Insert Title Here:
Why Manchester United Desperately Need a Title this Season.

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Contents

1 Introduction

After a glorious 26 year and 38 trophy spell at Manchester United, Sir Alex Ferguson decided to step down from his role as manager immediately after winning the 2012-2013 English Premier League campaign. It was always going to be hard to live up to the expectations a club of this caliber demanded, but the first season after Fergusons departure was nothing short of a disaster. Under the management of David Moyes, the team finished seventh in the league, too low to qualify for places in European competitions for the first time in recent memory, let alone mount a challenge for the title. The infamous campaign cost Moyes his job, and Louis Van Gaal, a headline grabbing, no-nonsense, outspoken coach, was brought in to replace him. With Van Gaal at the helm, United performed slightly better, finishing fourth in the league and claiming the very last qualifying slot for the lucrative Champions league, but still a far cry away from a team vying for the championship.

2 Research Goal

Louis Van Gaal divides opinion. His admirers fawn over his confident and straightforward approach, attributing the upturn in the clubs fortune to his footballing genius; his detractors claim his bold stances and controversial tactics are but smoke and mirrors, and associate the small improvement in the team to chance alone. The primary purpose of this paper, then, is to investigate whether or not Manchester United actually improved under the leadership of Louis Van Gaal when compared to the season under

David Moyes. Since the effect of the coach on the team is very difficult to tease out, the project will attempt only to determine if there was a significant improvement in any metrics related to team performance from the 2013-2014 season to the 2014-2015, *without* relating the effect to the coach himself.

Furthermore, this paper attempts to determine whether the last two years at the club could be objectively termed a "crisis". After all, although people remember Sir Alex Ferguson as the manager who won the league title on 13 occasions, he actually finished in the bottom half of the table twice in his first three years. Therefore, the secondary purpose of this paper is to establish a method of comparison between the last two seasons and those during Fergusons reign, in order to conclude whether or not these two have been significantly worse.

3 Method

3.1 Overview

In order to answer our first question, we will conduct various t-test to determine whether the team improved significantly under Van Gaal in any of the main areas that are commonly measured in soccer (points per game, goals for/against, total passes, possession, etc.). Once we have identified any significant differences, we will run a regression model to see whether those specific variables have any measurable impact on the number of points won per game. Lastly, we will run a regression model to identify how much the players that Van Gaal brought into the club during his tenure contributed to the points won over the course of the season.

To answer our second question, we will make use of rank sum tests on three key variables that measure the performance of the team over the last three decades. We will then average those p-values and determine how extreme our observed p-value mean is compared to the p-value means we would see if the two seasons analyzed separately were chosen at random.

3.2 Data Collection

The data that used in this paper was collected from two separate online sources[1]. Data includes detailed game by game metrics for all 38 games in each of the last three seasons[2]. For the seasons dating back to 1988, data is composed of three key summary statistics per season, namely final position in the league, average points per game, and average goal differential per game. Data are stored in .csv format.

3.3 Analysis Design

In the first section, we are able to conduct two sample t-tests on all game by game indicators since most data could be transformed to be roughly symmetrical.

For our regression model, Points was the clear candidate for the response variable. However, it is clear that the Points variable is neither normally distributed, nor easily transformed into a symmetric distribution. Furthermore, variables in the data are not independent, leading us to consider regression models other than simple linear regerssion.

Based on the characteristics of the collected data, it is reasonable to use Ordered Logistic Regression Model(OLR) to adjust for the violations of the normality and independence assumptions[3]. Ordered Logistic Regression model is designed for ordinal dependent variables, offering an alternative when assumptions of linear regression are not met. To create our model, we combined the detailed data from the last three years. removing goals for/against as predictors due to the extreme collinearity with the variable Points.

[1] www.whoscored.com and www.emfootball.co.uk.

[2] Variables include points, goals for/against, shots for/against, shots on goal for/against, possession, number of passes, and percentage of pass/shot accuracy.

[3] We thank Dr. K. Rader for providing this suggestion during our research.

In the second section, we performed Wilcoxon Rank-Sum tests on the final position in the league, average points per game, and average goal differential per game, considering the seasons under Sir Alex as our first group and the last two seasons as our second. Then, we created an exact distribution of the average p-values we would obtain if we selected the group of two seasons at random instead of by coach to see where our observed average p-value would lie and determine whether it provides enough evidence to conclude these last two seasons have been objectively worse on average.

3.4 Findings Summary

In brief, our analysis did not provide enough evidence to reject the null hypothesis that the did not actually improve from the 2013-2014 season to the 2014-2015 season. It did, however, provide enough evidence to reject the null hypothesis that the last two seasons were as successful as the seasons with Sir Alex at the helm, leading us to conclude that the club is indeed two years into a full-blown crisis.

4 Moyes vs Van Gaal

4.1 T-Tests on Indicators

To assess whether or not there were significant differences in the metrics between the last two years, we collected 12 different variables to conduct two-sample t-tests. The null hypothesis for all these tests is that there is no difference in the mean of the transformed data under Moyes and under Van Gaal. Most of the variables that are low count and bounded by zero (Goals per Game, etc.) are usually roughly Poisson distributed, but they can be made more symmetric by taking the square root (histograms of the transformed variables are available in the Appendix). Points as a variable cannot be transformed into a symmetric distribution due to the fact that it can only take the values 0, 1, and 3, and that the majority of games are wins. The following table specifies which transformation if any was performed on a variable before running the t-tests. Reported means refer to the untransformed data so that they are easier to interpret, although the t-statistic and associated p-value are obtained from the test on the transformed variables.

