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From College to the NFL Playoffs: An Analysis of Individual Contribution to Team Success

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Introduction/Background

The National Football League (NFL) Draft is the process by which NFL teams, through their general managers, select players who have just finished their college careers to add to their rosters. The worst NFL team from the previous season gets the first overall selection in the Draft, and the Super Bowl winner from the previous season gets the last selection of the first round. The first round comprises 32 selections, or picks, one for each team in the NFL. Round two consists of picks 32-63, round three picks 64-99, round four picks 100-135, round five picks 136-166, round six picks 167-207, and round seven picks 208-252 (NFL.com). Teams compete in the Draft for the "best" college players. Currently, the Draft strategy used by most general managers relies heavily on the results of the NFL Combine, a workout that showcases the top prospects from college football, selecting players who attended prolific football colleges, and winners of prestigious college football awards. The goal is to select players who will make the best contribution to the team higher in the Draft, while also keeping in mind the positions the team may need to fill.

Purpose

This study focuses on NFL teams that have made the NFL playoffs following the 2007-2011 seasons. These teams will be analyzed to investigate relationships between characteristics of the college career of the top players on each of these teams and the teams' achievements in the NFL playoffs.

Previous studies of predictors of NFL success in college football players have mainly focused on predicting individual success at the professional level, or predicting draft status. This study investigates the relationship between characteristics of college player experience and playoff victories. The Super Bowl is held as the pinnacle of NFL play, and as such should be a

focus when general managers are trying to choose high quality players to add to their team. The further a team advances in the NFL playoffs, the closer it is to the Super Bowl, or the more success the team is considered to have had that season.

The study was performed with a sample set collected from the players with the highest touchdown totals from each playoff team from 2007-2011. Variables describing players' college success, whether or not they played for a prolific program[1], and their NFL Draft status were analyzed. The goal of the study was to pinpoint those attributes which correlate most closely with Super Bowl wins. These attributes were then compared to attributes of college players currently most considered for the draft.

The main goal of this study is to create a plan for the NFL Draft that a team's general manager could use with the intent of creating a better chance of their team winning the Super Bowl. Managers would be able to look at the college players who have the characteristics which indicated the most correlation and move them up on their draft list, or move other players down on their draft list who are missing these characteristics.

Literature Review

The literature review discusses what strategies general managers of NFL teams are currently using when they look at which players to draft. The correlation between when a player is drafted and their performance in the NFL is also investigated, to determine how effective these current Draft strategies might be. I looked at research discussing the benefits of playing for a more prestigious program, and at correlation between college performance and NFL

1 A "prolific" college program is a program nationally renowned for having the most success on a consistent year after year basis. These are the programs who are best able to recruit the top high school players and who have historically won the most bowl games and National Championships. They also play for "major" conferences, which are conferences having several prolific programs.

performance, to form predictions for what this research might show. Finally, I provide evidence to show that selecting only offensive players for inclusion in this study can be done without loss of generality.

Current Draft Strategy

Blees (2011) indicated that whether a player attended a college in one of the Bowl Championship Subdivision (BCS) conferences[2] or not played a significant role in determining his position in the draft, improving his draft position by 55 picks over those players who did not attend a BCS conference school. Hendricks, DeBrock, and Koenker (2003) found similar effects of playing for a prolific program, noting "statistical discrimination against athletes from weaker, less visible programs" (p. 877). This shows a mentality by general managers of teams (the ones who make drafting decisions in the NFL) that players from these prolific schools are superior to other players.

Studies have noted a strong correlation between performance in the NFL Combine and draft location. The Combine is a yearly event in which invited college athletes participate in physical performance measures including bench press tests, 40 yard dash, 20 yard shuttle, 60 yard shuttle, 3-cone drills, and vertical and broad jump tests. McGee and Burkett (2003) found that the Draft held a high predictability level based on Combine results, indicating that much of the current draft strategy for NFL general managers is to look at Combine tests and pick the best performers from this for their higher draft picks. Forty yard dash times were found to be significant determinants of draft orders for wide receivers by Treme and Allen (2009). As Van Bibber (2012) noted in his Combine analysis blog, the Combine changes previous conceptions of

2 The six BCS conferences, as indicated in the Blees study, are the Atlantic Coast, Big East, Big Ten, Big 12, Pac-10, and Southeastern conferences. The champions of each of these conferences receive automatic bids to the BCS bowls, the top five bowl games in college football. They are seen as the best conferences in college football.

what draft order will be each season. Players who perform better or worse than expected in the Combine can make or break their draft status.

Media exposure is also a factor affecting draft location. Treme and Allen (2009) found that for wide receivers, players who had two more stories referencing them than the average college player had in newspapers, television sporting programs, or magazines moved up an average of one position in the draft.

Correlation between Draft Location and NFL Performance

Although Combine performance seems to be a major indicator of draft order, it does not have significant correlation to NFL performance. Treme and Allen (2009) found that 40-yard dash times from the Combine did not "improve first year performance, lead to more games played, or more games started" (p. 6-7). Since Combine performance lends a high degree of predictability to draft order, but not to performance, we can see that draft order does not have a strong correlation to performance. This is an issue for general managers because of the large sums paid out to high draft picks. If players drafted at the top then do not produce results, it is a huge monetary loss for the team.

Berri and Simmons (2009) also found that draft location was not a valid predictor of performance for quarterbacks. In their study, quarterbacks chosen after the first ten picks did not perform better than quarterbacks chosen in the first ten who were in fact outperformed by later picks.

After the Draft, teams have the opportunity to test players out in a sort of probationary period during training camp and off-season workouts. Hendricks et al (2003) tested draft effectiveness using this knowledge by analyzing players on the opening day roster of the team drafting them during the 1996 season. They found that 100 percent of players drafted in the first

or second rounds were on opening day rosters, and this percentage decreased as the round number increased. This shows that the draft is effective in some way, that teams are choosing players in early rounds that they are very confident in and not likely to let go before the first season starts. Players in later rounds are subject to this probationary period and may not live up to expectations teams had for them.

School FBS Status

As previously noted, whether a player attends a FBS (Football Bowl Subdivision)[3] or non-FBS school greatly affects his draft location. It has also been shown to affect their later performance in the NFL, manifesting in Pro Bowl selections. The Pro Bowl is an event featuring the best players at each position from each conference of the NFL.[4] Players are selected for the Pro Bowl by a combination of fan, coach, and peer-player voting. Hendricks et al (2003) used the percentage of his career for which a player was chosen for the Pro Bowl as a measure of NFL performance success. Their results showed that players from Non-Division IA schools (these schools correspond to what are now non-FBS schools) were selected to the Pro Bowl for a greater percentage of their career than Division IA players (corresponding to FBS schools) when compared among players within the same round of the draft. This lies in direct contrast to the result of FBS or non-FBS status improving draft location, because it shows that in each round of the draft, players from FBS schools are less likely to make the Pro Bowl consistently in comparison to their same round non-FBS counterparts.

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3 The FBS refers to schools that belong to what used to be Division IA, the most accomplished schools in college football. These schools must provide more scholarships to their teams than schools in lower divisions.

4 The NFL is divided into two conferences, the American Football Conference (AFC) and the National Football Conference (NFC). Half of the 32 NFL teams belong to each conference. Both conferences are always represented in the Super Bowl by the organization of the playoffs.

The Effect of College Performance on NFL Success

Most studies focus more on draft location as a predictor of on-field NFL success, assuming that the Draft adequately describes college performance, but one measures NFL success based directly on college performance. Treme and Allen (2009) ran a study focused on wide receivers, measuring success with draft location, salary, and individual performance in the NFL. They included whether or not the player attended a BCS conference institution and if the player entered the NFL draft early (leaving college before completing their NCAA eligibility) as variables, along with touchdowns in their last year of college and pre-draft ranking compared to other wide receivers. The study found that receptions in the last year of college were a determinant of the player's success as a wide receiver in the NFL.

Selecting Offensive or Defensive Players

Although the cliché exists that "defense wins championships", in recent years this has been challenged and many would change it to "offense wins championships". Moscowitz and Wertheim (2012), however, noted that the data says there is no statistical difference in the contribution of a defense from the statistical contribution of an offense in the NFL in terms of winning championships, playoff games, and games in general. Thus, an analysis of only the offensive players of a team would have no loss of generality, and since offensive players have generally more reliable and acquirable data, this study investigates the offensive players of NFL playoff teams.

I. Hypotheses to be Tested

This study tests the following hypotheses:

Hypothesis 1: Individual college performance of players, such as on-field statistics and individual awards, have direct correlation with the number of NFL playoff games won.

Hypothesis 2: Outside influences on play, such as entering the Draft early, have no correlation with the number of NFL playoff games won.

Hypothesis 3: Characteristics of a player's college team experience, such as final AP rank of school (or status as a non-FBS school), bowl wins, and team record, have direct correlation with the number of NFL playoff games won.

Hypothesis 4: Draft location has no correlation with number of NFL playoff games won.

