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COMPARATIVE ANALYSIS OF FANTASY FOOTBALL DRAFT PROJECTION ACCURACY

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ABSTRACT

Today's fantasy sports industry is worth $2 billion. In 2008, 22% of adult male Americans with Internet access between the ages of 18 and 49 competed in at least one fantasy sports league. Of the 27 million Americans that play at least one fantasy sport, 85% play fantasy football. The game has gotten so competitive that many fantasy football owners rely on expert advice to make their fantasy draft decisions. Although the draft is critical to a fantasy team's success and dozens of agencies produce fantasy draft projections, little has been done to determine which set of draft projections is most accurate. The purpose of this study is to compare three popular sources of fantasy football draft projections (Yahoo, ESPN, and Sports Illustrated) and determine which agency provides the most consistently accurate fantasy football draft projections.

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SECTION I: INTRODUCTION

THE RULES OF FANTASY FOOTBALL

Fantasy football involves "owners" holding a draft to pick a team of NFL "players" to compete against other teams in their "league" according to a mathematical formula that converts NFL statistics into "points." After the draft, owners can trade players with other owners or drop players from their team to pick up free agents (players not initially on another team). Each week, owners select a predetermined number of their players at each position to form a starting lineup; only the players in this starting lineup contribute to their team's point total for that week.

A fantasy football season begins with a draft: owners take turns selecting players for their team. The ability to identify the best player available in each round of the draft is critical to a team's success throughout the rest of the season. This is a difficult task for even the most knowledgeable NFL fan – it requires a deep understanding of hundreds of individual players across the country. As a result, many owners turn to third-party agencies for fantasy football player projections to guide their decisions during the draft.

If one set of projections is more accurate than another, then owners could gain an advantage by identifying it. For example, in 2010, Dwayne Bowe finished as the second best wide receiver. Yahoo projected him as the 15^{th} best among receivers while ESPN and Sports Illustrated projected him at 20^{th} and 29^{th} respectively. Bowe tallied 206.6 fantasy points while the receivers that ESPN and Sports Illustrated projected 15^{th} in 2010 only scored 107.1 and 125.9 fantasy points respectively. Owners trusting ESPN and Sports Illustrated would have passed on Bowe during their

draft, but those using Yahoo to make their draft selections would have had a significant advantage. The purpose of this paper will be to compare the consistency and accuracy of three popular agencies used by fantasy football team owners in selecting players. Although a fantasy team includes several positions, this analysis will be restricted to two: running backs and wide receivers.[1]

THE RISE OF FANTASY FOOTBALL

The $2 billion fantasy sports industry traces its roots back to 1960 when William Gamson, a Harvard sociologist, created the concept (Neiger, 2010). He and his friends would select baseball players through an auction and earn points based on their final batting average, runs batted in, earned run average, and wins in a game called the "Baseball Seminar." Gamson later brought the Baseball Seminar to the University of Michigan where it made an impression on a student named Dan Okrent who would go on to work for Sports Illustrated. In 1980, Okrent built upon Gamson's idea and created Rotisserie League Baseball with a group of sports journalists that met regularly for lunch at a Manhattan restaurant called La Rotisserie Française (Walker, 2006, p. 66). Okrent's version of the game included an auction-style draft, expanded roster, trades, free agents, and eight measures of player performance. Okrent's Rotisserie League Baseball spread through the New York sports media, and when he published an essay with the rules in May of 1981, thousands of people began playing. The game's popularity created a national

[1] In the author's experience as an avid fantasy football league owner, he has observed that Yahoo, ESPN, and Sports Illustrated have been popular sources for fantasy draft projections among owners in his leagues.

obsession with sports statistics. In 1982, the USA Today began to publish its paper on a daily basis specifically to keep up with the growing demand for statistics for fantasy baseball: sports editor Henry Freeman said the statistics page "is to the paper what the sun is to Miami."(Schwarz, 2004, p. 174-178). From 1991 to 1994, the number of fantasy baseball players increased from one million to three million (Walker, 2006, p. 72).