The summary of the t-tests appears in Table 1. From the 12 available statistics, Van Gaal has an edge over Moyes in nine (shown in bold). Moyes' only advantage comes in offensive production, as his average of Goals For per Game, Shots For per Game, and Shots on Goal For per Game are all higher than Van Gaal's. The column of p-values indicates that there is a significant difference between seasons for only two of the 12 variables for which we have data, namely **Passes per Game** and **Possession**, both in Van Gaal's favor. This result suggests that although the team may have played better soccer under Van Gaal, they were unable to translate their dominance on the ball into any concrete offensive or defensive gains; it appears as though Moyes was actually able to do more with less in terms of offense.

4.2 Ordered Logistic Regression Model Using Points as Responding Variable

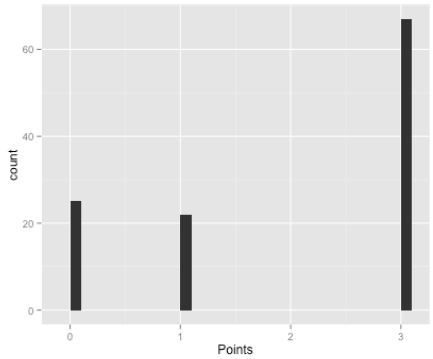

Figure 1: Histogram for the Responding Variable

After having determined which metrics were significantly different between the two seasons, we ran a regression using Points per Game as the re-

Table 1: Summary Table for the T-Tests

Variable	μMoyes	μVanGaal	Transform	t-stat	p-value
Points	1.684	**1.842**	-	0.5168	0.6069
Goals For	**1.684**	1.632	$\sqrt{X}$	0.0249	0.9802
Goals Ag	1.132	**0.974**	$\sqrt{X}$	-0.2401	0.8109
Shots For	**13.842**	13.474	$\sqrt{X}$	-0.3798	0.7052
Shots Ag	11.921	**10.026**	$\sqrt{X}$	-1.8276	0.07165
SOG For	**4.816**	4.737	$\sqrt{X}$	-0.4154	0.6791
SOG Ag	3.789	**3.684**	$\sqrt{X}$	-0.1067	0.9154
Accuracy	0.357	**0.366**	-	0.2719	0.7866
Conversion	0.129	**0.146**	log(X + .05)	0.3733	0.71
Passes	537.605	**590.974**	-	2.3896	0.01959
Pass %	83.842	**84.368**	-	0.501	0.6179
Possession	55.263	**61.184**	-	3.0881	0.002843

Table 2: Summary Table for the Coefficients

	Estimate	Standard Error	T-Value	P-Value
Conversion	22.1890546	3.74795866	5.9203040	$3.213471 * 10^{-02}$
SOG.Against	-0.3045818	0.12445469	-2.4473312	$1.439185 * 10^{-02}$
SOG.For	0.3347503	0.12782227	2.6188730	$8.822080 * 10^{-02}$
Possession	-0.0625332	0.03148957	-1.9858388	$4.705123 * 10^{-02}$

sponse variable, to see if any of our other variables were useful in predicting how many points the team would win per game. As stated before, Points cannot be transformed into a symmetric distribution(Figure 1 shows the distribution of the responding variable), violating one of the assumptions for linear regression. Therefore, instead of running a linear regression, we opted for an ordered logistic regression with 0, 1, and 3 as our ordinal response variables. To arrive at an optimal model, we followed a stepwise process to select the model with the smallest AIC, using the intercept-only model as the lower bound and the model with all terms as the upper bound. The summary of the selected model is reproduced below:

$$\begin{aligned} Y_{points} &= 22.189X_{conversion} - 0.305X_{SOG.Against} \\ &\quad + 0.335X_{SOG.For} - 0.063X_{Possession} \\ AIC &= 148.59 \end{aligned}$$

Table 2 provides a detailed table for the coefficients in this model.

Results of this regression are inconclusive. Louis Van Gaal's team holds the edge in Conversion and Shots on Goal Against, while David Moyes' team has an advantage in Shots on Goal For, although none of these three variables was significantly different between the two squads. Since Possession showed up significant in both the t-test and the regression, it would appear as though Van Gaal's team actually performed significantly differently than Moyes' team in an area significantly related to Points won; however, counterintuitively, its coefficient estimate is negative, which would mean that having *more* Possession correlates to winning *less* points, so it seems as though the dominance Van Gaal's team enjoyed in terms of possession actually hurt instead of help.

4.3 Is the "Van Gaal Effect" Real?

Finally, in our only attempt to quantify the influence of Louis Van Gaal on the team, we at-

tempted to determine how the players he brought into the squad performed compared to the players that preceded him at the club. We identified six players[4] as "Van Gaal players" because they came into the first team at his orders. In order to evaluate their performance relative to their peers, we ran another ordered logistic regression with Points as the response variable and the number of players from this group who started the match as the only indicator. The results of the regression are reproduced below:

$$Y_{extrapoints} = 0.008 X_{vangaalplayers}$$
$$p - value = 0.97074003$$

The coefficient estimate of 0.008 indicates that, for every extra "Van Gaal" player that started the match, the team won 0.008 more points than it would have had another pre-Van Gaal player started instead. With a p-value of 0.97, though, the result is far from significant, meaning that the most likely case is that Van Gaal players performed equally to their peers. Although the result is not significant, the estimate is still very intriguing, because it means that, since Van Gaals players amassed 99 starts between them during the course of the season, they didnt even contribute an entire extra point over the whole campaign (the added value was exactly 0.792 points). That might have been the most expensive less-than-one-point in Premier League history, seeing as Daley Blind, Angel Di Mara, and Marcos Rojo together cost the club a cool £90 million in transfer fees, without even taking into account Radamel Falcaos large wage package (McNair and Blackett were promoted from the youth squad, and in that sense were "free").