Methodology

The study was completed during the Fall 2012 semester. Data were collected from espn.com, official NFL team sites, totalfootballstats.com, NFL.com, and official college team sites.

To form the sample set for the study, I selected players with the three highest touchdown totals, quarterbacks excluded[5], from each of the teams reaching the playoffs in the past five years (2007-2012 playoffs). In the case of a tie for touchdown count, I took the player with the most net yards (rushing and receiving) for the data set. The player with the most yards gained will have contributed more to additional touchdowns than the players he is tied with, even if he did not personally take the ball into the endzone. If no players were repeated in this set, this would result in a sample size of n=180 players. However, because many of the same teams reach the playoffs each year, the sample size was decreased to n=124. In the case of repeating players, I

5 Quarterbacks will be excluded because of the large number of studies that focus solely on quarterbacks, in an effort to bring new research to the field, and because they by nature have a hand in the vast majority of touchdowns scored.

used the player's earliest appearance so that the effect of reaching the playoffs on later performance was not a factor in the study. I took touchdown totals from the regular season for each team. Totals include rushing and receiving touchdowns. I easily found data necessary for determining which players to include in the sample on each team's official website. I also recorded this as a variable under *NFL Touchdowns.*

I defined the binary variable[6] *Division* as 1 if a player played for a school in the FBS, and 0 if a player played for any school outside of the FBS, or if they did not play college football. I also included *Final Rank* as a variable amongst the schools receiving a 1 in the *Division* variable, which indicates the value of the school's end of season AP Ranking (1-25 or unranked), one of the two most common ranking systems in college football. I defined *Bowl Win* as a binary variable valuing 1 if the player's school won a bowl game his last year of college and 0 if he did not. This variable applies for all players who played for an FBS school, since they participated in the bowl system. If the player's team did not play in a bowl game during the season in question, he was assigned a 0 for this variable, the same as a bowl game loss. I defined *Early Draft* as a binary variable valuing 1 if the player entered the NFL Draft process early (this is defined as a player who does not use up his four years of NCAA eligibility) and 0 if he did not.

I also included the variable *Individual Awards* to indicate an overall sense of the player's accomplishments and amount of national attention they received. This variable measures the number of awards from the list provided at ESPN's "College Football Awards"[7] that a player received during his college career.

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6 A binary variable is an indicator variable which takes on the value of 1 if the variable is true and 0 if the variable is false.

7 http://espn.go.com/college-football/awards

Draft Pick was included to test effectiveness of current Draft strategies in selecting Super Bowl champion teams. Although this measure has been shown to be ineffective in individual player performance, studies have not been done to determine its effect on team performance. This will measure how the expectation of a player when he enters the NFL affects team performance, and *Years in League* will measure the effect of playing in the league on the player's contribution to the team. This is a variable denoting the number of years a player has been in the NFL, selected to determine whether or not experience has a strong correlation with how far a team goes in the playoffs.

The remaining variables are more direct reflections of college on-field performance. *Team Wins* is the number of wins recorded by each player's college team in his last year of college play. *College Touchdowns* is a count of the touchdowns recorded by each player in his last year of college play.

Since the literature already indicates that Combine results do not have a strong correlation with individual NFL performance, I chose to not include these results as variables in my analysis. In addition, the literature shows that Combine results are strongly tied to Draft location, so the *Draft Pick* variable could indicate correlation with Combine results if indeed there is one.

The independent variable in the study is *Playoff Games Won,* which indicates how far into the playoffs the player's NFL team advanced that year. If the team received a bye[8], this was counted as a win, since the team was automatically advanced to the next round of the playoffs. This variable takes on values between 0 and 4, with 0 indicating the team made the playoffs but

8 Each year, four teams (the top two ranked from each conference of the NFL), receive a bye in the playoffs, which means they do not play in the first round.

lost its first game and 4 indicating the team won the Super Bowl that year. How far a team advances into the playoffs is often used as an evaluation of team success for the season by sportswriters and analysts.

Analysis

Summary Statistics

All of the raw data for independent and dependent variables for all analyses are included in Appendix A. After data collection, I calculated summary statistics such as mean, median, minimum and maximum values, and standard deviation for all variables. These summary statistics are shown in the two tables below:

	Playoff TDs	Final Rank	Team Wins	Individual Awards	Draft Pick	Years in League	College TDs	Playoff Games Won
mean	8.92	11.25	8.15	0.15	71.62	4.31	11.08	1.23
median	8.00	10.00	9.00	0.00	52.00	3.00	10.50	1.00
min	3.00	1.00	2.00	0.00	2.00	1.00	0.00	0.00
max	24.00	25.00	14.00	5.00	252.00	14.00	30.00	4.00
st. dev.	3.86	6.97	2.70	0.57	69.48	2.97	6.95	1.25
n	124.00	53.00	123.00	124.00	110.00	124.00	124.00	124.00

	Division	Early Draft	Bowl Win
sum	107	40	42
n	124.00	124.00	107.00

A cursory look at the data indicates that players in the sample set scored about 11 touchdowns in their senior season of college and 9 in their playoff season. Their teams had an average of 8 wins (of around 11 to 12 games played in an average college season), and about half of the FBS teams in the sample set were ranked at the end of the season. Players averaged

around 4 years in the NFL when playing on a playoff team. About one-third of the players in the sample set left college early for the NFL Draft, and players who were drafted averaged at the 72nd pick, which is in the 3rd round of the Draft. It should be noted that although the highest draft pick in our sample set is 2, the last time a non-quarterback offensive player who was not a lineman (in other words, a player who would be eligible for our sample set) was selected with the first pick in the Draft was 1996. About 40% of players playing for FBS schools won a bowl game with their team in their senior season of college.

Regression/ANCOVA

In order to assess the trend of team NFL success and determine what factors are related to this trend, I ran a linear regression analysis using ANCOVA. Linear regression is an analysis which models the relationship between two or more variables by fitting a line which best explains or models the dependent variable using the selected independent variables. This is accomplished by taking the square of the vertical distance from each data point to the line, summing all of these values, and minimizing them (Yale, 1998).

ANCOVA, or analysis of covariance, is a process which gives linear regression for different categories of a variable. In this case, I used a parallel ANCOVA to provide separate linear regression lines for players who played for an FBS school and players who did not. The two models have the same coefficients for each independent variable, but different y-intercepts. I also ran a separate ANCOVA, forming two models, one for the players who played for an FBS school and one for players who did not, allowing for different coefficients for the independent variables as well as different y-intercepts. The last model used is called the Common Model, and is a regression run with no differentiation between FBS and non-FBS players. I then used

hypothesis testing with an F-distribution to determine which of the three models is the most effective representation of the data.

The independent variables which have statistically significant effects on the dependent variable can then be determined by their p-values. P-value is the probability that the data would form this same pattern given completely random data where there was no relationship between variables. Thus, the smaller the p-value, the more likely it is that this independent variable actually has some relationship with the dependent variable, and the more significant it is.

When running a linear regression analysis, a cutoff p-value that will be acceptable is chosen. For this analysis, I chose the cutoff value to be 0.15. I then performed regression using both backward elimination and forward selection. Backward elimination is a process in which all desired independent variables are initially included in the linear regression, and after the regression is run, the variable with the highest p-value is removed and the analysis is repeated. This process repeats until all included variables give a p-value lower than the cutoff value, leaving only statistically significant variables. Forward selection is essentially the reverse of this process, in which no variables are initially included in the analysis. The analysis is performed with each of the independent variables alone, and the one which gives the lowest p-value (as long as it is below the accepted cutoff value) is added. The analysis is then repeated with this variable, adding each of the others to perform several two-variable regressions. At each step, the variable which yields the lowest p-value is the one added to the model. The process ends when no more variables can be added to give a p-value lower than the cutoff.

I also used r-squared plots for the regression models to select the best model. R-squared is a measurement of the strength of the relationship between the covariates and the dependent variable. It is a measure between 0 and 1 that indicates the fraction of variability that is

explained by the given model. If we plot the r-squared value of the best model with one covariate, the best model with two covariates, and continue to the full model, there should be an "elbow", or bend in the plot at some point. This is the point that indicates that there is not enough of an increase in the amount of variability explained by the next model to justify adding another variable. The notion of *parsimony* says that we should try to gain as much information as possible using as few covariates as possible. Then, the model at the elbow of the r-squared plot is the best model using the notion of parsimony.

Once all of these selection methods have been performed, the best model must be selected. If one model results from several of the methods, it is likely the best model. The best model can also be selected by looking at the various p-values and interpretations of the slopes of the covariates. After this model is chosen, I must check model assumptions before it can be interpreted and used. I need to check that each data value is equally reliable, that the covariates are measured without error, that the observations are independent, that a linear model is appropriate to the situation, that data is from a normal population, and that I have constant variance. The first three assumptions are checked simply by inspecting the method of data collection used. They check out for all models formed from this data. The data is all collected from reliable sources and there is no reason to believe that there are any errors present in the data values; the observations are independent of each other, since they describe individual players and their performances. A normal probability plot of the residuals is used to check that the data is from a normal population. If the normal probability plot of the residuals is approximately a straight line, it is reasonable to assume that the residuals, and thus the data, are normally distributed. I can check that a linear model is appropriate by looking at the predicted vs. residuals plot. If this scatterplot seems to be random, with no noticeable pattern, it is safe to

assume that a linear model is appropriate for the data. This plot also indicates constant variance if there is no noticeable pattern.