In 1962, a few years after Gamson created the Baseball Seminar, Bill Winkenbach created the framework for fantasy football when he founded the Greater Oakland Professional Pigskin Prognosticators League (GOPPL) (Dickey, 2004). Winkenbach, a limited partner with the 1962 Oakland Raiders of the American Football League, developed a system for reporters and friends to draft a team of football players and bet on their individual scoring performance. Another founding member of the GOPPL said, "[Winkenbach] would sit together with the other limited partners at home Raider games, and for the first couple weeks of the season their big concern was not how the Raiders were doing, but how well their GOPPL team was playing" (Harris and Kadlec, n.d.). Winkenbach's rules were eventually modified in the 1970s to include yards gained, but today's fantasy football rules remain very similar to the GOPPL's (Harris and Kadlec, n.d.). The game spread through bars and offices in the San Francisco Bay Area and eventually reached the entire country (Esser, 1994). In 1990, "The Pigskin Playoff," a public fantasy football competition, was printed in 12 major newspapers and attracted over 135,000 fantasy owners (Wojitas, 1991).

The rise of the Internet in the mid-90s fueled the growth of fantasy sports immensely. In 1996, Commissioner.com launched a service to host fantasy leagues and automate the scoring process for $300 per league. This service was so successful that Sportsline bought it in 1998 for $31 million (Walker, 2006 p. 72). In 1999, Yahoo made fantasy sports even more accessible by offering one of the first free online services to host fantasy leagues ("YAHOO!," 1999).

Today, fantasy sports are estimated to be a $2 billion industry (Neiger, 2010). To put this figure into perspective, the NFL generated $9 billion in revenue in 2009 (Bell, 2011). In 2008, 22% of adult male Americans with Internet access between the ages of 18 and 49 competed in at least one fantasy sports league (Smith, 2009). Fantasy enthusiasts can choose from a wide variety of sports that includes football, baseball, basketball, hockey, golf, NASCAR, world soccer and more. However, of the 27 million Americans that play at least one fantasy sport, 85% play fantasy football (*Fantasy Sports Trade Association*, 2010; Clemens, 2010).

Fantasy football has grown into an $800 million dollar industry since Winkenbach first created the framework for the game in 1962. The game has grown to such a tremendous scope that fantasy owners can even invest in insurance for their key players or pay lawyers to settle collusion disputes (McLaughlin, 2009). In 2009, ESPN offered more than $40,000 in prizes for the top owners in prize-eligible fantasy football leagues. Since the law views fantasy sports as games of skill rather than luck, it is completely legal to place bets. In one high-stakes league of high-power executives, fantasy football owners compete for $1 million in prize money every year.

Meanwhile, owners in more typical private leagues might contribute up to $500 each to the prize pool (Weinbach, 2008).

SECTION II: LITERATURE REVIEW

Sara Holladay has ranked the accuracy of fantasy football projections annually since 2006. Her work has appeared in the New York Times "Fifth Down" NFL blog since 2007. In 2006 and 2007, she simply summed the absolute difference between the projected ranking and final ranking for each agency's top 100 projected players to determine which agency was most accurate (Holladay, 2007; Holladay, 2008).

In 2008, Holladay partnered with the Fantasy Sports Trade Association in her annual review of fantasy football projection accuracy. She improved her methodology by squaring the difference in projected and final rank for each player to penalize large errors. She also provided separate evaluations of the best predicting agencies for each position. However, she only evaluated the top ten players at each position, which, in some cases, was not enough data to clearly identify one agency as significantly the best. Holladay mentions, "The average squared difference for the top 12 sites for WR rankings were all within about 4 points of one another" (Holladay, 2009). In 2009 and 2010, Holladay changed the number of players per position that she analyzed to 25 quarterbacks (QBs), 50 running backs (RBs), 50 wide receivers (WRs), and 20 tight ends (TEs).