4.4 Result

Although the t-tests showed that Van Gaal's team was significantly better at keeping possession and making more passes than Moyes' team, we cannot determine that the team actually improved. Firstly, number of passes and possession are highly correlated, so we cannot even conclude that the team improved in two areas rather than one. Secondly, said improvement occurred in an area that was negatively correlated to Points per Game in our regression model, and Manchester United fans would probably prefer more points over more passes. Finally, the expensive players Van Gaal brought into the club did not perform any better than the players available to him beforehand, leading us to conclude that Van Gaal does not possess the Midas touch that the media attributes to him on occasion.

[4]Daley Blind, Angel Di Mara, Radamel Falcao, Marcos Rojo, Paddy McNair, and Tyler Blackett; Luke Shaw and Ander Herrera were brought in with Van Gaal, but not because of him.

5 Was the Grass Greener with Sir Alex?

We have established that very little changed at Manchester United from the dismal 2013-2014 season to the below average 2014-2015 season, but how much changed from Sir Alex Fergusons tenure to these last two years? To assess whether or not the club is indeed experiencing a crisis, we obtained basic summary data stretching back to Sir Alex Fergusons first full season in charge of the club (1987-1988).

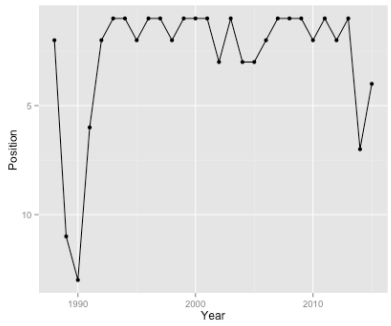

Figure 2: League Positions v Year

Table 3: The Respective P-Values

	League Position	Points Per Game	Goal Diff Per Game	Average P-Value
P-Value	0.0518	0.0815	0.0817	0.0717

Table 4: List of P-Values from Rank Sum Permutation Test

1st	0.0204	0.0277	0.0306	0.0348
5th	0.0383	0.0406	0.0504	0.0504
9th	0.0643	0.0662	**0.0717**	0.0785

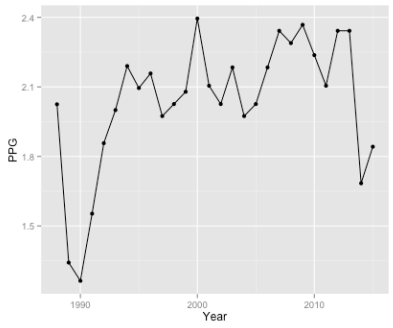

Figure 3: Average Points per Game v Year

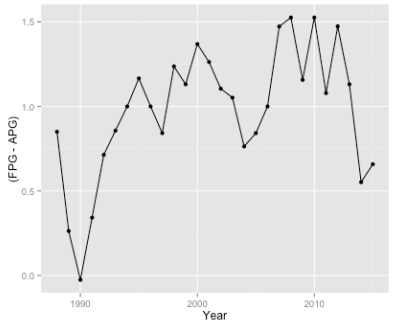

Figure 4: Average Goal Difference per Game v Year

We performed Rank-Sum tests to determine whether or not the team performed significantly better in the years under Sir Alex than it did in the years after his departure using three statistics: the final position in the league(Figure 2), the average points per game(Figure 3), and the average goal difference per game(Figure 4), and the two-sided p-values of the result is provided(Table 3).

Even though all three tests returned low p-values, none of them proved significant at the a = 0.05 level, individually, at least. Nevertheless, we wanted to investigate what the probability was of observing three p-values so close to significance under the null hypothesis, and so we decided to build the exact sampling distribution of the average of the p-values from the tests in order to see where our observed p-value average would lie. To do so, we had to run a for-loop[5] that would perform all three Rank-Sum tests on every single combination of two seasons[6] and then average all three p-values into a single statistic. Building a histogram (Figure 5) of the average p-values from the three tests, we can determine whether our observed p-value (marked in red) is one that we could have gotten by chance alone. Sorting the 378 average p-values, we see that there are only 10 other averages smaller than the one we observed (Table 4), meaning that the probabilty of observing our average p-value if the distributions of the variables were the same during and after Sir Alex is 11/378 = *0.029*.

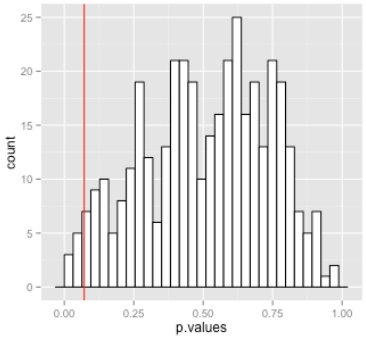

Figure 5: P-Value Distribution of the "Rank Sum" Permutation Test

[5]R code available in the appendix
[6]There are 28 choose 2 = 378 of them

5.1 Result

Despite the fact that none of our individual Rank-Sum tests returned a significant p-value, knowing that the probability of observing the mean p-value under the null hypothesis is 0.029, we can reject the hypothesis that the variables considered follow equal distributions in the Sir Alex era and after the Sir Alex era. Therefore, we conclude that the team has performed objectively worse during these last two years, so labeling these two years a "crisis" would be appropriate.

6 Conclusion

6.1 Summary of Results

Our research did not provide enough evidence to indicate that the team performed any better under Van Gaal than it had under David Moyes. Although some slight improvements were measured, they did not directly contribute to the number of points the team won, which is what matters most in soccer. In fact, if Manchester United had won 64 points under Van Gaal, like they did under Moyes, they would have still claimed fourth place in the 2014-2015 campaign.

Although we could not find a significant improvement from Moyes to Van Gaal, our analysis did provide enough evidence to determine that there was a marked decline in the teams fortune after Sir Alex left the club, leading us to conclude that the club is indeed two years into a full-blown crisis.

6.2 Scope and Validity

Since no aspect of the data collection was randomized (one cannot randomly assign a coach to a game, for example), then the findings in the study cannot be expanded to data beyond the one we utilized, and our results cannot be causally attributed to the coach in charge.