The covariates I selected for inclusion in the full model regression analysis and ANCOVA are *Team Wins, Early Draft, Individual Awards, Draft Pick,* and *College Touchdowns*. These variables were chosen because they had data for the majority of players in the sample set, allowing the number of data values to be maximized for the analysis. This resulted in 110 data values for the regression analysis. The dependent variable selected was *Playoff Games Won*.

Cluster Analysis

I performed several cluster analyses on the data. Cluster analysis separates data into groups that are most similar to each other by producing diagrams called *dendrograms* which begin with clusters of the most similar data and merge the remaining data with these clusters as it becomes less similar. The analysis uses a measure of distance to determine how "far apart" data values are, or how dissimilar they are from the original cluster of most similar data (Holland, 2006). The cluster analysis performed here used Euclidean distance, which is just one option for distance measures. With this analysis, it was possible to determine which variables may have a relationship with playoff success by identifying when clusters are formed of players who advanced furthest into the playoffs, and determine which variables may have a relationship with general team success by identifying when clusters are formed of the highest touchdown scoring players. It is also possible to see relationships between other variables in the analysis using this method.

I performed cluster analysis on the following subgroups: players whose teams were ranked in the AP poll at the end of their final college season, players who played for non-FBS

schools, players who won a bowl game in their final college season, players who won individual awards in college, players who were drafted in the first round of the draft, players whose NFL teams reached the Super Bowl, and players whose NFL teams won the Super Bowl.

Anticipated Results

After performing the analysis, I expected to find several results. I thought that the variables of *Individual Awards* and *College Touchdowns* would have a strong direct relationship with how far the player's NFL team advances in the playoffs. These players were chosen for the data set for having the largest scoring contribution to their playoff team, and it would make sense that players who score more touchdowns in the NFL also scored more touchdowns in college. Additionally, the individual awards received in college are intended to indicate the best players from the field and these players should theoretically have more success in the NFL.

I did not think that there would be any relationship between entering the Draft early and how far the player's team advanced in the playoffs. Some players are simply prepared to enter the NFL after their junior season, while others need another year in college to continue to develop, but this should not affect their performance later in the NFL.

Since FBS schools are schools with more emphasis on their football programs and better name recognition and prestige, they should attract the best players going into college. They should also have the best ability to prepare players to succeed in the NFL. Therefore, I thought that the status of a player's school as FBS or non FBS would definitely make a difference in how far these player's teams advanced in the playoffs, and thus that the parallel ANCOVA model or separate ANCOVA model would be a better model than the Common model, or general linear regression.

The *Team Wins* variable measures the success of the player's team as a unit in their last year of college play. I predicted that being a part of a successful team in college prepares you to succeed after college and so expected a strong direct correlation between this and advancing in the NFL playoffs as well.

Since the literature indicates that Draft location is determined primarily based on indicators which do not correlate strongly to NFL performance success, such as the Combine, I did not expect correlation between *Draft Pick* and how far teams advanced into the playoffs.

Results

Regression/ANCOVA

All data for the ANCOVA can be found in Appendix B. The first step after running Model I: Separate ANCOVA, Model II: Parallel ANCOVA, and Model III: Common Model was to determine which of these models was the most effective representation of the data. I first did hypothesis testing on the following assumptions:

H_0: The Common Model is most effective

H_a: The Parallel ANCOVA model is most effective

The test statistic for this hypothesis test is

$$\frac{(SSE_{III} - SSE_{II})/(df_{III} - df_{II})}{SSE_{II}/df_{II}} = \frac{(142.145 - 139.433)/(104 - 103)}{139.433/103} = 2.0034$$

SSE stands for the sum of squared error of the residuals of each model, and *df* represents the degrees of freedom of the model. Using α=0.05, the cutoff value of the F-distribution is 3.92. Since the test statistic is lower than this value, I fail to reject the null hypothesis. Then, I compare the Common Model to the Separate Model.

H_0: The Common model is most effective

H_a: The Separate ANCOVA model is most effective

In this case, the test statistic is

$$\frac{(SSE_{III} - SSE_I)/(df_{III} - df_I)}{SSE_I/df_I} = \frac{(142.145 - 136.832)/(104 - 98)}{136.832/98} = 0.6342$$

Using α=0.05, the cutoff value of the F-distribution for these degrees of freedom is approximately 2.72. Our test statistic is not higher than this value, so I fail to reject the null hypothesis. The Common Model is the best model for the data.

The forward selection and backward elimination are then performed on the Common Model, and I also look at r-squared plots to determine a most effective model. The statistical summaries of these processes can be found in Appendix C. In forward selection, *Team Wins* was the first variable to be added with a p-value of 0.139. The only other variable to be added was *College Touchdowns* with a p-value of 0.084. The reason that the second variable added has a smaller p-value than the first is that the model changes once the first variable is added. In backward elimination, the first variable to be removed was *Individual Awards*, with a p-value of 0.797. Next to be removed was *Draft Pick*, with a p-value of 0.481. Last, *Early Draft* was removed with a p-value of 0.601, leaving the same model as found by the forward selection.

I then ran all possible regression models, with the model having the highest r-squared value for each possible number of covariates being selected. The results are shown in Figure 1.

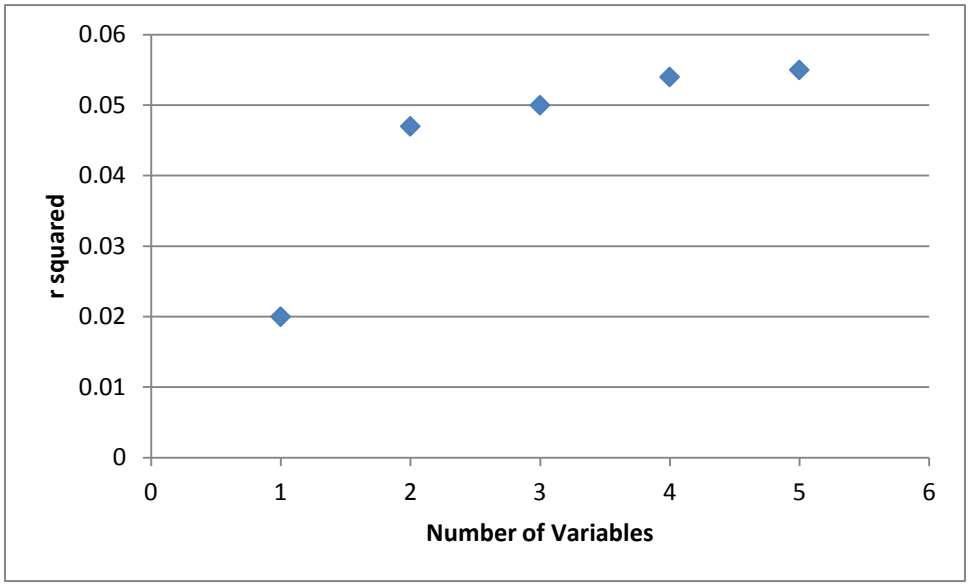

Figure 1.

The bend in the graph is at the two-covariate model, indicating that adding a third covariate does not add enough information to be worthwhile for parsimony. The two-covariate model with the highest r-squared, included in the graph, is the same model found using both of the other selection methods including *Team Wins* and *College Touchdowns*.

Based on the selection procedures used, the best model for the data appears to be the two-covariate model including *Team Wins* and *College Touchdowns*, since all of the methods selected this model. The equation from this model is

$$Playoff\ Wins = -0.088(Team\ Wins) + 0.029(College\ Touchdowns) + 1.568$$

Before I can use the selected model, I must check model assumptions. As described before, the assumptions that each data value is equally reliable, that the covariates are measured without error, and that the observations are independent check out for this data. Next, I check that data is from a normal population, using a normal probability plot of the residuals. The normal probability plot can be seen in Figure 2.

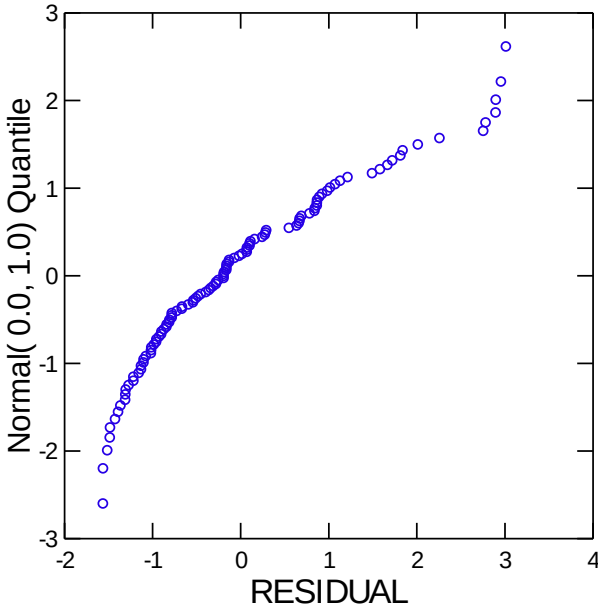

Figure 2.