In addition to an annual projection accuracy evaluation, Holladay has also written articles on the most accurate agencies over the past three years at each position. These rankings are based on an average of the percentiles in which each agency finished each of the past three seasons (Holladay "Multi-Year," 2010). Unfortunately, since Holladay only ranked the top ten players in each category three seasons ago, (as compared to the top 20-50 in the past two years, depending on

position) this is not a fair comparison. An agency that may be very good at ranking the top 10 and very poor at ranking other players would benefit from the methodology used in 2008. Also, since there is such little separation between agencies among the top 10 players, percentile is a poor measure to capture the magnitude of the difference between agencies each year. For example, this method puts too much weight on years such as 2008 when 12 agencies predicted WRs with average squared difference scores within 4 points of each other.

FantasyFootballNerd.com (FFN) conducts a projection analysis and takes the concept a step further: they gather projections from each agency and weight them according to their credibility to form their own list of fantasy draft projections. The methodology used to determine the top agencies or even their rankings is not public information (Dyken, n.d.).[2] In 2008, FFN participated in Sara Holladay's fantasy football projection accuracy challenge and did not finish in the published top 10 of 23 participating agencies (Holladay, 2009). It is unclear whether or not FFN participated in Holladay's 2009 or 2010 competitions, but FFN did not appear in the published lists for top 10 agencies for each position or top 15 agencies for all positions in either of these years (Holladay, 2010; Holladay, 2011).

One weakness in Holladay's original method is that the difference in rankings is not squared and therefore does not penalize agencies enough for the large errors that could devastate an owner's fantasy season. Another problem is that she grouped all of the positions together: past the first few rounds of the draft, most owners are

[2] In correspondence with Joe Dyken, creator of FFN, he declined to be a part of this study, and explained "unlike other sites, FFN has obtained permission from the various sources to aggregate their data. Part of the agreement with several of the sites is to not display them side by side with their competitors. …releasing that data would constitute a breach of trust."

looking for a player at a certain position. It's more useful to be able to predict the order in which each WR is ranked than to be able to predict how many players from other positions will be ranked in between them. Holladay resolved these issues in her analysis of 2008, 2009 and 2010, but the inconsistent methodology makes it difficult to make comparisons across all five years. Finally, Holladay did not perform any statistical comparisons; "best" was simply decided by the agency with the lowest sum or average. With the results provided by year, there was no measure of consistency over time.

This study has several key differences from the previous work done on this topic. Rather than analyzing a given year, this study will look at the past five years (2006-2010) and compare the projected and final ranks of the top 32 projected running backs and the top 32 projected wide receivers under the same consistent method. This is more useful in determining the best agency for a fantasy owner to use for draft projections going forward. Holladay's number one agencies for WRs and RBs in 2009 did not even finish among the top 10 agencies for these positions in 2010. Therefore, if an owner had used the agencies recommended in 2009 during the 2010 draft, they would have done poorly. By measuring error over time, we can analyze which, if any, agency is statistically more consistent.

SECTION III: MODEL AND PROCEDURE

DEFINITION OF VARIABLES

The metric used to evaluate the agencies was a squared error score (SES). Each agency's projection of the top 32 RBs and 32 WRs contains each player's preseason rank. Ordering each player according to his final season fantasy points yielded a final rank for each player. The SES for each player was calculated by squaring the difference between his preseason rank and final rank. A player's preseason rank can range from 1 to 32, because only the top 32 players were considered. However, a player's final rank can range from 1 to more than 100: every player in the NFL was considered in calculating the final rank for the players of interest. Therefore, a lower SES would demonstrate an actual rank closer to the projected rank for that player. The analysis compared the mean SES across the five-year period for the two factors. The calculation of SES for any given year is provided in Equation 1.

(1) $\text{SES} = \sum_{k=1}^{32}\left(\text{Y}_{\text{ijk}} - A_{ijk}\right)^2$, where i = 1 to 2, j = 1 to 3, and k = 1 to 32 and,

Y_{ijk} = projected rank for Position i in Agency j for Player k,

A_{ijk} = actual rank for Position i in Agency j for Player k

i = 1 to 2, j = 1 to 3, and k = 1 to 32

This calculation reflects a squared Euclidean distance between projected and final player rankings. Empirically, the SES derived by this sum of squared differences compared to sum of absolute differences utilized by Holladay in 2006 and 2007 provided stronger evidence that the dependent variable followed a normal distribution; an assumption of the statistical model employed. A test of normality -

where the null hypothesis is the assumption of normality - for SES using the square root method resulted in a p-value of 0.313; the p-value using absolute differences was 0.039. The higher p-value provided stronger evidence that normality was plausible.