6.3 Other Considerations

Furthermore, our study only focused on Manchester Uniteds performance in the English Premier League, the main competition that they play in. We did not take into account how playing in other competitions simultaneously would affect the teams performance in the EPL; for instance, Louis Van Gaal had the luxury of only having to focus on securing a top-four spot in the EPL, while David Moyes had to juggle domestic competition and the UEFA Champions League, which might have contributed to the poor performance of his team.

6.4 Ideas for Further Reasearch

The fact that soccer data is not as readily available as other forms of sports data definitely hampered the extension of our research. Perhaps with a larger and more detailed dataset, one could build a more accurate model that predicts number of points won per game than the one offered in this paper. Moreover, any such model should probably do a better job of fixing our accounting for the violations of assumptions for linear and logistic models, since the kind of model we probably needed was beyond the scope of this course.

7 Appendix

7.1 T-Test Normality Check

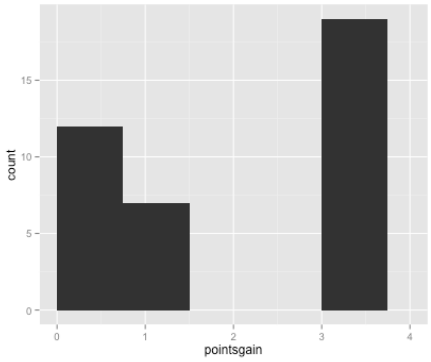

Figure 1: Histogram of the Points for Moyes

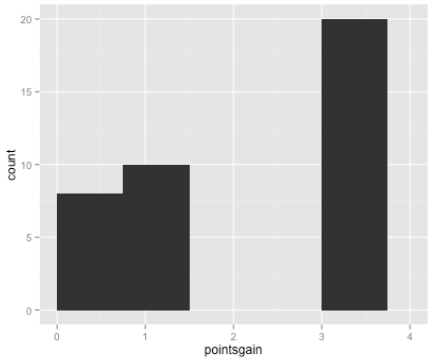

Figure 2: Histogram of the Points for Van Gaal

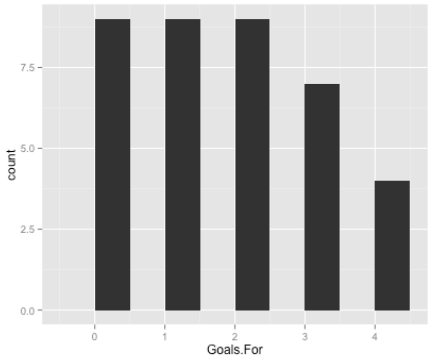