The plot should look linear; unfortunately this plot has a definite curve. The reason for this is discussed in the check of the predicted vs. residuals plot.

Next, I check the assumption that a linear model is appropriate to this situation and that I have a constant variance, using a plot of predicted values vs. residuals. This plot is shown in Figure 3.

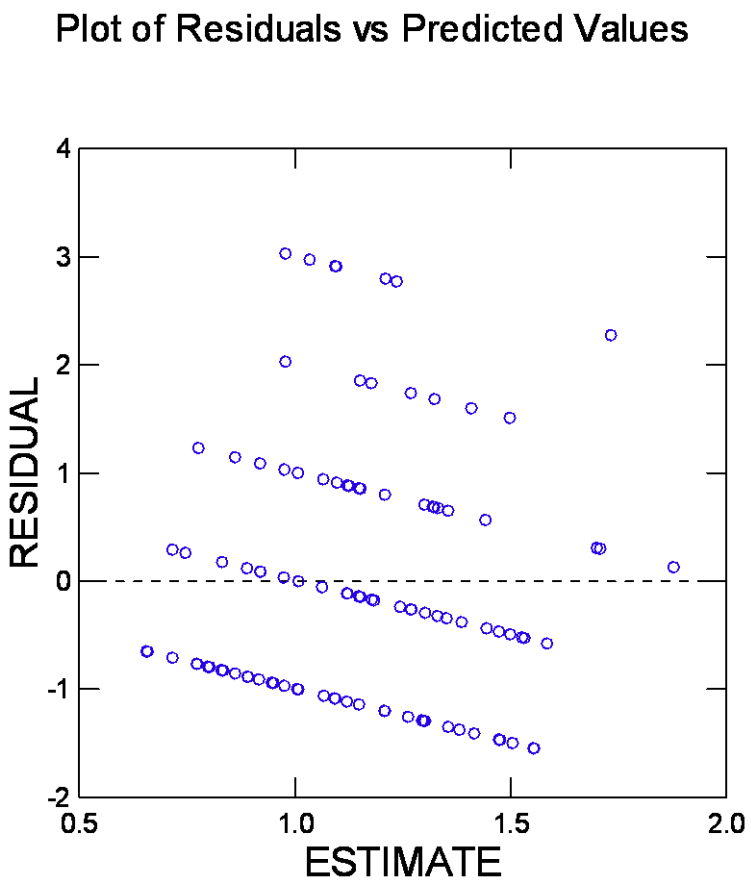

Figure 3.

Unfortunately, the plot indicates a pattern in the residuals. Five distinct lines can be seen in the plot, and upon further inspection, these lines correspond to the possible values of the dependent variable *Playoff Wins*. That is, the players whose NFL teams won zero playoff games tend to be below the regression model's prediction, and players whose NFL teams won the Super Bowl, or four playoff games, tend to be farther above the model's prediction than other data points. The model can still be used, but it should be noted that the model is probably not very strong and is limited as I discuss results. This is likely due to the low number of data values having values of 3 or 4 for the independent variable *Playoff Wins*, and the small sample size due to the limitations placed on the variables (such as only using players from the sample set who were drafted).

The first things which can be looked at when analyzing this model are the coefficients, or slopes, of each covariate. The Parallel ANCOVA keeps these slopes constant for each division, but the constant is different for each case. The -0.088 coefficient of *Team Wins* indicates an inverse relationship between the number of wins a player's college team had and the number of playoff wins their NFL team had. This is certainly surprising, as it seems logical that more successful college teams would lead to more successful NFL teams, but I should also note the small value of the coefficient. Each game the player's team wins in college only decreases the number of playoff games won by 0.088. In other words, it would take around 12 more games won in college to decrease the playoff wins by one game, and 12 games is an entire college season. Nonetheless, the inverse relationship is interesting, and the opposite of what was predicted. This relationship could be due to the fact that players from less successful college teams have to do more to be noticed from the NFL. They do not get any "free press" from their school doing well, so they are drafted or selected for an NFL team based solely on their individual performance, which has a direct relationship with *Playoff Wins* as indicated by the *College Touchdowns* coefficient. This results in a higher caliber of players from teams with fewer wins.

The coefficient of *College Touchdowns* is 0.029, indicating a direct relationship between the number of touchdowns scored in a player's final college season and how far his NFL team advances in the playoffs. This fits with the predictions, but again, the coefficient is small. A player would have to score 37 touchdowns to increase their team's playoff wins by just one game. It is likely that *College Touchdowns* really result in more NFL touchdowns scored, which does help the team reach the playoffs and win in them, but in general, fewer touchdowns are

scored in the NFL than in college, so this could explain the relatively small contribution of these touchdowns.

Next, I used the model to make some predictions. I created data values from the minimum value of each covariate, from the maximum value of each covariate, and from the mean of each covariate. Additionally, I will look at the player currently predicted to be the top drafted player in the 2013 NFL Draft to see what the model predicts their NFL success to be.

The summary statistics for the relevant variables are shown.

	Team Wins	College TDs
min	2	0
max	14	30
mean	8.51	11.56

For the minimum data value, the model gives $Playoff\ Wins = -0.088(2) + 0.029(0) + 1.568$, which predicts 1.392 playoff wins. The sample set is the top three touchdown contributing players on each team, so this shows that the teams with the lowest ranking best players in the playoffs tend to win just over one game.

For maximum data values, the FBS model gives $Playoff\ Wins = -0.088(14) + 0.029(30) + 1.568$, which predicts that the teams with players with the highest college wins and highest college touchdowns will win 1.206 playoff games. Since the model gives one direct and one inverse relationship, maximum values for all covariates will change the playoff wins slightly in favor of the one with the larger coefficient, in this case *Team Wins*. In other words, maximizing the data value in this case will actually decrease the predicted value given by the model.

Average data values give $Playoff\ Wins = -0.088(8.51) + 0.029(11.56) + 1.568$, or 1.154 playoff wins. The 95% confidence interval for this prediction is (0.936, 1.373). This makes sense, since the expected value for playoff wins is $\frac{1}{12}(4) + \frac{1}{12}(3) + \frac{2}{12}(2) + \frac{4}{12}(1) + \frac{4}{12}(0) = 1.25$, and this falls within the confidence interval for the prediction.

Models like this are constructed to be able to predict future performance, so I will test the results of the model on a current college player. Due to the restrictions of our model, it is best to look at this prediction critically and take into consideration other factors. According to NFL.com official analysts, the current top draft prospect is a quarterback, and so the model would not apply to him. The second current prospect is Marcus Lattimore of South Carolina. I will apply the model to Lattimore, although it is very important to note that Lattimore recently suffered a season-ending knee injury in which he tore all of the ligaments in his knee. The draft prospect charts note that his prospect as a number 2 pick is very reliant on his ability to recover from this injury. Since Lattimore's future is in such doubt, I will also apply the model to the third prospect, Robert Woods of USC. Data for both players will be taken from the 2011-2012 season, since the current season is not completed.

Lattimore scored 11 touchdowns last season and South Carolina won 11 games. This gives a predicted playoff win value of $-0.088(11) + 0.029(11) + 1.568 = 0.919$. If Lattimore's future NFL team makes the playoffs and he is one of their top touchdown producers, they are predicted to either lose in the first round or win one game. Woods scored 15 touchdowns last season, and USC won 10 games. The model predicts that an NFL team with Woods would win $-0.088(10) + 0.029(15) + 1.568 = 1.123$ games. According to the model, Woods would be the better addition to a team than Lattimore.

Cluster Analysis

The dendrograms produced for each cluster analysis performed can be found in Appendix D for reference. The first cluster analysis performed was on those players whose college teams were ranked in the AP poll at the end of their last season of college play. This subset includes n=53 players, and all variables besides *Final Rank* (since it was used to select the subset) were included in the cluster analysis. The dendrogram shows that all of the data in this sample is very similar, with the exception of one data point. The player in question here is Ben Obamanu of the Seattle Seahawks. Draft pick separates him from the other data; while he was drafted 249th, the next lowest drafted player in the set was selected with the 127th pick. This means that players whose college teams were ranked at the end of the previous season tend to be selected sooner by teams in the Draft. Pick 127 is in the 4th round of the Draft, while 249 is in the 7th. This shows that current Draft strategy favors more prolific and successful college programs.