The necessary NFL data to determine each player's final fantasy rank was collected from Pro-Football-Reference.com's database of NFL statistics. Sports Illustrated (SI) preseason rank data was gathered from back issues of the magazine on the SI Vault.[3] ESPN preseason rank data was made available by James Quintong, an editor for ESPN.com Fantasy. Sara Holladay, of the New York Times Fifth Down NFL blog, provided Yahoo preseason rank data for 2006-2010. However, since she collected her data for 2006 and 2007 a month in advance of the first game of the season, the Wayback Machine was used to collect data closer to the beginning of the season for more consistent timing ("Internet Archive," n.d.).[4] The data for each source was collected prior to the first game of the each season and as close to the first game as possible.

All of these sources base their projections on the same standard scoring system. This system was also used in calculating each player's final fantasy points:

- Rushing Yard = 0.1 point
- Rushing TD = 6 points
- Receiving Yard = 0.1 point
- Receiving TD = 6 points

[3] The SI Vault (http://sportsillustrated.cnn.com/vault/) contains all of the back-issues of Sports Illustrated. In 2006 and 2007, SI did not print fantasy football projections; instead, these issues directed readers to look for up-to-date projections online. In 2008-2010, SI printed projections in their magazine. In 2009, SI's final set of projections was published in the June issue – two months before the start of the season. These projections won't be able to account for key injuries and trades during July and August.

[4] The Wayback Machine archives web pages back to 1996. Users can view pages as they appeared on specific dates in the past.

Typical leagues allow RBs to accumulate receiving points and WRs to accumulate rushing points. However, RBs and WRs do not score points for passing statistics. These conditions are consistent with the scoring system used to calculate final fantasy points.

These variables were measured over the course of the most recent five seasons (2006-2010) for the top 32 projected wide receivers and running backs by each agency. Standard fantasy football leagues typically consist of 16 teams starting 2 players at each of these positions. Therefore, any players drafted after the top 32 at each position are less likely to start and are expected to be less significant to a team's overall success. These players earn significantly fewer fantasy points in a season, as demonstrated in Figure 1 and Figure 2 of the Appendix. Additionally, owners are less reliant on draft projections when drafting players outside the top 32.[5]

STATISTICAL MODEL

To analyze the difference in projections, the mean SES was compared across each agency and position for five years. If each set of projections was equally accurate, they should all have approximately the same SES over time. Therefore, the means of the SESs should be approximately equal for all agencies and positions throughout the five years (2006-2010). An interaction was considered between Agency and Position but was found to be insignificant (p-value 0.961) [See Table 1].

[5] In the author's experience as an avid fantasy football league owner, he has observed that owners tend to make more strategic decisions in this phase of the draft instead of simply drafting the player with the greatest expected fantasy points. For example, owners may look for consistently mediocre veterans to guarantee a few points during a starter's bye week, or they may take a chance on a rising star with upside potential. At this point in the draft, owners will likely do research on individual players and make decisions based on their appetite for risk instead of following a predetermined draft order.

SAS Proc Mixed was used to model this data. For a sample of the SAS code used in this analysis, see Figure 3 of the Appendix. Each model used two factors: Agency and Position, where Agency had three levels (ESPN, SI, and Yahoo) and Position had two levels (RB and WR). These factors were repeated over the five years. The first model was a two-factor ANOVA model that treats individual years as independent trials. Since an agency is likely to predict about as well as they did the previous year and a position is likely to be about as volatile as it was the previous year, the next model used repeated measures to account for dependency across years. The second, more complex model was a repeated measures two-factor crossed model.

Further analysis was conducted to determine if the two-factor ANOVA model was sufficient compared to the repeated measures model. Four fit statistics were examined: -2 Log Likelihood, AIC, AICC, and BIC. For AIC, AICC, and BIC, a smaller fit statistic indicates a better fit. The difference in -2 Log Likelihood is known to follow a Chi-square distribution with degrees of freedom equal to the difference in model covariance parameters. This structure is reasonable given the yearly spacing of the response (Littell et al., 1996).

A likelihood ratio test was used to compare the -2 Log Likelihood statistics of the two models. In this test, the alternative hypothesis is that the repeated measures model is better than the ANOVA model. Under a difference in covariance parameters of 2, the Chi-square test of the -2 Log Likelihood parameter yields a 0.095 p-value. Based on this result and the lower AIC and BIC fit statistics, we rejected the null hypothesis and decided the repeated measures model to be appropriate [See Table 2].

STATISTICAL PROCEDURE

In the repeated measures two-factor crossed model for each of the agencies and positions repeated over years, the null hypothesis is the projections are equally accurate, and the alternative hypothesis is that the accuracy of the projections is significantly different. The procedure described below for agencies is the same for position and agency by position. This test evaluates the null hypothesis that each agency's mean SES is equal. Even if only one agency's mean SES is significantly different from the rest, the hypothesis is rejected, and we would conclude the alternative hypothesis: each agency's set of fantasy draft projections is not equal.

Since there was no significant interaction, a test was conducted to test for mean differences in SES for Agency and Position. An interaction plot is given in Figure 4. For any significant results, two-way comparisons of means were conducted. With three agencies, an adjusted Tukey-Kramer p-value was used in these. Since there were only two positions being compared, no p-value adjustment was needed for this test of mean differences. Therefore, two questions remained:

1. Is there a main effect for Agency, and if so, which agency or agencies performed better in their projections?
2. Is there a main effect for Position, and if so, which position was easier to project?

SECTION IV: RESULTS

AGENCY

The effect of agency (p-value of 0.0624) was significant [See Table 3]. This indicated a significant difference between the accuracy of the agency projections.

Since the agency effect was significant, each pair of agencies was also analyzed. SI was significantly more accurate than ESPN (Tukey-Kramer adjusted p-value of 0.0598). However, no other significant conclusions could be drawn: SI was not significantly different from Yahoo, (Tukey-Kramer adjusted p-value of 0.1999) and ESPN was not significantly different from Yahoo (Tukey-Kramer adjusted p-value of .7962) [See Table 3]. These results illustrated that SI was clearly better than ESPN, but not significantly different from Yahoo. Similarly, ESPN and Yahoo were not significantly different.

POSITION

With a p-value of 0.0057 there was a strong significant main effect for position [See Table 4]. Since RB was compared to WR, we concluded that RB projections were significantly more accurate than WR projections.

Given the nature of these positions, this is not surprising. Top RBs will generate points more consistently since they will nearly always have an opportunity to get their carries. Top WRs, however, are harder to predict since a star receiver's fantasy impact is more likely to be nullified by opposing teams' defensive schemes targeting this player. This creates opportunities for other WRs to take advantage of holes in the defense and outperform their expectations.

SECTION V: CONCLUSION

There was a significant difference in the accuracy of fantasy football draft projections among the three agencies investigated: ESPN, SI, and Yahoo. In particular, SI had significantly more accurate projections than ESPN. Yahoo's accuracy was not significantly different from ESPN's or SI's.

SI was the only one of the three agencies to be significantly better than another agency at projecting the top 32 RBs and top 32 WRs from 2006-2010. Given this performance over time, fantasy football owners should use SI for their draft projections.

This study also showed that RB projections are significantly more accurate than WR projections across agencies. Fantasy owners should be aware that when they are drafting a WR, they are taking a much greater risk than when they are drafting a RB. That is to say, a first round pick on a WR is much more likely to be a bust than a first round pick on a RB. This confirms the conventional wisdom in fantasy football drafts to focus on RBs first.

Although SI was the only printed source of the three, it was the only source to be significantly more accurate than another. This was surprising. Since online projections can be updated until hours before the first game of the season, print magazines can be outdated by the start of the season. This allows online projections to account for the suspensions and injuries that occur during the summer, possibly leading fantasy team owners to perceive them as more reliable. The results of this study, however, concluded that SI was able to overcome this disadvantage and make more accurate projections than an online source. Owners should choose a set of

projections based on the agency rather than making assumptions based on its medium. However, owners using a printed source should also use more current resources to avoid drafting an injured or suspended player.

This study does have some limitations. With only the top 32 players at each position being considered, owners should rely on their own research to make strategic decisions in later rounds of the draft or if drafting players outside the projected top 32. This study could also be expanded to include more agencies. There are more than 50 agencies that provide information on NFL players for use in fantasy football; this study considered only three. Finally, in each fantasy football season there are players called sleepers who substantially outperform their low expectations. Many projection agencies provide a separate list of potential sleepers. An analysis of an agency's ability to predict sleepers is another condition to be considered.

SECTION VI: APPENDIX

Figure 1: Points per rank, Running Backs

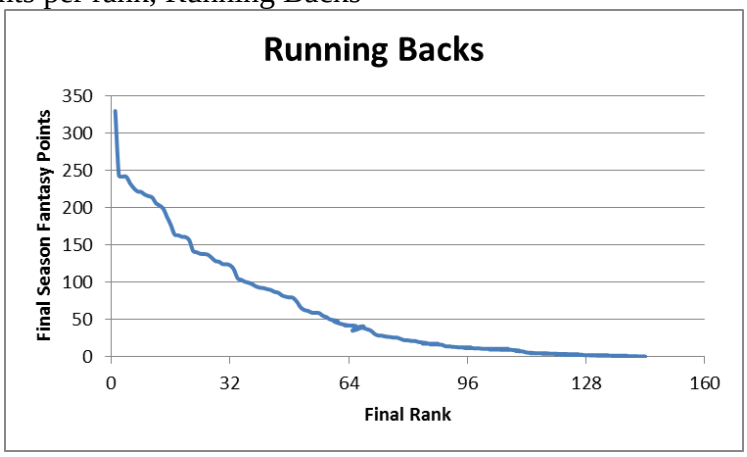

Figure 2: Points per rank, Wide Receivers

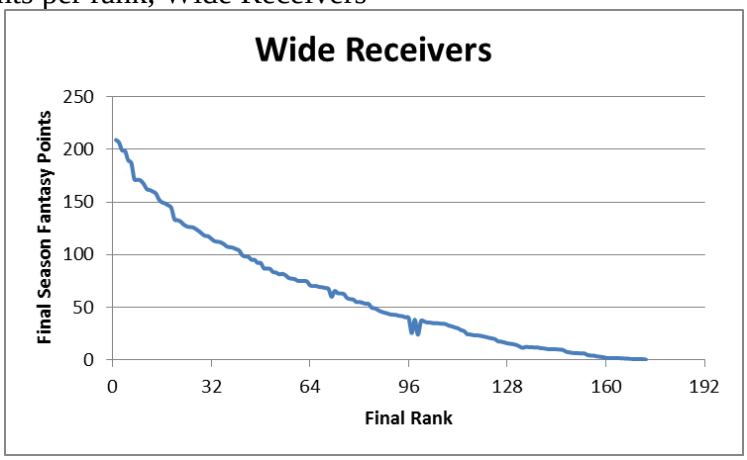

Figure 3: Sample SAS Code

```
proc mixed data=Fantasy;
  class resource position year;
  model score = resource | position;
  run;

proc mixed data=Fantasy;
  class resource position year;
  model score = resource | position;
  random year;
  repeated / subject=resource type=ar(1);
  lsmeans resource position /adjust=tukey diff;
  run;
```

Figure 4: Interaction plot

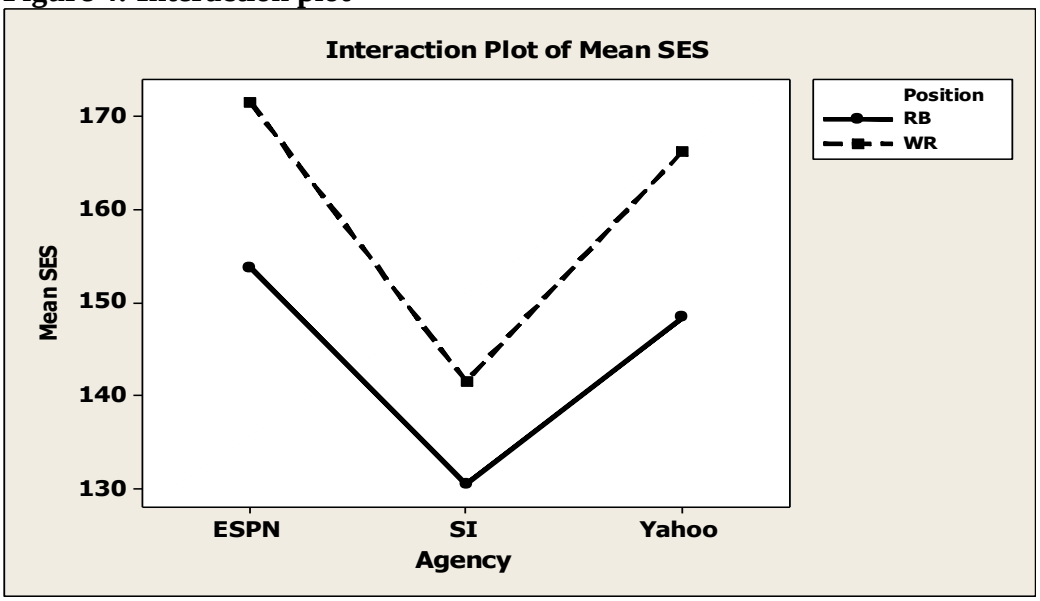

Table 1: Interaction between Agency and Position

Effect	F-Statistic	p-value
Agency *Position	0.04	0.9610

Table 2: Fit Statistics for ANOVA and Repeated Measures Models

Fit Statistics	ANOVA Model	Repeated Measures Model
-2 Log Likelihood	272.5	267.8
AIC	274.5	273.8
AICC	274.6	274.9
BIC	275.7	272.6

Table 3: Agency

MAIN EFFECT

Effect	F-Statistic	p-value
Agency	3.15	0.0624*

*Signficant at 0.10

AMONG AGENCIES

Agency	Agency	Adjusted p-value
ESPN	SI	0.0598*
ESPN	Yahoo	0.7962
SI	Yahoo	0.1999

*Signficant at 0.10

Table 4: Position

Effect	F-Statistic	p-value
Position (RB-WR)	9.37	0.0057***

***Significant at 0.01

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Exam 2/FM (Passed – August 2009)
Exam 3/MFE (Passed –May 2010)
Exam 3/MLC (Passed – November 2010)

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June 2010 – August 2010
Dental Pricing Actuarial Intern
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XL Capital, Exton, PA

January 2009 – May 2011
Actuarial Teaching Assistant to Professor Ron Gebhardtsbauer
The Pennsylvania State University, University Park, PA

June 2008 – August 2008
Environmental Insurance Underwriting Intern
XL Capital, Exton, PA

Related Experience:

Fantasy Football (2009) – 2nd of 8
Fantasy Football (2008) – 3rd of 14
Fantasy Football (2007) – 1st of 16
Fantasy Football (2007) – 4th of 16
Fantasy Football (2007) – 9th of 20
Fantasy Football (2006) – 1st of 6
Fantasy Football (2003) – 11th of 16

Awards:

Ralph H. Wherry Student Service Award (2011)
XL America Foundation Scholarship (2008)
Dean's List (7 of 7 Semesters)

Organizations:

Actuarial Science Club – Vice President, THON Dancer
Phi Sigma Pi National Honor Fraternity – Risk Management Chair
Penn State Marching Blue Band – Trumpet Player