Figure 3: Histogram of the Goals Scored for Moyes

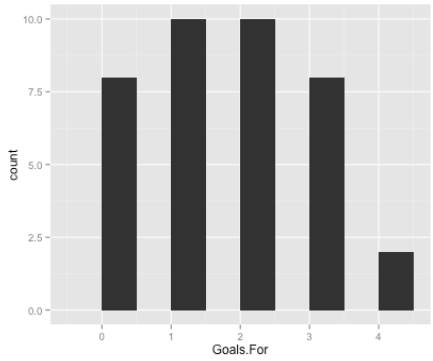

Figure 4: Histogram of the Goals Scored for Van Gaal

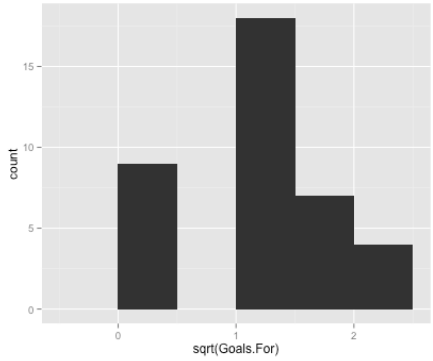

Figure 5: Histogram of the Squared Root Transformed Goals Scored for Moyes

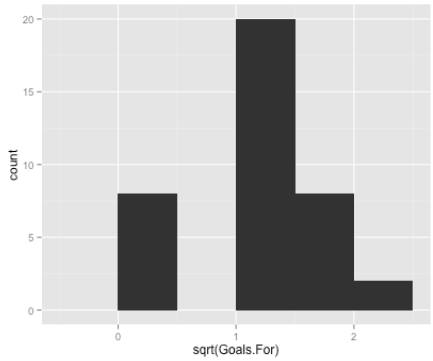

Figure 6: Histogram of the Squared Root Transformed Goals Scored for Van Gaal

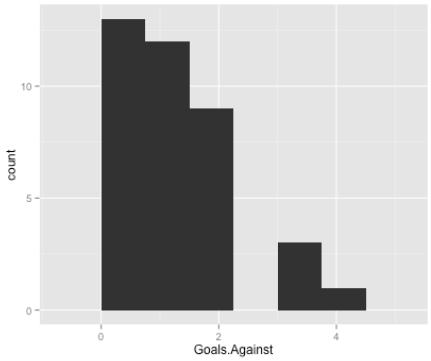

Figure 7: Histogram of the Goals Against for Moyes

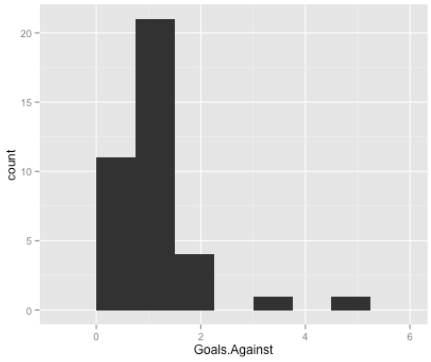

Figure 8: Histogram of the Goals Against for Van Gaal

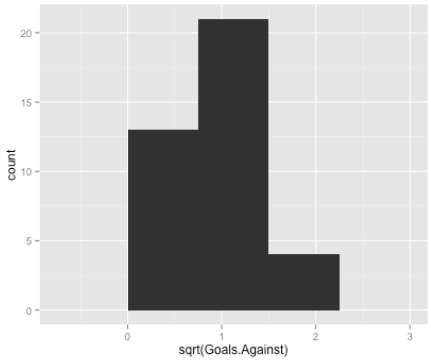

Figure 9: Histogram of the Squared Root Transformed Goals Against for Moyes

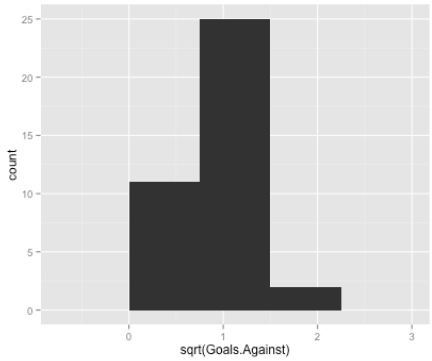

Figure 10: Histogram of the Squared Root Transformed Goals Against for Van Gaal

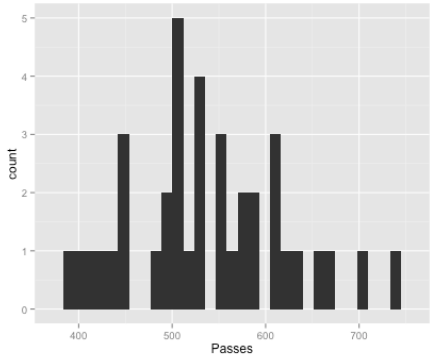

Figure 11: Histogram of the Passes for Moyes

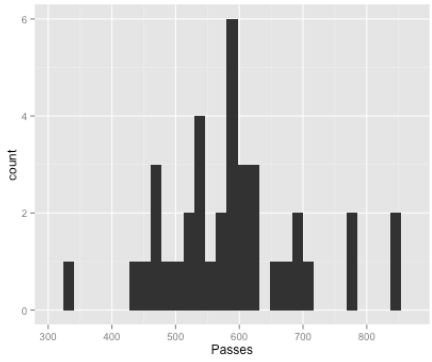

Figure 12: Histogram of the Passes for Van Gaal

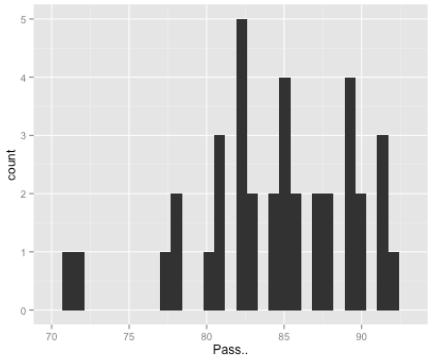

Figure 13: Histogram of the Passes Percentage for Moyes

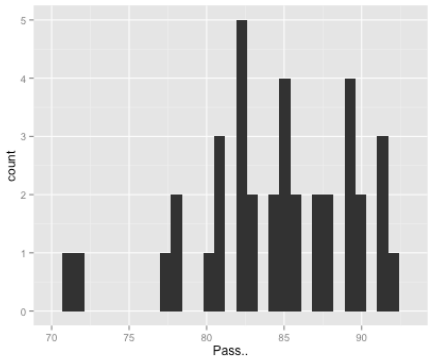

Figure 14: Histogram of the Passes Percentage for Van Gaal

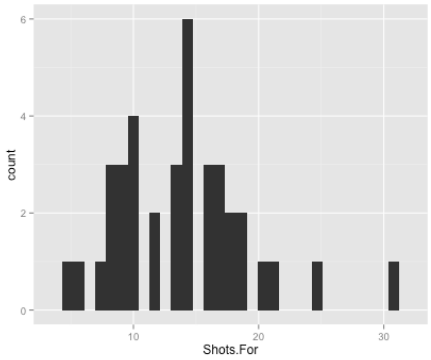

Figure 15: Histogram of the Shots for Moyes

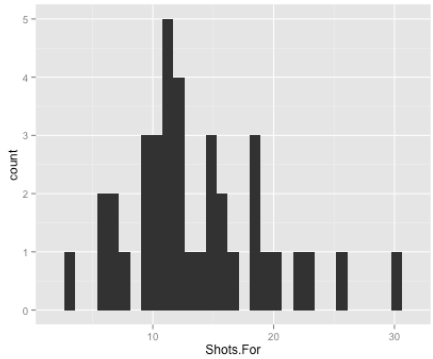