The second cluster analysis was run on the set of players who played for non-FBS schools. This subset includes 16 players, and *Playoff Touchdowns, Individual Awards, Years in League, Team Wins, College Touchdowns,* and *Playoff Games Won* were the variables used. Antonio Gates of the San Diego Chargers was removed from this subset, as Gates did not play college football, rendering the *College Touchdowns* and *Team Wins* variables irrelevant to him. The dendrogram shows that the most similar data has the highest *College Touchdowns* and *Team Wins* values. This makes sense, because players from non-FBS schools must do something to gain the attention of NFL scouts, who normally pay much more attention to FBS schools. The *Team Wins* data indicates that 30% of these players' teams had 10 or more wins in their final season, which likely indicates a trip to the FCS playoffs. In *College Touchdowns,* 69% of the players scored 10 or more touchdowns in their final college season. This shows that these high

production non-FBS players who have team and individual success in college can become the players who stand out on their NFL playoff teams as well.

The cluster analysis of players whose college teams won a bowl game included variables *Team Wins, Early Draft, Individual Awards, Years in League, College Touchdowns,* and *Playoff Games Won* on a subsample of n=42 players. The only interesting component of this dendrogram is the outlier, Ricky Williams of the Miami Dolphins. Williams scored a very high number of touchdowns (27) in his senior college season. The data in this subset does not otherwise yield any interesting results.

The cluster analysis of players who were drafted in the first round of the NFL Draft (picks 1-32) gave a subset of n=43 players. The variables *Bowl Win, Team Wins, Early Draft, Individual Awards, Years in League, College Touchdowns,* and *Playoff Games Won* were used in this analysis. The clusters here are formed by a combination of *College Touchdowns* and *Team Wins*. The players whose teams won 10 or more games comprise 56% of this subset, and 70% of them scored more than 10 touchdowns in their final college season. This again points to a current Draft strategy of selecting players from successful teams who had high touchdown production higher in the Draft.

A cluster analysis was performed on the n=12 players who won individual awards during their college careers. *Team Wins, Early Draft, Draft Pick, Years in League, College Touchdowns,* and *Playoff Games Won* were the variables included. The analysis gives two outliers, who were the only two players in the subset drafted outside the first round of the Draft. This is another indicator that individual awards are used as a current Draft strategy; players who win these awards tend to be drafted in the first round. If I remove *Draft Pick* from the analysis to try to find other relationships, the data clusters by *College Touchdowns*. The last values to be

merged into clusters are the players with the lowest touchdown totals and all other players scored 15 or more touchdowns in their final college season. This makes sense, as many of these individual awards are awards given for prolific offensive contribution.

Included in the cluster analysis of teams reaching the Super Bowl were the variables *Division, Team Wins, Years in League,* and *College Touchdowns*. The n=19 players in this subset cluster by *College Touchdowns*. Outliers are Willie Parker, who scored no touchdowns in his final college season, Amani Toomer, who was in his 12th year in the league (compared to the next highest non-outlying value of 5), John Kuhn, whose college team only won four games his final season, and Randy Moss, who scored 25 touchdowns his final college season and was in his 10th year in the league. Again, about 68% of the players scored 10 or more touchdowns in their final college season. This indicates some relationship between the number of touchdowns scored in a player's final college season and their NFL team reaching the Super Bowl.

The final cluster analysis was performed only on the n=11 players in the sample whose teams won the Super Bowl. Variables included were *Division, Team Wins, Early Draft, Years in League,* and *College Touchdowns*. Before looking at the cluster analysis, it is interesting to note that none of these players won individual awards while in college. This raises a question of whether those highly prolific college players truly contribute to their NFL team's success. The clusters here again seem to form by a combination of *Team Wins* and *College Touchdowns*. However, these totals are not particularly high in comparison to the general data set.

Further Research

There are several limitations to the significance of this study. As previously stated, this is one of few studies focusing on the impact of individual players on team success, so there is a limitation because of the lack of other studies to support the findings of this one. Additionally,

this study only investigates non-quarterback and scoring offensive players, while general managers have to draft defensive players, quarterbacks, linemen, and special teams players as well. The results point to individual on-field college performance having significance, but the study only included one measure of this in *College Touchdowns*, and there are many factors that could cause this to be an inaccurate portrait of a player for a general manager trying to decide whether or not to draft him.

Since the model resulting from this data did not meet all model assumptions, it could be of interest to complete further research to try to find a better model predicting team NFL success from individual college performance. Some options include performing a similar regression analysis on the population of top players from all teams, not just playoff teams, with the independent variable being *Season Wins* rather than *Playoff Wins*. It may also be of interest to do the same model presented here with a sample of all players from playoff teams, rather than just the top players, as it may be difficult to tell which players truly contributed "most" to the team's success.

Since this study discovered the strongest link between touchdowns scored in college and team NFL success, it could be beneficial to further study links between other individual performance attributes and team NFL success. This could include yards gained, games played, receptions, and carries.

Conclusion

This study is intended to provide guidance to general managers in the NFL who want to draft college players who will give the highest possible contribution to their team's playoff success. Most previous research focuses on individual success in the NFL, rather than team

success, so this study fills a gap in research, allowing general managers to use research based techniques to determine their desired Draft order.

Many general patterns can be seen from the data. First, it seems obvious by several of the cluster analyses that the current Draft strategy being used by team general managers is not very effective. *Draft Pick* was the covariate with one of the highest p-values in pretty much every regression model run, meaning it is insignificant in terms of team success. The cluster analysis also uncovered a better description of what current Draft strategy actually is. I can see from the clusters of ranked teams and first round Draft picks that the Draft favors the most prolific college programs: those that were ranked in the top 25 of the AP poll at the end of the season and those that had 10 or more wins.

From the final model used, however, it can be seen that selecting these higher winning teams could actually be detrimental to team NFL playoff success, as indicated by the inverse relationship in the model. Perhaps general managers should look more closely at individual performance indicators, like touchdowns scored, and pay less attention to the team's success. Across all of the analyses present in this study, *College Touchdown* seems to be the best indicator of NFL team success.

At the start of the study four hypotheses were posed, and are revisited now:

Hypothesis 1: Individual college performance of players, such as on-field statistics and individual awards, have direct correlation with the number of NFL playoff games won.

On-field statistics indeed have a direct correlation with playoff games won, but individual awards do not. In fact, the cluster analysis of teams winning the Super Bowl from the sample reveals that none of them won individual awards. The expectation of these prestigious college players having the greatest NFL success seems unfounded. General managers should be aware

of the emphasis placed on these awards and avoid being tricked into drafting these players higher solely for this reason.

Hypothesis 2: Outside influences on play, such as entering the Draft early, have no correlation with the number of NFL playoff games won.

This hypothesis is supported by the evidence. *Early Draft* was removed using all regression equation selection processes, having low significance. This points to players being able to accurately judge (with advising) whether or not they are prepared to enter the NFL and making the right decisions for themselves.

Hypothesis 3: Characteristics of a player's college team experience, such as final AP rank of school (or status as a non-FBS school), bowl wins, and team record, have direct correlation with the number of NFL playoff games won.

This hypothesis was not supported by the evidence. *Final Rank* was not a significant covariate and *Team Wins* actually had an inverse correlation with *Playoff Wins*. General managers should be aware of putting too much importance on these team success indicators and pay attention instead to individual players.

Hypothesis 4: Draft location has no correlation with number of NFL playoff games won.

This hypothesis was found to be supported by the evidence of the study, indicating that general managers may benefit from reevaluating their current Draft strategies.

Through the study, it became evident that it is very difficult to predict team success from individual attributes. Very few covariates had significance in any models, and few of the cluster analyses pointed toward relationships with team success. Unfortunately, this is just what general managers are asked to do in the Draft: pick the players, based on individual attributes, that will give their team the most success. What they are doing in the Draft right now is not working

effectively towards this purpose, but it is difficult to provide much guidance as to what needs to change, as discussed in the limitations. Touchdown production is the best indicator found in this study, but further research could pinpoint more individual attributes and provide better guidance to team general managers.

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Appendix A: Raw Data

Player	Team	Year	Playoff TDs	Division	Final Rank	Bowl Win	Team Wins	Early Draft	Ind. Awards	Draft Pick	Years in League	College TDs	Playoff Games Won
Marion Barber	Cowboys	2007	11	1		1	7	1	0	109	3	11	1
Jason Witten	Cowboys	2007	7	1		0	8	1	0	69	5	5	1
Donald Lee	Packers	2007	7	1		0	3	0	0	156	5	1	2
Greg Jennings	Packers	2007	14	1		0	7	0	0	52	2	14	2
Ryan Grant	Packers	2007	11	1		0	6	0	0		1	5	2
Joseph Addai	Colts	2007	12	1	6	1	11	0	0	30	2	10	1
Reggie Wayne	Colts	2007	11	1	2	1	11	0	0	30	7	10	1
Dallas Clark	Colts	2007	12	1	8	0	11	1	1	24	5	4	1
Reggie Williams	Jaguars	2007	10	1		0	6	1	0	82	4	8	1
Maurice Jones-Drew	Jaguars	2007	12	1	16	1	10	1	0	60	2	17	1
Fred Taylor	Jaguars	2007	6	1	4	1	10	0	0	9	10	13	1
Randy Moss	Patriots	2007	24	1		0	10	0	1	21	10	25	3
Laurence Maroney	Patriots	2007	9	1		0	7	1	0	21	2	11	3
Wes Welker	Patriots	2007	10	1		1	8	0	0		3	10	3
Amani Toomer	Giants	2007	6	1	17	0	9	0	0	34	12	7	4
Plaxico Burress	Giants	2007	13	1	7	1	10	1	0	8	8	12	4
Hines Ward	Steelers	2007	7	1	10	1	10	0	0	92	10	6	0
Heath Miller	Steelers	2007	8	1	23	0	8	1	1	30	3	5	0
Santonio Holmes	Steelers	2007	9	1	4	1	10	1	0	25	2	11	0
LaDainian Tomlinson	Chargers	2007	19	1	21	0	10	0	1	5	7	22	2
Nate Burleson	Seahawks	2007	11	1		0	5	0	0	71	5	12	1

