had a simulated point total within five points of their actual total. The top three teams who overperformed and earned more points than they were expected to were the Boston Bruins, Washington Capitals, and St. Louis Blues. The top three teams who underperformed and earned less points than they were expected to were the Colorado Avalanche, Tampa Bay Lightning, and the Dallas Stars.

As for the division titles, the simulation correctly predicted 4 out of 6 division titles. It was correct in predicting that the San Jose Sharks, Detroit Red Wings, Boston

Bruins, and Washington Capitals would win their respective divisions. However, it did not correctly predict that the Pittsburgh Penguins and the Vancouver Canucks would win their respective divisions.

<u>Analysis of Overachieving Team</u>

One team that overachieved during this season was the Washington Capitals. They had the second highest residual for Pythagorean point percentage and also had the second highest difference in points in the simulated season. The team who had the highest residual in the Pythagorean point percentage was the New York Rangers, but they lacked any significant difference in points in the simulation. On the other hand, the Boston Bruins had the biggest difference in points in the simulation, but also underachieved according to the Pythagorean point percentage. Therefore, the Washington Capitals are definitively the team that overachieved the most during this season. This was most definitely due to their excellent offense, which is shown by them having the third highest Corsi percentage in the league. The Capitals during this season had Alex Ovechkin who was arguably the best player in the entire league, and he definitely played a role in improving the team's offense.

Figure 9: Washington Capitals Simulated Point Totals
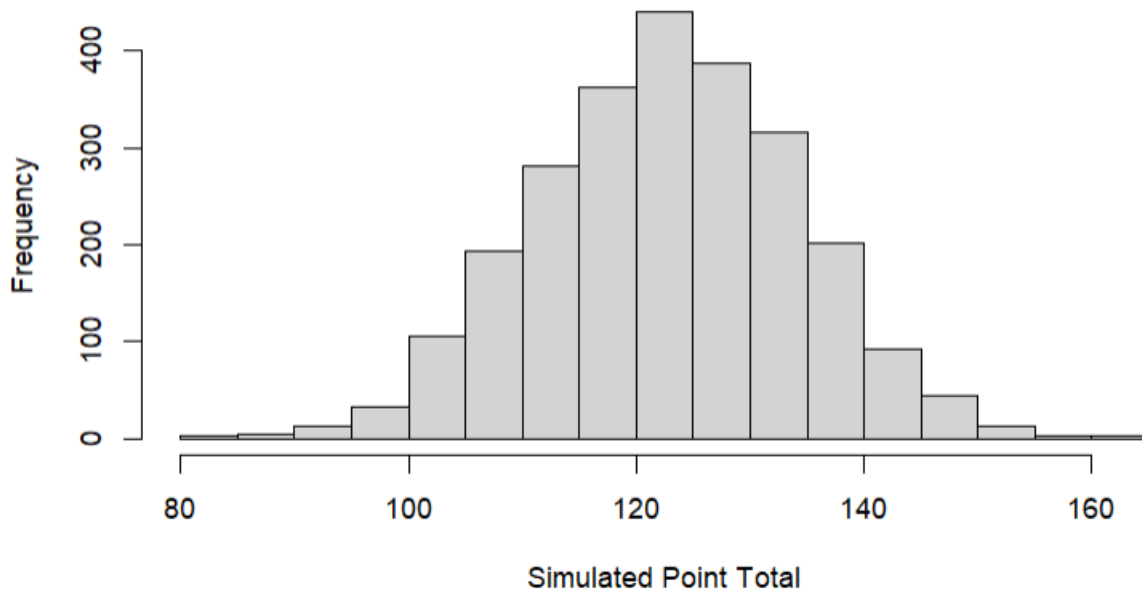
Analysis of Underachieving Team

The team that underachieved the most was the Tampa Bay Lightning. They had the highest residual for their Pythagorean point percentage and the third highest difference in points in the simulation. The teams who had greater differences in the simulation were the Colorado Avalanche and the Dallas Stars, who both slightly overachieved according to the Pythagorean point percentages. Therefore, Tampa Bay Lightning was the team who underachieved the most. This team had the sixth lowest Corsi percentage and had the seventh lowest PDO, which means that a combination of poor offense and some bad luck contributed to this team underachieving.

Figure 10: Tampa Bay Lightning Simulated Point Totals
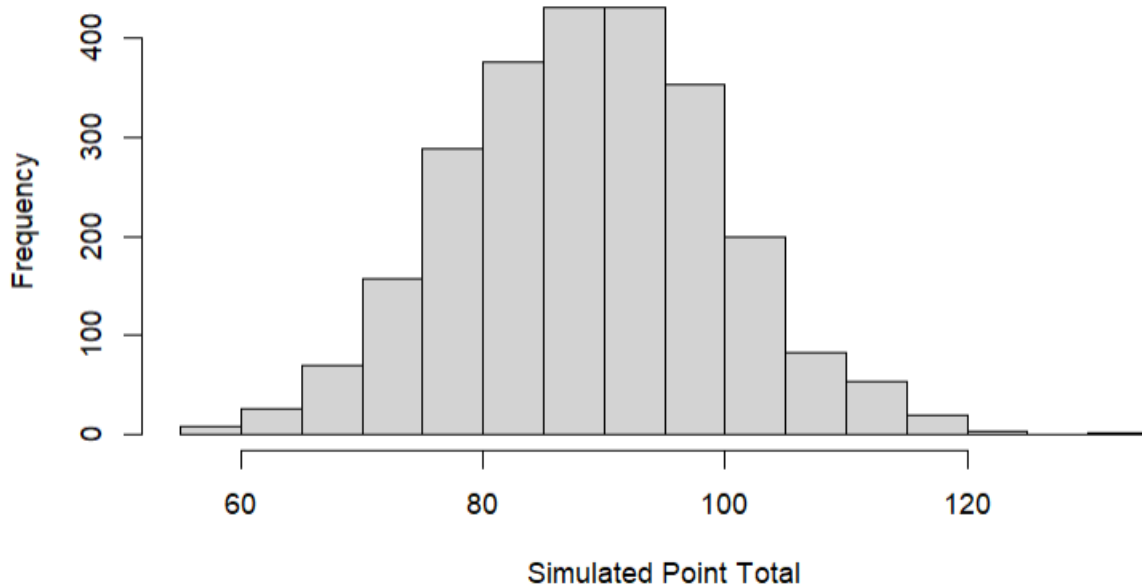
Conclusion

As stated in the beginning, my goal was to figure out if the Pittsburgh Penguins were truly the best team in the league during this season. However, the findings show that this is far from the truth and that statistically they were only slightly above average. The season simulation did not even predict them to win the division title and they may have experienced a bit of luck according to their PDO. However, it is also not realistic to consider them an underdog either since they had one of the highest Elo ratings before the season started, which meant they were a strong team. Undoubtedly the best team in the NHL for this season was the Detroit Red Wings. They had the highest starting and ending Elo, low PDO but still made it into the top three for points during the regular

season, and had the highest expected points and still managed to just come up one point shy of reaching it. The Detroit Red Wings placed second overall but were statistically the strongest team. Another great team during this season was the Washington Capitals, who scored 26 more points than they were expected to and who finished in the conference semifinals after giving Pittsburgh a tough and memorable 4-3 series. Two more teams that I did not expect to do as good as they did were the Chicago Blackhawks and Boston Bruins, who both scored 20 or more points than expected and who both increased their Elo rating by over 50. Overall, I believe this season showed that a team, like the Penguins, driven by revenge more than anything else can win a championship despite their statistical inferiority.