Figure 16: Histogram of the Shots for Van Gaal

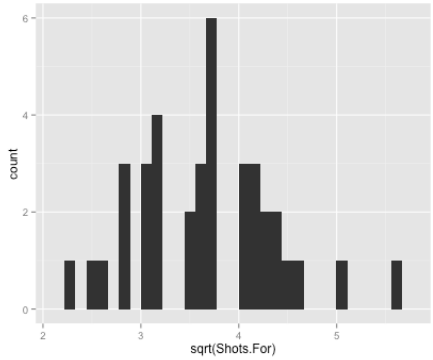

Figure 15: Histogram of the Squared Root Transformed Shots for Moyes

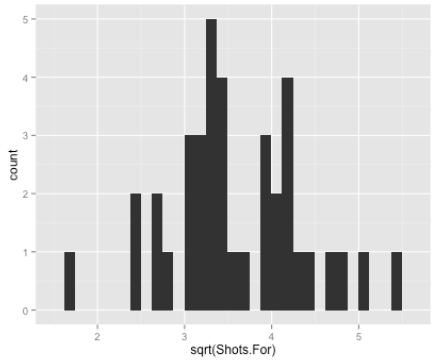

Figure 16: Histogram of the Squared Root Transformed Shots for Van Gaal

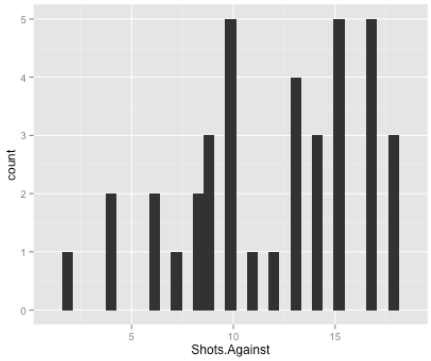

Figure 15: Histogram of the Shots.Against for Moyes

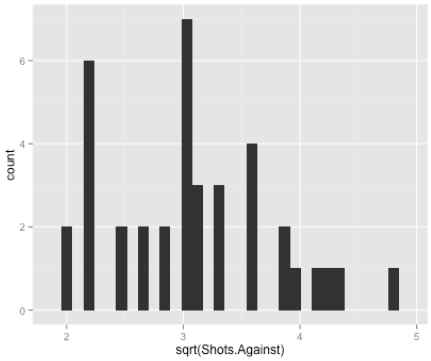

Figure 16: Histogram of the Squared Root Transformed Shots.Against for Van Gaal

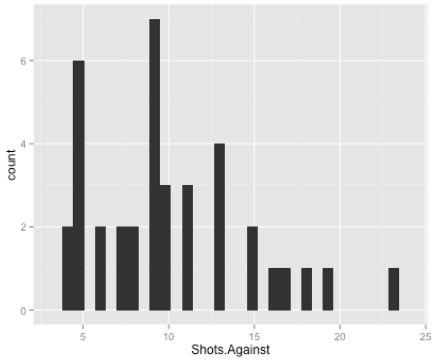

Figure 16: Histogram of the Shots.Against for Van Gaal

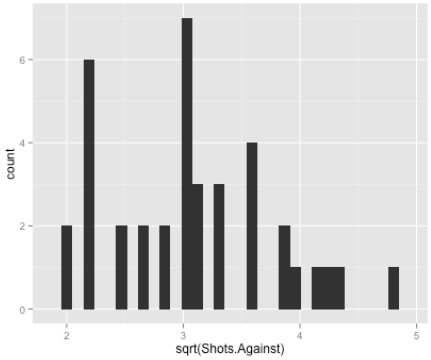

Figure 15: Histogram of the Shots on Goal for Moyes

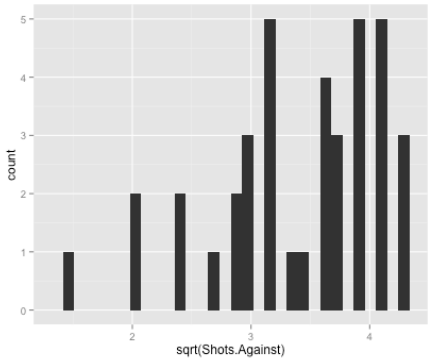

Figure 15: Histogram of the Squared Root TransformedShots.Against for Moyes

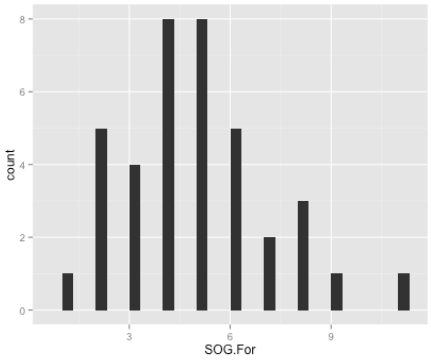

Figure 16: Histogram of the Shots on Goal for Van Gaal

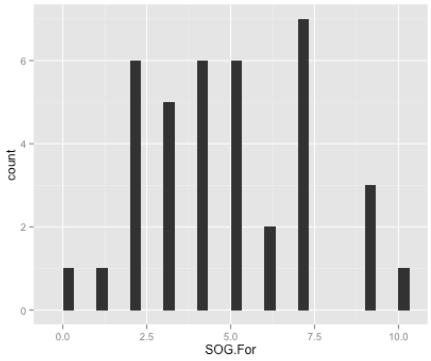

Figure 15: Histogram of the Squared Root Transformed Shots on Goal for Moyes

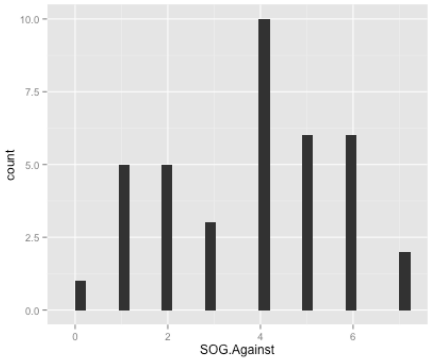

Figure 16: Histogram of the Shots on Goal.Against for Van Gaal

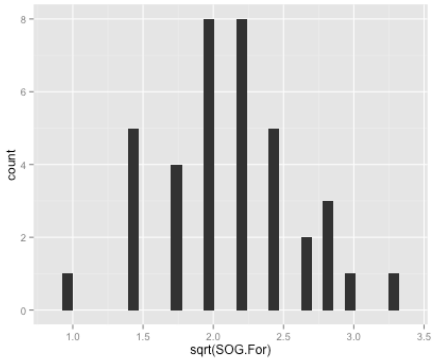

Figure 16: Histogram of the Squared Root Transformed Shots on Goalfor Van Gaal

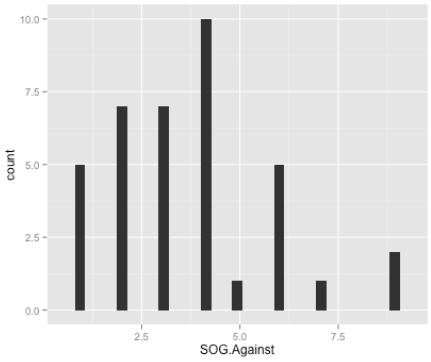

Figure 15: Histogram of the Squared Root Transformed Shots on Goal.Against for Moyes