Bobby Engram	Seahawks	2007	7	1	13	1	9	0	1	52	11	12	1
Shaun Alexander	Seahawks	2007	5	1	8	0	10	0	0	19	8	23	1
Alex Smith	Buccaneers	2007	4	1		0	4	0	0	71	3	3	0
Joey Galloway	Buccaneers	2007	6	1	14	0	9	0	0	8	13	8	0
Earnest Graham	Buccaneers	2007	11	1		0	8	0	0		4	11	0
Roydell Williams	Titans	2007	4	1		0	5	0	0	136	3	12	0
Chris Brown	Titans	2007	5	1	20	0	9	1	0	93	5	18	0
LenDale White	Titans	2007	7	1	2	0	12	1	0	45	2	26	0
Chris Cooley	Redskins	2007	8	1		0	3	0	0	81	4	7	0
Clinton Portis	Redskins	2007	11	1	1	1	12	1	0	51	6	11	0
Santana Moss	Redskins	2007	4	1	2	1	11	0	0	16	7	7	0
Terrell Owens	Cowboys	2007	16	0			4	0	0	89	12	1	1
Brandon Jacobs	Giants	2007	8	0			10	0	0	110	3	19	4
Vincent Jackson	Chargers	2007	5	0			2	0	0	61	3	11	2
Antonio Gates	Chargers	2007	9	0				0	0		5	0	2
Anquan Boldin	Cardinals	2008	12	1	21	0	9	1	0	54	6	13	3
Larry Fitzgerald	Cardinals	2008	19	1		0	8	1	2	3	5	22	3
Michael Turner	Falcons	2008	18	1		0	10	0	0	154	5	14	0
Jerious Norwood	Falcons	2008	4	1		0	3	0	0	79	3	6	0
Roddy White	Falcons	2008	8	1		0	7	0	0	27	4	14	0
Le'Ron McClain	Ravens	2008	11	1		0	6	0	0	137	2	3	2
Derrick Mason	Ravens	2008	6	1		0	6	0	0	98	12	2	2

Willis McGahee	Ravens	2008	9	1	2	0	12	1	0	23	5	28	2
Steve Smith	Panthers	2008	7	1		0	4	0	0	51	8	4	1
DeAngelo Williams	Panthers	2008	18	1		1	7	0	0	27	3	19	1
Jonathan Stewart	Panthers	2008	11	1	23	1	9	1	0	13	1	13	1
Anthony Fasano	Dolphins	2008	7	1	9	0	9	1	0	53	3	2	0
Ricky Williams	Dolphins	2008	4	1	15	1	9	0	5	5	8	27	0
Ronnie Brown	Dolphins	2008	11	1	2	1	13	0	0	2	4	8	0
Bernard Berrian	Vikings	2008	8	1		1	9	0	0	78	5	4	0
Adrian Peterson	Vikings	2008	12	1	11	0	11	0	0	7	2	13	0
Correll Buckhalter	Eagles	2008	4	1	8	1	10	0	0	121	5	8	2
DeSean Jackson	Eagles	2008	5	1		1	7	1	0	49	1	6	2
Willie Parker	Steelers	2008	7	1		0	2	0	0		5	0	4
Darren Sproles	Chargers	2008	9	1		0	4	0	0	130	3	11	1
Justin Gage	Titans	2008	6	1		0	5	0	0	143	6	9	1
Chris Johnson	Titans	2008	10	1		1	8	0	0	24	1	23	1
Tim Hightower	Cardinals	2008	11	0			11	0	0	149	1	20	3
Dominic Rhodes	Colts	2008	9	0			7	0	0		7	18	0
Visanthe Shiancoe	Vikings	2008	7	0			7	0	0	91	6	4	0
Kevin Boss	Giants	2008	6	0			6	0	0	153	2	5	1
Brian Westbrook	Eagles	2008	15	0			8	0	1	91	7	29	2

Beanie Wells	Cardinals	2009	8	1	9	0	10	1	0	31	1	8	1
Ray Rice	Ravens	2009	9	1		1	8	1	0	55	2	25	1
Laveranues Coles	Bengals	2009	6	1	3	0	11	0	0	78	10	4	0
Chad Ochocinco	Bengals	2009	9	1	4	1	11	0	0	36	9	6	0
Cedric Benson	Bengals	2009	7	1	5	1	11	0	1	4	5	19	0
James Jones	Packers	2009	6	1		1	9	0	0	78	3	11	0
Sidney Rice	Vikings	2009	12	1		1	8	0	0	44	3	10	2
Benjamin Watson	Patriots	2009	5	1	7	1	11	0	0	32	1	2	0
Robert Meachem	Saints	2009	9	1	25	0	9	1	0	27	2	11	4
Pierre Thomas	Saints	2009	9	1		0	2	0	0		3	6	4
Dustin Keller	Jets	2009	5	1		1	8	0	0	30	2	7	2
Thomas Jones	Jets	2009	15	1		0	7	0	0	7	10	17	2
Braylon Edwards	Jets	2009	5	1	14	0	9	0	1	3	5	15	2
Brent Celek	Eagles	2009	8	1		1	8	0	0	162	2	3	0
Jeremy Maclin	Eagles	2009	5	1	19	1	10	1	0	19	1	15	0
Patrick Crayton	Cowboys	2009	7	0			11	0	0	216	6	19	1
Miles Austin	Cowboys	2009	12	0			6	0	0		3	11	1
Donald Driver	Packers	2009	6	0			5	0	0	213	11	10	0
Marques Colston	Saints	2009	10	0			7	0	0	252	4	5	4
Tony Gonzalez	Falcons	2010	6	1		0	6	1	0	13	14	5	1
Devin Hester	Bears	2010	7	1	17	0	9	0	0	57	4	0	2
Matt Forte	Bears	2010	9	1		0	4	0	0	44	3	23	2
Austin Collie	Colts	2010	8	1	25	0	10	1	0	127	2	15	0

Jamaal Charles	Chiefs	2010	9	1	10	1	10	1	0	73	3	18	0
Dwayne Bowe	Chiefs	2010	15	1	3	1	11	0	0	23	4	12	0
Rob Gronkowski	Patriots	2010	10	1		1	8	1	0	42	1	10	1
BenJarvus Green-Ellis	Patriots	2010	13	1		0	3	0	0		3	6	1
Chris Ivory	Saints	2010	5	1		0	2	0	0		1	1	0
Lance Moore	Saints	2010	8	1		0	9	0	0		5	14	0
LeSean McCoy	Eagles	2010	9	1		0	9	1	0	53	2	21	0
Mike Wallace	Steelers	2010	11	1	14	1	9	0	0	84	2	7	3
Rashard Mendenhall	Steelers	2010	17	1	20	0	9	1	0	23	3	19	3
Ben Obomanu	Seahawks	2010	4	1	14	0	9	0	0	249	3	5	1
Marshawn Lynch	Seahawks	2010	7	1	14	1	10	1	0	12	4	15	1
Mike Williams	Seahawks	2010	5	1	1	1	12	1	0	10	4	16	1
Johnny Knox	Bears	2010	5	0			11	0	0	140	2	13	2
John Kuhn	Packers	2010	6	0			4	0	0		4	14	4
Pierre Garcon	Colts	2010	7	0			14	0	0	205	3	16	0
Julio Jones	Falcons	2011	8	1	10	1	10	1	0	6	1	7	0
Ed Dickson	Ravens	2011	5	1	11	0	10	0	0	70	2	6	2
Torrey Smith	Ravens	2011	8	1	23	1	9	1	0	58	1	12	2
Jermaine Gresham	Bengals	2011	6	1	5	0	12	0	0	21	2	14	0
AJ Green	Bengals	2011	7	1		0	6	1	0	4	1	9	0
Eric Decker	Broncos	2011	9	1		0	6	0	0	87	2	5	1
Demaryius Thomas	Broncos	2011	5	1	13	0	11	1	0	22	2	8	1
Kevin Smith	Lions	2011	7	1		0	10	1	0	64	4	30	0
Titus Young	Lions	2011	6	1	9	1	12	0	0	44	1	9	0

