Max Bauer

Bryan Nelson

STAT 1341

12/15/2023

Season Overview and Format

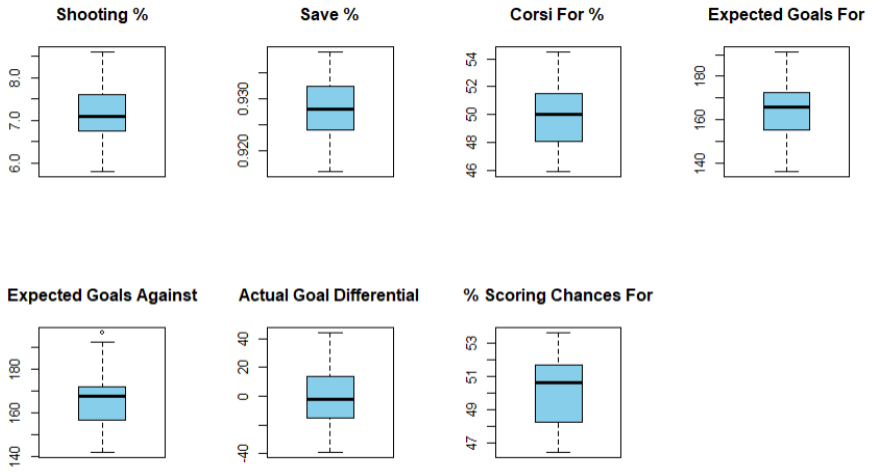
I decided to look at the 2017-2018 NHL season. I thought this season would be interesting to simulate because this was the season an expansion team was added to the league, the Vegas Golden Knights. The Knights would also go on to the Stanley Cup Finals in their first season ever, which I found interesting. This put the league at a total of 31 teams, with 4 divisions, putting each division at eight teams besides the Central Division at seven. Below is a look at the divisions.

East		***West***	
Atlantic Division	**Metropolitan Division**	**Central Division**	**Pacific Division**
Buffalo Sabres	Carolina Hurricanes	Chicago Blackhawks	Anaheim Ducks
Boston Bruins	Columbus Blue Jackets	Minnesota Wild	Edmonton Oilers
Tampa Bay Lightning	New Jersey Devils	St. Louis Blues	San Jose Sharks
Florida Panthers	New York Islanders	Nashville Predators	Calgary Flames
Toronto Maple Leafs	New York Rangers	Winnipeg Jets	Los Angeles Kings
Detroit Red Wings	Philadelphia Flyers	Dallas Stars	Arizona Coyotes
Ottawa Senators	Pittsburgh Penguins	Colorado Avalanche	Vancouver Canucks

Montreal Canadiens	Washington Capitals		Vegas Golden Knights

Statistical Summary of Relevant Statistics

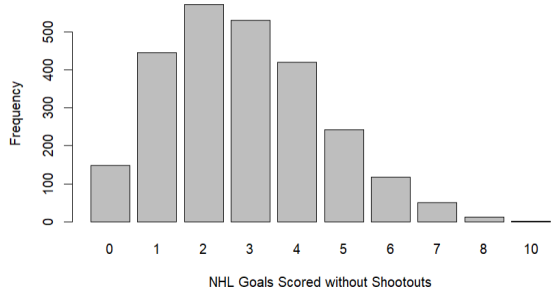
To analyze the performance of individual teams here is a summary of a few statistics. I decided to look at the shooting percentage (efficiency in converting shots to goals), save percentage (goaltending performance), Corsi For Percentage (proportion of shot attempts in their favor), expected goals for/against (estimates for scoring and conceding based on shot quality), actual goal differential (difference between goals scored and conceded), and percentage of scoring chances in a team's favor (proportion of high-quality chances generated). These measures collectively assess offensive efficiency, defensive strength, goaltending quality, and overall gameplay effectiveness of teams. These can be seen in the box plots below:

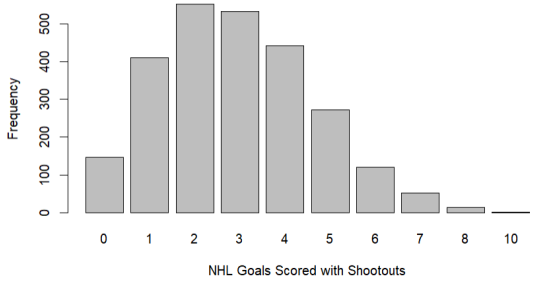


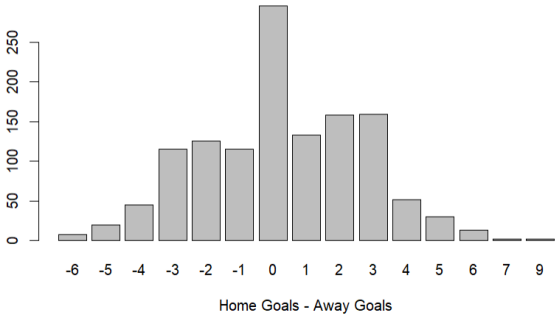
Their respective averages are as follows: 7.2, 0.9281, 49.99, 165.5, 165.5, -0.968, and 50.0.

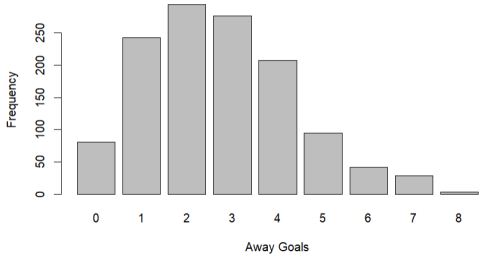
Scoring Distribution

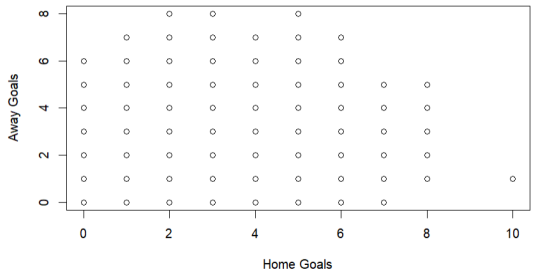
Below are a few graphs to look at scoring distribution. These graphs include NHL goals scored with and without shootouts, away goals scored, margin of victory, and a scatterplot of home and away goals.







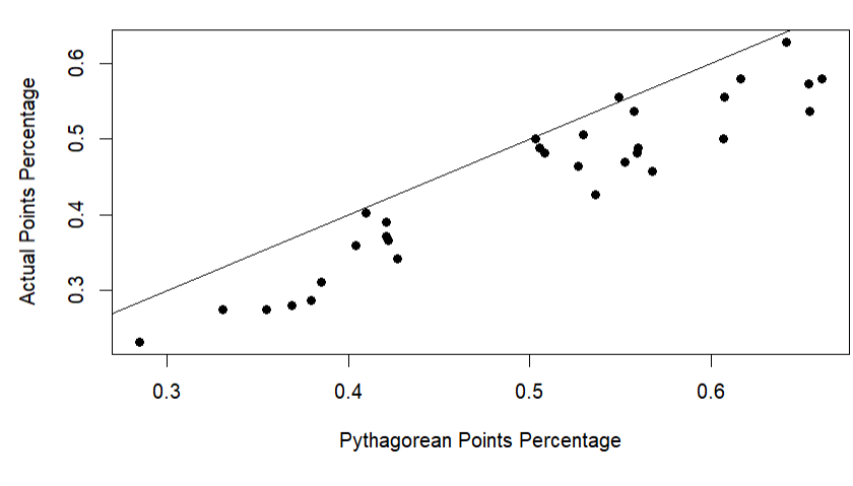




Both graphs, NHL goals with shootouts and without shootouts, seem to show a right skew of their distribution. The graph also goes to show that NHL games are pretty low-scoring. The away goals graph shows most goal totals scored by the away team are between one and four, with a slight right skew of the distribution. The margin of victory is fairly symmetrical with the most common margin being two to three goals for the home team. The scatterplot seems to show that when one team scores a lot of goals the other does as well with some outliers. The correlation between home and away goals is -0.034 suggesting there is very close to no correlation at all.

Pythagorean

Below is a plot of actual points against Pythagorean points.



Based on the plot of actual points percentage against Pythagorean points percentage, it seems the Pythagorean points percentage tended to overestimate. There is still a strong correlation of 0.948 between actual and Pythagorean points percentages. The biggest underachieving team was the Boston Bruins. Although they finished with 88 points, the Pythagorean predicted them to get 0.65 total points (106). There was one team that overachieved and that was the Washington Capitals. They were predicted to get 0.55 of the total points available (90), and they finished with 91 points. Here is a table of the Pythagorean points percentage of each team below:

Teams	***Pythagorean Points Percentage***	***Pythagorean Points***	***Actual Points Percentage***	***Actual Points***

Anaheim Ducks	0.5675646	75	0.616	101
Arizona Coyotes	0.3689	46	0.427	70
Boston Bruins	0.65	88	.683	112
Buffalo Sabres	0.2845	38	.378	62
Calgary Flames	0.42067	64	.512	84
Carolina Hurricanes	0.4210	61	.506	83
Chicago Blackhawks	0.427	56	.463	76
Colorado Avalanche	0.552	77	.579	95
Columbus Blue Jackets	0.529	83	.591	97
Dallas Stars	0.526	76	.561	92
Detroit Red Wings	0.3796	47	.445	73
Edmonton Oilers	0.40956	66	.476	78
Florida Panthers	0.5055	80	.585	96
Los Angeles Kings	0.6068	82	.598	98
Minnesota Wild	0.559	79	.616	101
Montreal Canadiens	0.354	45	.433	71
Nashville Predators	0.6614	95	.713	117
New Jersey Devils	0.5084	79	.591	97
New York Islanders	0.422	60	.488	80
New York Rangers	0.404	59	.470	77
Ottawa Senators	0.330	45	.409	67

Philadelphia Flyers	0.536	70	.598	98
Pittsburgh Penguins	0.557	88	.610	100
San Jose Sharks	0.56	80	.610	100
St Louis Blues	0.50	82	.573	94
Tampa Bay Lightning	0.64	103	.689	113
Toronto Maple Leafs	0.607	91	.640	105
Vancouver Canucks	0.385	51	.445	73
Vegas Golden Knights	0.61	95	.665	109
Washington Capitals	0.549	91	.640	105
Winnipeg Jets	0.654	94	.695	114

Poisson

Since the NHL is low scoring I ran a Poisson rating. Below is a table of the Poisson Offensive and Defensive coefficients:

Teams	***Off. Coefficient***	***Def. Coefficient***
Anaheim Ducks	-0.17073	0.03504
Arizona Coyotes	-0.27839	-0.14150
Boston Bruins	-0.04754	0.02016
Buffalo Sabres	-0.33367	-0.24220
Calgary Flames	-0.23439	-0.11291

Carolina Hurricanes	-0.21119	-0.15030
Chicago Blackhawks	-0.17201	-0.15163
Colorado Avalanche	-0.06175	-0.08809
Columbus Blue Jackets	-0.16874	-0.03942
Dallas Stars	-0.16635	-0.01939
Detroit Red Wings	-0.27012	-0.15473
Edmonton Oilers	-0.17049	-0.19217
Florida Panthers	-0.12738	-0.11702
Los Angeles Kings	-0.14689	0.06762
Minnesota Wild	-0.08557	-0.05403
Montreal Canadiens	-0.29347	-0.16923
Nashville Predators	-0.04673	0.06113
New Jersey Devils	-0.13628	-0.10130
New York Islanders	-0.05410	-0.30457
New York Rangers	-0.19567	-0.18969
Ottawa Senators	-0.23053	-0.26930
Philadelphia Flyers	-0.11280	-0.08530

Pittsburgh Penguins	-0.02957	-0.13903
San Jose Sharks	-0.10310	-0.04729
St. Louis Blues	-0.20127	-0.01745
Tampa Bay Lightning	0.03959	-0.08832
Toronto Maple Leafs	-0.03274	-0.06676
Vancouver Canucks	-0.21998	-0.17653
Vegas Golden Knights	-0.02123	-0.04757
Washington Capitals	-0.08476	-0.09539
Winnipeg Jets	NA	NA

The location coefficient is 0.09283. So, the baseline scoring for a generic home team playing a generic away team is 3.179. The best offensive team was the Tampa Bay Lightning (.0395), with the best defensive team being the Los Angeles Kings (.06762). The worst offensive team was the Buffalo Sabres (-0.33367), while the worst defensive team was the New York Islanders (-0.30457). The teams that were closest to average were the New Jersey Devils, Florida Panthers, and Philadelphia Flyers.

Elo Ratings

Below is a table of the preseason and postseason elo ratings:

Team	*Pre 2017*	*Post 2017*	*Difference*
Anaheim Ducks	1536.604	1349.152	-187.452
Arizona Coyotes	1438.187	1390.076	-48.111
Boston Bruins	1517.595	1651.666	134.071
Buffalo Sabres	1460.482	1486.147	25.665
Calgary Flames	1496.409	1515.908	19.499
Carolina Hurricanes	1477.559	1595.075	117.516
Chicago Blackhawks	1523.605	1374.837	-148.768
Colorado Avalanche	1411.632	1590.001	178.369
Columbus Blue Jackets	1520.073	1376.247	-143.826
Dallas Stars	1482.028	1554.987	72.959
Detroit Red Wings	1454.455	1436.45	-18.005
Edmonton Oilers	1518.968	1593.333	74.365
Florida Panthers	1479.319	1549.582	70.263
Los Angeles Kings	1499.984	1528.551	28.567
Minnesota Wild	1522.978	1535.266	12.288
Montreal Canadiens	1507.888	1394.583	-113.305

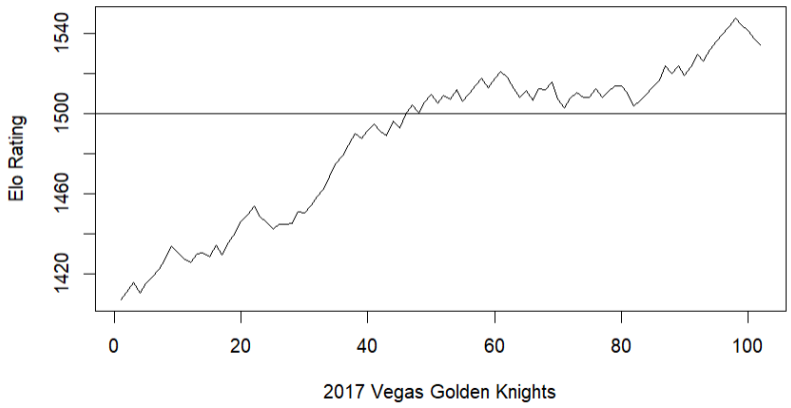
Nashville Predators	1535.459	1492.295	-43.164
New Jersey Devils	1438.732	1538.409	99.677
New York Islanders	1513.19	1515.114	1.924
New York Rangers	1529.389	1568.663	39.274
Ottawa Senators	1513.925	1474.71	-39.215
Philadelphia Flyers	1493.451	1411.555	-81.896
Pittsburgh Penguins	1565.685	1505.281	-60.404
San Jose Sharks	1517.502	1376.001	-141.501
St. Louis Blues	1532.105	1487.311	-44.794
Tampa Bay Lightning	1517.407	1546.86	29.453
Toronto Maple Leafs	1498.205	1576.32	78.115
Vancouver Canucks	1432.292	1471.576	39.284
Vegas Golden Knights	1400	1606.403	206.403
Washington Capitals	1572.659	1472.872	-99.787
Winnipeg Jets	1492.149	1510.077	17.928

Heading into the 2017 season the best team was the Washington Capitals, while the worst rated team was the Vegas Golden Knights. This makes sense since the Knights did not play a game in team history so they started at a rating of 1400. Besides the Knights, the worst rated team

was the Colorado Avalanche. Based on the preseason ratings, the expected playoff teams out of the East were the Capitals, Penguins, Rangers, Bruins, Lightning, Senators, Blue Jackets, and Islanders. Out of the West the expected playoff teams were the Predators, Blues, Blackhawks, Ducks, Oilers, Sharks, Wild, and the Kings.

Elo Ratings for One Team

I decided to look at the Vegas Golden Knights for this season. Below is a look at their Elo rating over the season.



They seemed very consistent throughout the season continuously improving. They had a large win streak between the first 20 to 40 games. They did showcase some losing streaks but overall represented an upward trend.

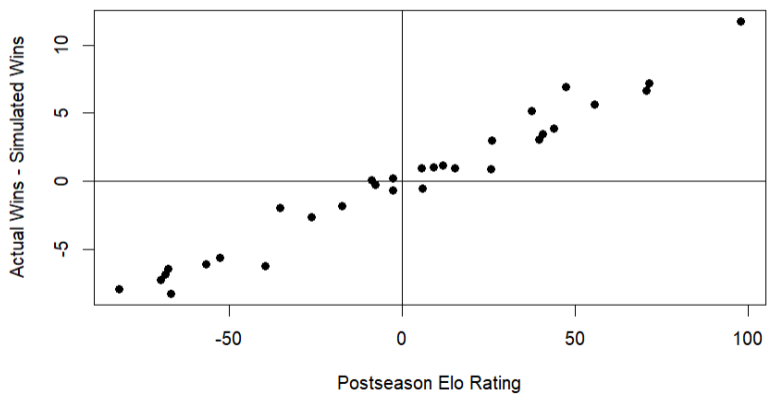
Simulated Regular Season

Below is a table of the Monte Carlo simulation and a plot of the difference in actual and simulated wins:

Team	***Actual Wins***	***Sim. Wins***	***Div. Titles***

Anaheim Ducks	45.5	44.3008	0.285
Arizona Coyotes	30.5	30.4022	0.0001
Boston Bruins	50	46.0979	0.282
Buffalo Sabres	25.5	31.8835	0.0002
Calgary Flames	38.5	40.4375	0.08
Carolina Hurricanes	36	37.8052	0.0087
Chicago Blackhawks	33.5	41.7564	0.0616
Colorado Avalanche	42.5	35.8507	0.0043
Columbus Blue Jackets	44	43.0179	0.0784
Dallas Stars	41.5	40.4375	0.0348
Detroit Red Wings	28	34.2066	0.0025
Edmonton Oilers	34	39.6262	0.0562
Florida Panthers	44	38.825	0.0173
Los Angeles Kings	44.5	43.6058	0.2334
Minnesota Wild	45	44.0639	0.1441
Montreal Canadiens	31	37.8144	0.0126
Nashville Predators	53.5	47.8283	0.4382

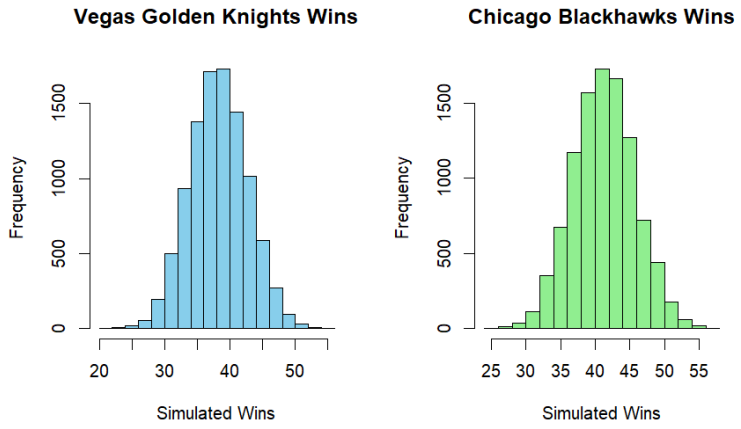
New Jersey Devils	43.5	36.5672	0.0043
New York Islanders	35	41.1047	0.0355
New York Rangers	35	42.2157	0.056
Ottawa Senators	30.5	38.3795	0.0163
Philadelphia Flyers	44.5	41.5004	0.0433
Pittsburgh Penguins	47	47.6351	0.3583
San Jose Sharks	44	44.5155	0.3023
St. Louis Blues	42.5	45.0968	0.1918
Tampa Bay Lightning	52	48.5421	0.5511
Toronto Maple Leafs	46.5	43.4512	0.118
Vancouver Canucks	33.5	33.2476	0.0025
Vegas Golden Knights	50.5	38.7483	0.0406
Washington Capitals	48	48.2432	0.4155
Winnipeg Jets	51	43.7929	0.1251



The teams that were expected to win their division were the Lightning, Capitals, Predators, and the Sharks. All but the Sharks were consistent with what actually happened, the Knights ended up winning the Pacific. The team that performed closest to their expected win total was the Washington Capitals. The team farthest away from their expectations was the Vegas Golden Knights, outperforming their expectations by 11.751.

Overachieving/UnderAchieving

The team that overachieved was the Vegas Golden Knights and the team that underachieved was the Chicago Blackhawks. Below is a histogram of these two teams from the simulation.



I think the Knights partly overachieved due to the fact that this was their inaugural season. Vegas was an average team in almost all stats other than shooting percentage where they finished sixth best overall. As for the Blackhawks, they were ninth highest in GA/G. Despite being fifth best in xGF they had the eighth-highest actual goal differential and finished twenty-seventh in shooting percentage.

Overall the main takeaway from this season is still the fact that the Vegas Golden Knights did so well in their inaugural season. The changes in Elo rating from pre-season to post-season are a bit confusing, but they do showcase how much Vegas overperformed. Although the Pythagorean points percentage tended to overestimate it showed a correlation of 0.948. As for the simulation of the season, it did very well in predicting the top teams of the league, getting three out of 4 division winners.