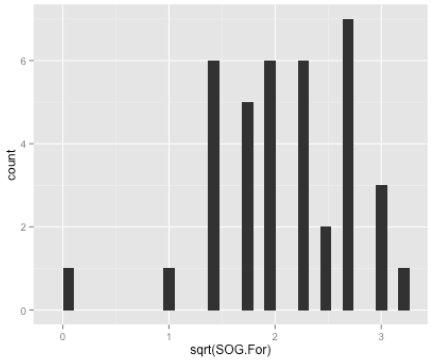

Figure 15: Histogram of the Shots on Goal.Against for Moyes

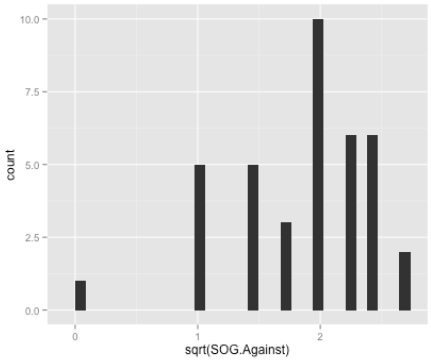

Figure 16: Histogram of the Squared Root Transformed Shots on Goal.Against for Van Gaal

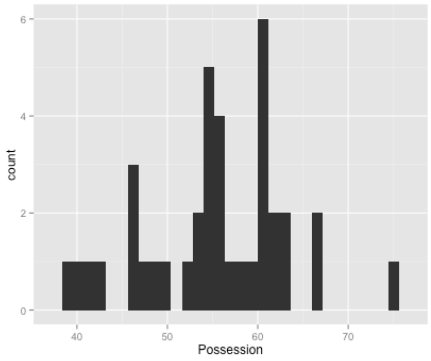

Figure 15: Histogram of the Possession for Moyes

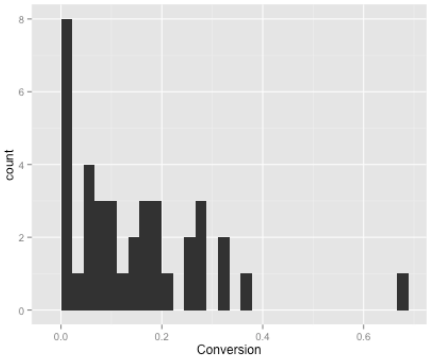

Figure 16: Histogram of the Conversion for Van Gaal

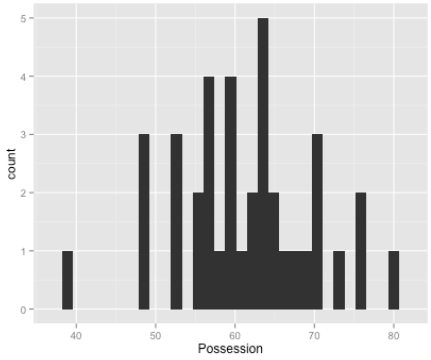

Figure 16: Histogram of the Possession for Van Gaal

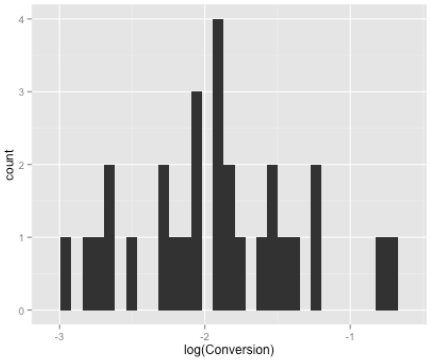

Figure 15: Histogram of the Logged Conversion for Moyes

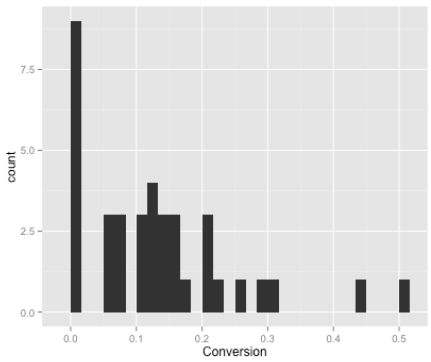

Figure 15: Histogram of the Conversion for Moyes

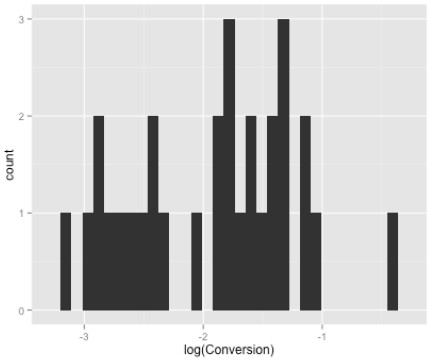

Figure 16: Histogram of the Logged Conversion for Van Gaal

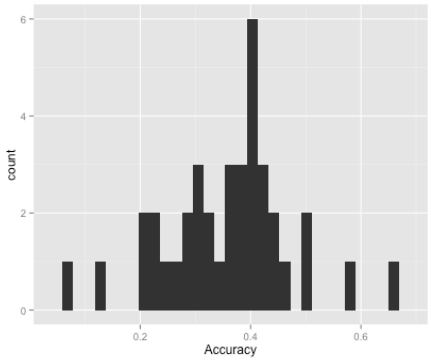

Figure 15: Histogram of the Accuracy for Moyes

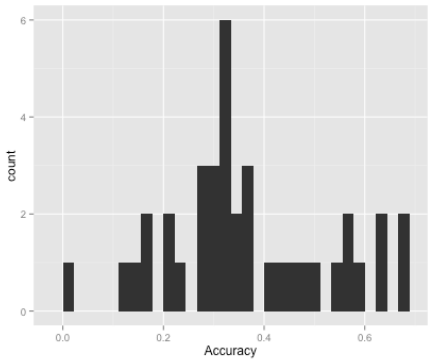

Figure 16: Histogram of the Accuracy for Van Gaal

7.2 Related R Codes

7.2.1 R Code for Ordered Logistic Regression

```
> model1 <- polr(as.factor(pointsgain) ~ 1,
    data = data_olr, Hess=TRUE)
> model0 <- polr(as.factor(pointsgain) ~ 1,
    data = data_olr, Hess=TRUE)
> modelf <- polr(as.factor(pointsgain) ~ .,
    data = data_olr,Hess = TRUE)
> m <- step(model1, scope = list(lower=
    model0, upper = modelf), direction = "
    both", k = 2)
Start: AIC=223.47
as.factor(pointsgain) ~ 1

              Df    AIC
+ Conversion   1 156.02
+ Accuracy     1 202.69
+ SOG.For      1 213.03
+ SOG.Against  1 220.37
<none>           223.47
+ Pass..       1 223.53
+ Shots.Against 1 223.87
+ Possession   1 224.86
+ Passes       1 225.24
+ Shots.For    1 225.28

Step: AIC=156.02
as.factor(pointsgain) ~ Conversion

              Df    AIC
+ SOG.Against  1 150.89
+ SOG.For      1 151.10
+ Shots.Against 1 152.60
+ Shots.For    1 154.88
+ Accuracy     1 155.25
<none>           156.02
+ Pass..       1 157.18
+ Passes       1 157.69
+ Possession   1 157.96
- Conversion   1 223.47

Step: AIC=150.89
as.factor(pointsgain) ~ Conversion + SOG.
    Against

              Df    AIC
+ SOG.For      1 148.59
<none>           150.89
+ Accuracy     1 150.97
+ Shots.For    1 151.36
+ Possession   1 151.78
+ Shots.Against 1 152.44
+ Passes       1 152.80
+ Pass..       1 152.88
- SOG.Against  1 156.02
- Conversion   1 220.37

Step: AIC=148.59
as.factor(pointsgain) ~ Conversion + SOG.
    Against + SOG.For

              Df    AIC
+ Possession   1 146.39
<none>           148.59
+ Passes       1 149.09
+ Pass..       1 150.05
+ Shots.For    1 150.37
+ Accuracy     1 150.52
+ Shots.Against 1 150.59
- SOG.For      1 150.89
- SOG.Against  1 151.10
- Conversion   1 212.75

Step: AIC=146.39
```

```
as.factor(pointsgain) ~ Conversion + SOG.
    Against + SOG.For +
    Possession

              Df    AIC
<none>           146.39
+ Passes       1 147.62
+ Shots.Against 1 147.84
+ Pass..       1 148.12
+ Accuracy     1 148.22
+ Shots.For    1 148.30
- Possession   1 148.59
- SOG.Against  1 150.79
- SOG.For      1 151.78
- Conversion   1 207.53
> summary(m)
Call:
polr(formula = as.factor(pointsgain) ~
    Conversion + SOG.Against +
    SOG.For + Possession, data = data_olr,
        Hess = TRUE)

Coefficients:
             Value Std. Error t value
Conversion 22.18905   3.74796  5.920
SOG.Against -0.30458  0.12445 -2.447
SOG.For     0.33475   0.12782  2.619
Possession -0.06253   0.03149 -1.986

Intercepts:
    Value  Std. Error t value
0|1 -2.5835 1.9257   -1.3416
1|3 -0.6877 1.9263   -0.3570

Residual Deviance: 134.3889
AIC: 146.3889
> (ctable <- coef(summary(m)))
               Value Std. Error  t value
Conversion 22.1890546 3.74795866 5.9203040
SOG.Against -0.3045818 0.12445469 -2.4473312
SOG.For     0.3347503 0.12782227 2.6188730
Possession -0.0625332 0.03148957 -1.9858388
0|1        -2.5835159 1.92570224 -1.3415967
1|3        -0.6877142 1.92628027 -0.3570167
> p <- pnorm(abs(ctable[, "t value"]), lower.
    tail = FALSE) * 2
> (ctable <- cbind(ctable, "p value" = p))
               Value Std. Error  t value
                   p value
Conversion 22.1890546 3.74795866 5.9203040
    3.213471e-09
SOG.Against -0.3045818 0.12445469 -2.4473312
    1.439185e-02
SOG.For     0.3347503 0.12782227 2.6188730
    8.822080e-03
Possession -0.0625332 0.03148957 -1.9858388
    4.705123e-02
0|1        -2.5835159 1.92570224 -1.3415967
    1.797268e-01
1|3        -0.6877142 1.92628027 -0.3570167
    7.210793e-01
> confint(m)
Waiting for profiling to be done...
                2.5 %      97.5 %
Conversion 15.40596832 30.170779012
SOG.Against -0.56043969 -0.067566321
SOG.For     0.09162491 0.596569173
Possession -0.12706500 -0.002652147
```

7.2.2 R Code for the P-Value Permutation Test

```
nsims <- 378
result = rep(NA, 378)
counter = 1
for (i in 1:27){
  for (j in (i+1):28){

    x1 = rbind(seasons[i,],seasons[j,])
    x2 = rbind(seasons[-c(i,j),])

    pos <- wilcox.test(x1$Position,
        x2$Position)
    pts <- wilcox.test(x1$PPG, x2$PPG)
    gdf <- wilcox.test(x1$FPG-x1$APG, x2$FPG-
        x2$APG)

    p <- c(pos$p.value,pts$p.value,gdf$p.
        value)

    result[counter] <- mean(p)
    counter = counter+1
  }
}

mean(result)
hist(result)
obs.p <- c(test.place$p.value,test.points$p.
    value,test.goals$p.value)
abline(v=mean(obs.p),lwd=3,col="red")
```