Calvin Johnson	Lions	2011	18	1		0	9	1	1	2	5	15	0
Jermichael Finley	Packers	2011	8	1	10	1	10	0	0	91	4	2	1
Jordy Nelson	Packers	2011	15	1		0	5	0	0	36	4	11	1
Joel Dreessen	Texans	2011	6	1		0	4	0	0	198	6	3	1
Ben Tate	Texans	2011	4	1		1	8	0	0	58	1	10	1
Arian Foster	Texans	2011	16	1		0	5	0	0		3	1	1
Jimmy Graham	Saints	2011	14	1	19	0	9	0	0	95	2	5	1
Ahmad Bradshaw	Giants	2011	10	1		0	5	0	0	250	5	21	4
Hakeem Nicks	Giants	2011	11	1		0	8	1	0	29	3	12	4
Antonio Brown	Steelers	2011	3	1		1	12	0	0	195	2	9	0
Frank Gore	49ers	2011	8	1	11	1	9	1	0	65	7	8	2
Michael Crabtree	49ers	2011	5	1	12	0	11	1	2	10	3	19	2
Vernon Davis	49ers	2011	10	1		0	5	1	0	6	6	6	2
Victor Cruz	Giants	2011	10	0			5	0	0		1	5	4

Appendix B: Regression Analysis Results

Common Model:

	Value	Std. Error	t value	P-value
Intercept	1.398	0.473	2.957	0.004
Team Wins	-0.086	0.047	-1.825	0.071
Early Draft	0.169	0.242	0.672	0.503
Individual Awards	-0.053	0.204	-0.258	0.797
Draft Pick	0.001	0.002	0.631	0.529
College TDs	0.03	0.018	1.691	0.094
SSE	142.145			
df	104			
rsquared	0.055			
n	110			

Parallel ANCOVA Model:

	Value	Std. Error	t value	P-value
Intercept	2.046	0.656	3.117	0.002
Team Wins	-0.087	0.047	-1.85	0.067
Early Draft	0.22	0.253	0.87	0.386
Individual Awards	-0.054	0.203	-0.268	0.789
Draft Pick	0	0.002	-0.028	0.978
College TDs	0.026	0.018	1.446	0.151
Division	-0.584	0.412	-1.415	0.16
SSE	139.433			
df	103			
rsquared	0.073			
n	110			

Separate ANCOVA Model:
FBS Schools:

	Value	Std. Error	t value	P-value
Intercept	1.777	0.542	3.28	0.001
Team Wins	-0.11	0.052	-2.126	0.036
Early Draft	0.238	0.247	0.964	0.339
Individual Awards	-0.033	0.198	-0.169	0.866
Draft Pick	-0.001	0.002	-0.343	0.732
College TDs	0.019	0.019	1.002	0.319
SSE	116.539			
df	92			
rsquared	0.061			
n	98			

Non-FBS Schools:

	Value	Std. Error	t value	P-value
Intercept	1.243	1.597	0.779	0.462
Team Wins	-0.096	0.223	-0.431	0.68
Individual Awards	-1.287	2.656	-0.485	0.643
Draft Pick	0.001	0.01	0.068	0.948
College TDs	0.095	0.111	0.855	0.421
SSE	20.293			
df	7			
rsquared	0.105			
n	12			

Appendix C: Forward and Backward Selection Results:

Forward Selection:

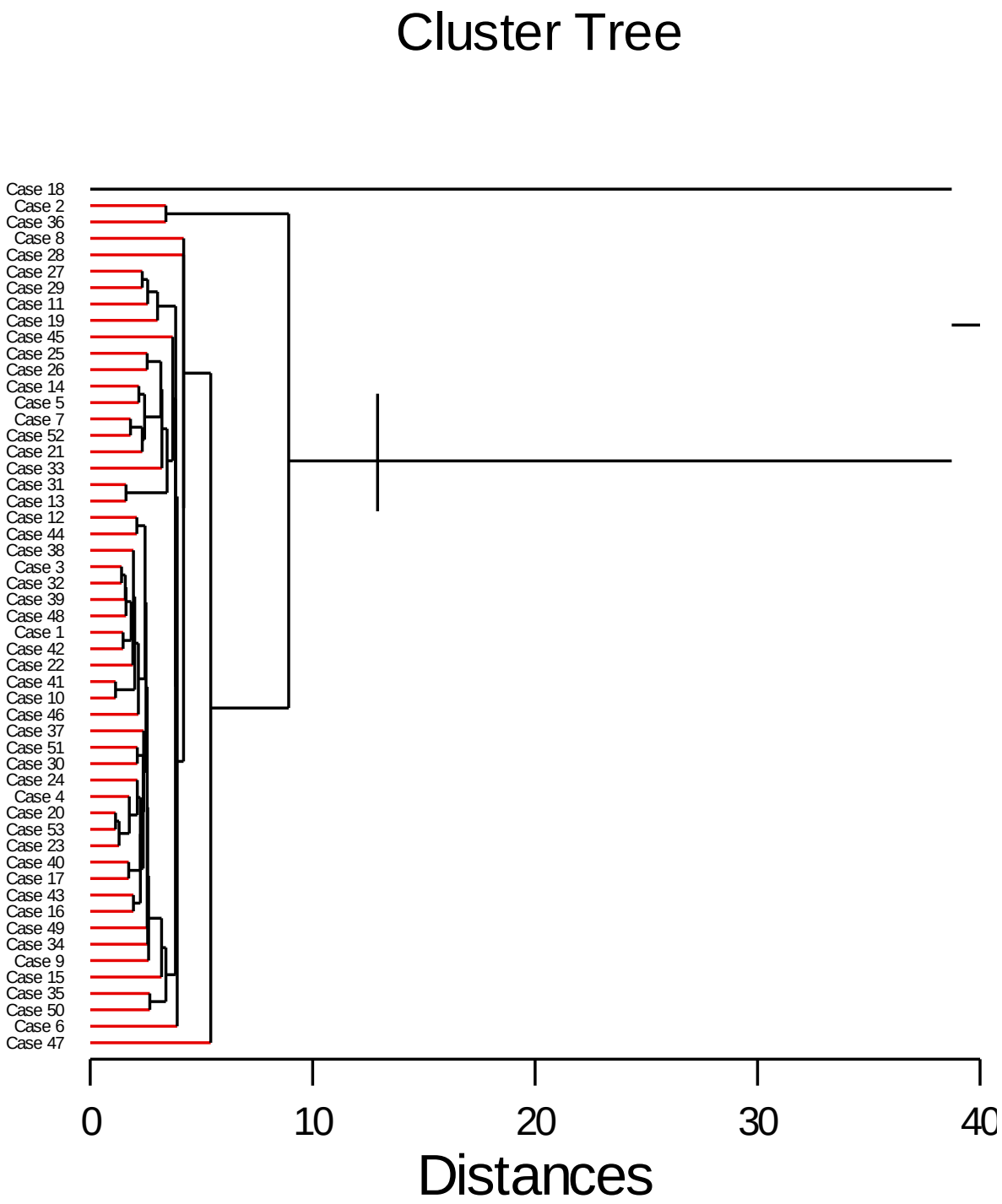
	Value	Std. Error	t value	P-value
Intercept	1.568	0.401	3.911	0
Team Wins	-0.088	0.046	-1.916	0.058
College TDs	0.029	0.017	1.744	0.084

Backward Elimination:

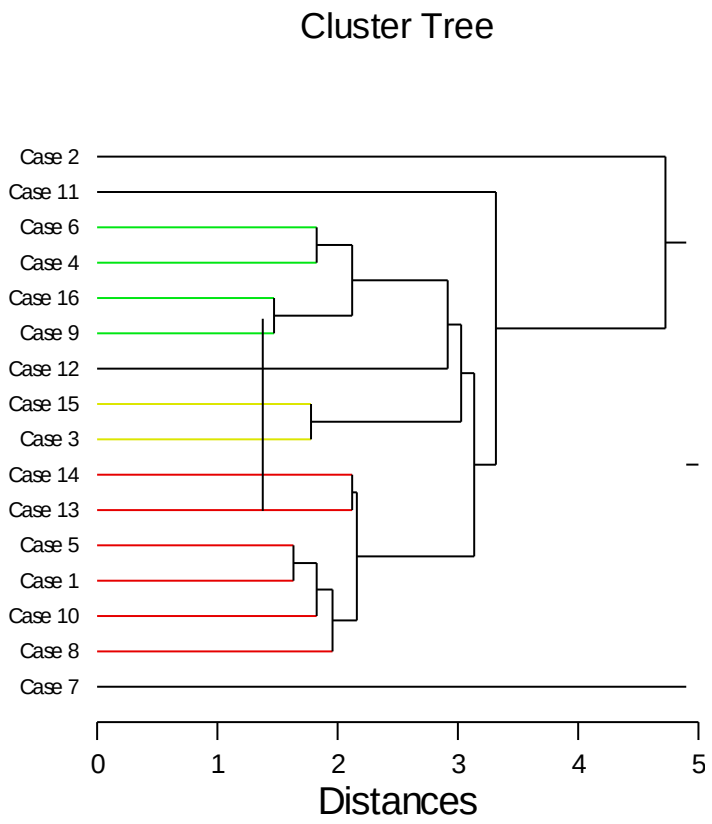
Same result as forward selection

Appendix D: Dendrograms

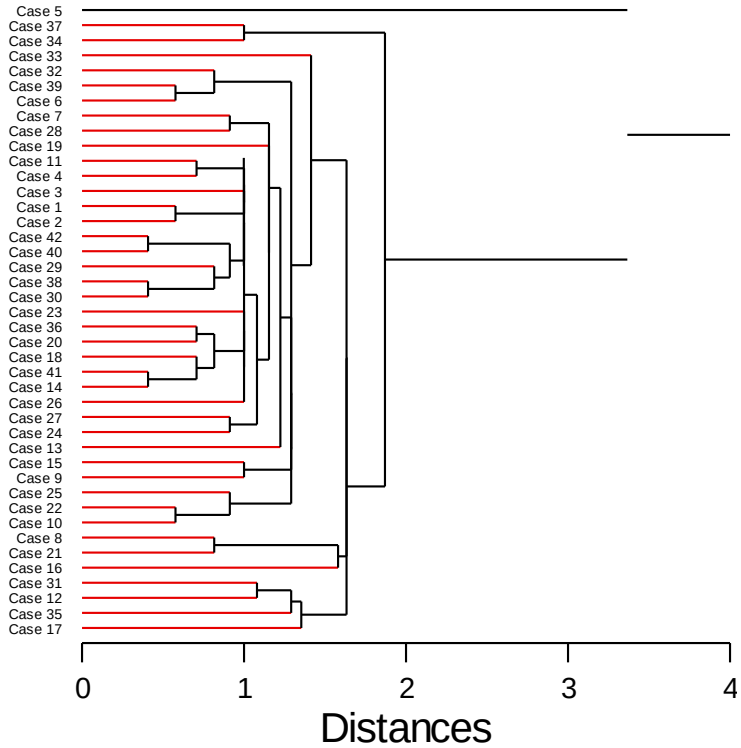
Ranked Teams:



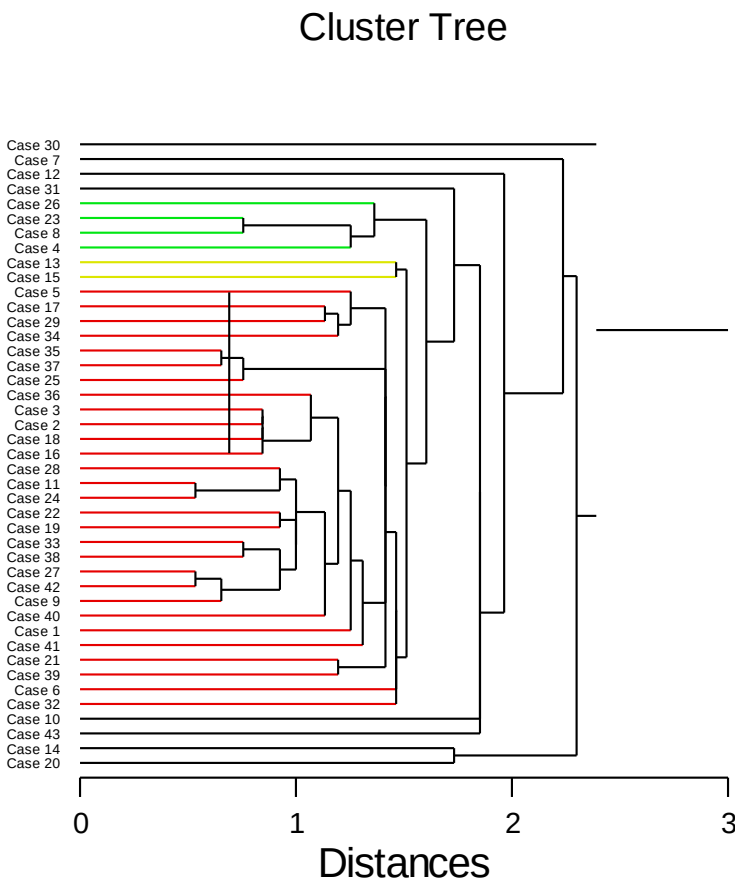
Non-FBS Players:



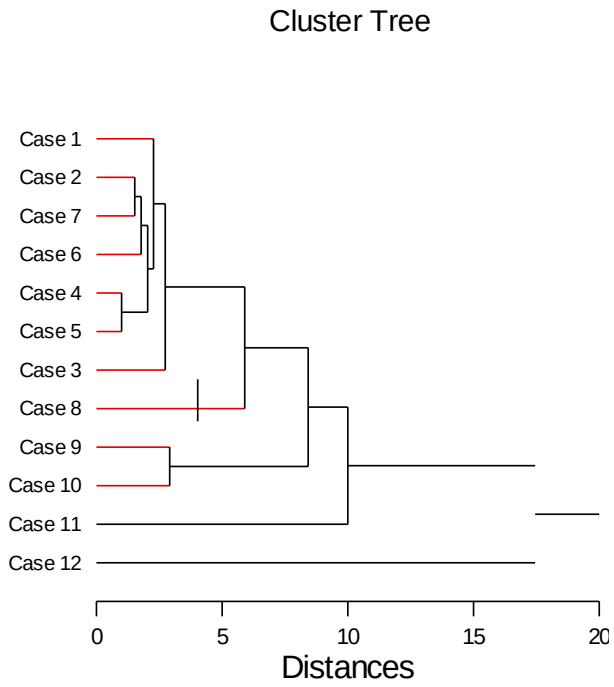
Bowl Winning Players:



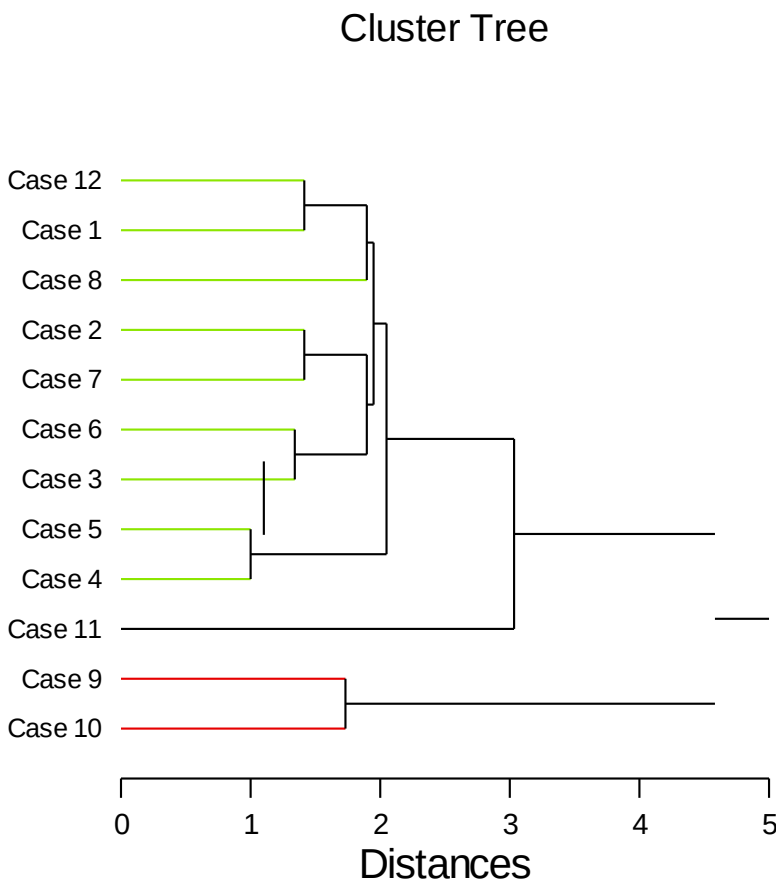
First Round Drafted Players:



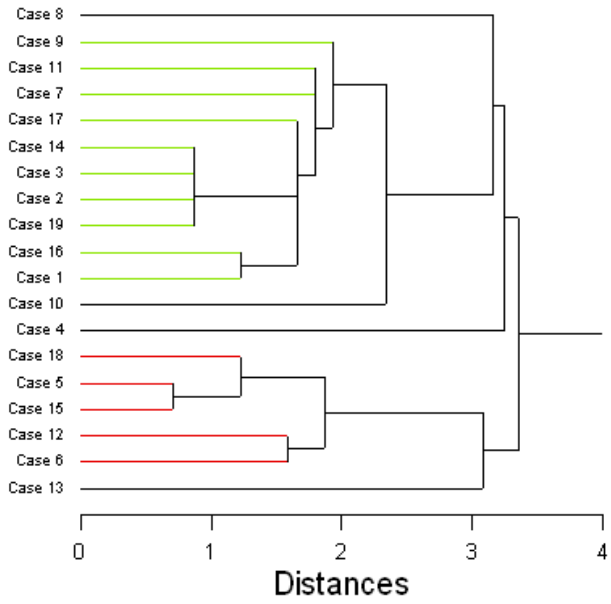
Individual Awards:



Individual Awards without *Draft Pick:*



Teams Reaching Super Bowl:



Super Bowl Champions: