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Analysis of the ESPN Fantasy Football Auto-pick Selection Tool and Alternative Suggestion

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ABSTRACT

In this paper, we will consider fantasy football, an extremely popular online game that is based on the performances of players from the National Football League (NFL). Per the Fantasy Sports and Gambling Association, over 59 million people played fantasy sports in 2017 in the United States and Canada, 78% of whom—a total of 46.5 million—took part in fantasy football. Most fantasy football participants host their leagues on three major media websites: ESPN, Yahoo!, and NFL.com. Each website has a team of analysts that focuses on reporting NFL news, providing preseason player rankings, specifying fantasy football draft opinions, and calculating weekly fantasy football players' points totals among a host of other duties. Despite the mass popularity of fantasy football, the tools that ESPN, Yahoo!, and NFL.com provide users to assist in player selection during the fantasy draft remain elementary.

This paper sets out to analyze the default drafting aid provided by ESPN, one of the most popular platforms for fantasy football, and provide an alternative selection method that can out-perform ESPN. The alternative selection tool will consider ESPN's preliminary draft rankings, each player's position, the remaining available players, and current roster to generate teams with advantageous roster compositions. The goal of the alternative strategy is to identify weaknesses in the ESPN-provided draft assistant while simultaneously assisting fantasy football participants by bolstering their draft selection choices. This paper primarily considers the opportunity costs that arise at each draft selection, making it unique insofar as previous literature analyzing fantasy football drafting employs alternative player projections and/or highly computational methods to identify strong draft picks.

This paper's provided alternative strategy gives managers more balanced rosters with more effective distributions of valuable players at the 4 most important positions, suggesting that ESPN's auto-pick selection tool must be revised to improve the competitiveness of fantasy football drafts.

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Chapter 1

Introduction

This paper concerns fantasy football, the extremely popular online game that is based on the performances of players from the National Football League (NFL). According to Fantasy Sports and Gambling Association (FSGA, 2019), about 60 million people played fantasy sports in 2017 in the United States and Canada – this is a dramatic increase from the 15.3 million fantasy sports participants in 2003. The economic impact of fantasy football is astonishing as the expected global market for fantasy sports is estimated to be approximately $22 billion in 2021 alone (Marketplace, 2021). Within these fantasy sports markets, it is estimated that 78% of participants (46.8 million) took part in fantasy football leagues (FSGA, 2019). These leagues are hosted by a variety of major media websites with the three most notably being ESPN, Yahoo!, and NFL.com (Bleacher Report, 2010). Each website has teams that focus on reporting NFL news, providing preseason player rankings, specifying fantasy football draft opinions, and calculating weekly fantasy football players' points totals among a host of other duties.

The draft is one of the most important stages of fantasy sports. A decent draft sets a manager up well for the season by providing a good starting point from which to work as the season progresses. Barring injuries, a good draft is likely sufficient to remain in contention for the league's playoffs where, by and large, monetary prizes can be won. The tools that ESPN offers users for the fantasy draft selection assistance remain elementary despite the mass popularity of fantasy football and the importance of the fantasy draft. ESPN provides fantasy football participants, who will be referred to as 'managers', information about players' position, yearly projected fantasy points, historical averages, bye week, injury history, and general outlook. At each pick, managers consider the remaining available players, their current roster, the risks associated with drafting different positions, who their opponents might be targeting, the differences between players at the same positions, among a host of possibilities. The popularity of fantasy football has led to dozens of online mock-drafts where individuals can practice their draft skills and master the complex problem that they are looking to solve. The aforementioned elements are *completely disregarded* by the auto-pick selection tool that ESPN provides. It is worth noting that this tool is the *only* available aid throughout the draft, and players that cannot attend the draft or choose not to select players themselves must use it. To quantify how many people might be employ the auto-draft, if only 1% of fantasy football managers miss their draft, an estimated 465,000 people will rely on the default auto-pick selection provided by ESPN. Especially for those who play for substantial amounts of money, trusting the auto-pick algorithm puts a lot of trust in a lackluster system.

As the market for fantasy sports continues to grow, new fantasy football manages will be playing each year. An improved auto-pick selection algorithm would assist in closing the skill gap between novice and advanced fantasy managers, increasing the competitiveness and enjoyment. While this might the highly skilled managers, it remains within reason that ESPN is interested in bringing new players to their platform. However, implementing auto-pick formulas that are too powerful could give certain managers unfair advantages. Ultimately, though, individuals who cannot attend a draft should not be unjustly penalized by resorting to the ESPN auto-pick.

This paper sets out to analyze the shortcomings of the ESPN auto-pick drafting aid and assist fantasy football participants by bolstering their draft selection choices. This paper primarily considers the opportunity costs that arise at each draft selection, making it unique insofar as previous literature analyzing fantasy football drafting uses highly computational methods to identify strong draft picks and/or employs alternative player projections.

The alternative strategy will consider ESPN preliminary draft rankings, player position, remaining available players, and current roster to generate well-balanced teams with valuable distributed across positions to diversify risk against injury and hedge against the inaccuracies of player rankings. In determining and evaluating the ESPN and alternative draft selection tools, this paper uses two major methodologies. The first is creating a static player selection suggestion algorithm which seeks to combat

ESPN's inefficiencies by generating well-rounded rosters that include high-scoring players at all positions. Other objectives of the alternative selection tool are to stockpile high upside players, provide insurance at important positions, and avoid over-selecting historically unimportant positions. Past NFL player performances are used to determine the relative value of positions at each point in the draft and given the current roster of already-selected players. Specifically, the reliability of ESPN's player rankings, 3 years of fantasy points scoring data, and ESPN's own articles detailing general draft strategies are analyzed to estimate the relative values of players over time, make inferences about tradeoffs between players at different positions, and, critically, when to strategically deviate from the ESPN auto-pick strategy.

The second major part of this paper's methodology is measuring the performance of the alternative selection tool against ESPN's auto-pick draft selection tool. To compare performance, the ESPN default auto-pick strategy will be compared to this paper's alternative auto-pick formula by drafting against opponents using a normalized strategy across different years and a constant league size of 12 participants. Opponents' draft choices are simulated following ESPN's very own auto-pick formula. Ultimate analysis will include team composition, i.e. the breakdown of positions on the roster, and the total number of effective picks. To be deemed an effective pick, the player must fall in the top-12 or top-24 of total fantasy points scored at their respective position given that this position has either one or two starting slots on each managers' roster. The details of rosters are broken down in the following section. Furthermore, effective picks must have played most games in the season, which is 9 or more. This type of analysis suggests how the draft generated value for the manager over the course of the season by tallying the number of desirable players that were rostered initially. Effective picks are further categorized into "Elite Picks", "A Picks", and "B Picks". The specifics of these distinctions and why they were strategically chosen will be discussed in a later chapter.

Overall, this paper highlights the shortcomings of ESPN auto-pick formula in a systematic, measurable way, while providing a logical alternative selection method based in historical NFL player data, ESPN analysts recommended strategy.

Understanding Fantasy Football—A Breakdown

Fantasy Football is an online game where 8-20 people participate in a league, each individual acting as a manager of an imaginary team. Each team has 16 available roster slots and each week 9 of these players are selected as "starters". These starters include one quarterback (QB), two running backs (RB), two wide receivers (WR), a tight end (TE), a flex (RB, WR, or TE), one defense/special teams, and one kicker. Managers create the teams by selecting actual NFL players and compete against a different opponent's team each week. Each fantasy season is divided into 3 distinct stages: the draft, weekly competition, and playoffs. While this remains constant within each league, there are many ways to alter the specifics within a league. Certain leagues decide that they prefer altering the maximum roster size, the number of slots for starting players, how many points a player gets for the corresponding real-world action (e.g. a reception, yard gained, the touchdown scored, etc.), among other customizable aspects of the game. For the sake of generalization and simplicity, only the default ESPN points-per-reception rules (PPR rules) are used to develop and analyze the drafting tool.

Many fantasy leagues have a gambling aspect to them to encourage managers to remain active and increase the intensity of the league. For example, leagues may require each manager to pay an entry fee to join the league and the top two teams split the entry fees in some pre-determined proportion. Often, the second-place team receives the value of their entry fee. In private leagues among friends and family, there are often punishments for the worst two teams in the league. For example, the two managers with the worst records from weekly play will be required to sit for the SAT—the standardized test many individuals seeking college admission take prior to applying. Contrary to cash prizes, punishing inferior performance keeps managers *all* involved throughout the year, even if their team does not stand a chance at winning the cash prizes.

Stage One: Drafting a team

Often considered the most stressful dimension of fantasy football, the fantasy draft preliminarily determines a manager's team. The draft occurs prior to the beginning of the NFL season; more specifically, it often occurs within a month of the first NFL game so that expected rosters, player injuries, and outlooks are as up to date as possible. The fantasy draft is critical as it determines the first iteration of each manager's roster. While a season is likely not won on draft day, it certainly can be lost. An unsuspecting manager who selects players based with the highest total fantasy points projections would select quarterbacks first—a key mistake because reliable quarterbacks in fantasy football are common, unlike running backs who are frequently sought after first due to their scarcity and weekly production value. Another manager might use their first 6 picks on running backs because they are historically the most important position—this would also be a key mistake because the skillful running backs are scarce, so diversifying picks across positions is important to attain valuable players that can actively score a manager points in weekly competition.

Each manager is allotted one pick per round and managers continue drafting until each of their 16 total roster spots have been filled. Additionally, drafts follow the snake format. Once managers' draft positions is determined for the first round, the order for the second-round reverses and managers pick again according to the reversed order. This reversal and selection process continues each round for a total of 16 rounds when all managers have successfully completed filling out their respective rosters. For example, in a league with 12 managers, if John is assigned to pick 11th and Kate is assigned to pick 12th, John picks 11th overall in the first round, followed by Kate who will make the 12th and 13th overall picks, followed again by John who takes the 14th pick, and so on. Also, ESPN sets time limits for each manager to select once it is their turn to select to reduce the total time spent draft. The default time that each manager is allotted is 1 minute and 30 seconds. Notably, managers who cannot make the preselected draft date and time default to an auto-pick algorithm provided by the ESPN's platform. The ESPN auto-pick feature will select the top available player left on the drafting board per the pre-determined fantasy rankings. As drafting is arguably the most important stage of fantasy, a decent draft, barring injuries, is likely sufficient for a manager to remain in contention for the playoffs throughout the season. Thus, managers using the ESPN auto-pick selection tool might have an increased risk of being punished.

Stage Two: Weekly play

Prior to the 2021-2022 NFL season, the NFL regular season consisted of 17 weeks. During these weeks, NFL team played 16 games and had one bye week during which they do not play a game. Typically, fantasy football leagues' weekly play occurs within the first 13-14 weeks of a season with the remaining NFL regular-season games being devoted to the fantasy playoffs. For each week in the weekly play stage, managers select players from their roster to start. Managers receive points based on the performances of their starting players in their NFL games. The table on the following page shows how all players score points in the PPR format, in which any reception by a player is worth 1 additional point. Players who are on a bye week do not receive points as their NFL team does not have a scheduled game, so starting players on bye weeks is not advantageous. Winners of each matchup are determined by total points accrued by managers' 9 starting players.

During this period, managers may also trade players with one another, drop players from their roster, and add players to their roster given that there is an available slot. Managers will trade, drop, and add players for a variety of reasons including player injuries, lack of talent at a position, depth at a position, a more well-rounded roster, etc. A team that fails to secure all the starting positions during the draft should drop then add an unrostered player or trade with opponents to secure the missing piece of their 9-player starting roster to maximize points scored during their matchup. More generally, managers who draft poorly will lack value within their rosters and have difficulties acquiring more important players via trading—one of the best options to secure high-value players given that almost all the best players will be rostered at any point in time. For example, if a manager waits too long to select their RBs and WRs, the best of which are thought to be the most important players in fantasy football, and selects QBs and TEs instead, which are generally similar across the position thus less valuable, when it comes time to trade for a RB, the manager can only offer to trade players with many comparable substitutes.

Table 1 – Fantasy Points Scoring Rules

Fantasy Points Scoring					
Passing		Rushing		Receiving	
Action	Points	Action	Points	Action	Points
TD pass	4	TD rush	6	TD reception	6
25 pass yds	1	1 rushing yard	0.1	1 receiving yard	1
2pt conversion pass	2	2pt conversion rushing	2	2pt conversion catch	2
Interception	-2			Pass caught	1
Defense/Special Teams		Defense/Special Teams		Defense/Special Teams	
Action	Points	Action	Points	Action	Points
Interception made	2	1-6 points allowed	4	46+ points allowed	-5
Fumble recovered	2	7-13 points allowed	3	Kickoff return TD	6
Blocked kick, punt, PAT	2	14-17 points allowed	1	Punt return TD	6
Safety	2	18-27 points allowed	0	Interception return TD	6
Sack	1	28-34 points allowed	-1	Fumble return TD	6
0 points allowed	5	35-45 points allowed	-3	Blocked punt return TD	6
Kicking		Miscellaneous Offense			
Action	Points	**Action**			Points
FG made (0-39 yds)	3	**Fumble lost**			-2
FG made (40-49 yds)	4	**Kickoff return TD (by an individual)**			6
FG made (50-59 yds)	5	**Punt return TD (by an individual)**			6
FG made (60+ yds)	6	**Fumble return TD (by an individual)**			6
Extra point made	1				
Missed FG	-1				

Stage Three: Playoffs

The structure of the playoffs follows that of the weekly play stage; however, the playoffs consist of the top-4 teams as determined by win-loss records. The tiebreaker. In the week prior to the playoffs, all trading is stopped to discourage collusion between managers in the playoffs and managers eliminated from the playoffs. These 4 teams take part in a 2-week playoff in which the 1^{st} and 4^{th} ranked teams face-off and the 2^{nd} and 3^{rd} ranked teams face-off. The winners compete against each other in the final to determine the ultimate winning manager.

Chapter 2

Literature Review

While the expected global market for fantasy sports is anticipated to be approximately $22 billion in 2021, it has not always been this way (Marketplace, 2021). As a result, fantasy sports drafting has not been widely studied. Even real-world sports drafting has not been explored extensively. Few formal academic papers have been written about fantasy sports, and even fewer discuss fantasy sports drafting. In the subsequent section, previous works in real-world sports drafting and fantasy sports drafting are reviewed and compared.

Becker and Sun (2016), considers a comprehensive strategic approach to fantasy football team management that spans the entire year. Using historical player data, the authors predict team and player performance. With their predicted player performances, the authors build a mixed-integer optimization model for draft selection as well as weekly line-up management that incorporates the entire objective of winning a fantasy football season. Numerical tests of their approach show promising performance as when the opposing teams exactly follow the publicly available rankings, the deviating team places in the top half of teams 64.7% of the time. Becker and Sun's draft selection model is so effective because it "[maximizes] the total number of winning games in the entire season as well as the total points scored by her team, subject to the constraints describing the fantasy football dynamics, opponent's drafting behavior, and logical relationship between drafting decisions" (Becker and Sun 2016). Additionally, the draft selection model uses mixed integer optimization which captures the discrete nature of fantasy draft player selection. Similarly, this paper uses strategical deviation from the remaining top-ranked player to improve balance among the positions of players acquired in the draft and solve the issue presented by ESPN's auto-pick selector.

The paper by Summers, Swartz, and Lockhart (2007) tackles optimal drafting in hockey pools, a similar problem to drafting players in fantasy football. The authors take a statistical approach and estimate the probability that a lineup drafted by a player beats alternative lineups at each stage of the drafting. The optimal drafting strategy is to choose an available hockey player that maximizes the probability that your team outscores all alternative teams. While no formal statistical probability is performed to forecast team performance in this paper, conjectures about expected value of player value are used in a similar theme Summers, Swartz, and Lockhart.

Fry, Lundberg, and Ohlmann (2007) propose a stochastic dynamic programming (DP) model for the player selection draft of a single real-world NFL franchise, where the best choice of drafting at each round is determined by the DP recursion that maximizes the sum of the value added by the drafted player and the total expected value added to the team in the future rounds. To produce a computationally tractable model, the authors introduce simplifying assumptions to remove stochasticity from the model in the form of uncertainty in opponent teams' behavior, thus reducing the size of state space and run time. The resulting deterministic DP is efficiently solved as a series of linear programs.

Gibson, Ohlmann, and Fry (2010) extend the above work of Fry et al. (2007) to a more general situation where the decision maker (DM) executes a sequence of resource allocation decisions under the uncertainty of resource availability due to actions of competitors. The paper introduces a new type of stochastic knapsack problem with sequential competition and proposes a stochastic ruler approach and agent-based modeling framework. The numerical test compares favorably with the deterministic DP approach proposed in Fry et al. (2007).

With respect to topics that this paper covers, Becker and Sun's is the most relevant. While their comprehensive approach to fantasy football team management will not be expanded in this paper, their drafting selection method offers key features that are replicated and/or adapted to fit this paper's approach. Explicitly defining a series of constraints, similar to Becker and Sun's, were developed to make inferences about player selection as the draft progresses. This paper sets a series of counters that track past picks to avoid the over-selection of certain positions at certain benchmark rounds to target the selection of diverse players, high-upside players, and build a well-rounded roster with valuable players distributed throughout the starting positions.

Chapter 3

Data Overview

All the data in this paper is taken from publicly available websites and resources. The two primary sources of data came from The Fantasy Pros Database, which is where yearly fantasy points totals are sourced, and ESPN, which is where the player rankings are sourced.

At the beginning of each fantasy football season, ESPN provides dozens of publicly available, free rankings from their team of analysts which include each player's name, team, position, previous year's fantasy points, predicted yearly total points, and a brief paragraph detailing their injury history and outlook. All this information is also available while managers are drafting players.

The Fantasy Pros Database provides users with copious amount of data on past player performance. One category of data that can be found on their website is historical fantasy points data. The data can be categorized by default scoring, where players do not receive points for receptions, and points per reception (PPR), where players *do* receive 1 point per reception. All player data and analysis in this paper assumes the ESPN PPR format and that the league contains 12 people—both are the most common (Grivas, 2021). ESPN recommends a league size of 12 with standard PPR format for most players as it results in higher weekly scores and increases the value of many players (ESPN, 2017).

Fantasy Pros Data

The Fantasy Pros' (TFP) data allows users to see historical fantasy points data and sort players by their positions: quarterback (QB), running back (RB), wide receiver (WR), tight end (TE), kicker (K), and defense/special teams (D/ST). The website has weekly and yearly information on every player/team name, their bye week, and the total fantasy points scored in that timeframe. By inputting the scoring rules of a given league, ESPN PPR for example, TFP calculates fantasy points given the rules set. For

QB/RB/WR/TE, Fantasy Pros tracks passing, rushing, receiving, and miscellaneous stats. There are more statistics than are necessary to calculate ESPN PPR total fantasy points are recorded on TFP’s website. These statistics are categorized in the following way:

Passing - completions, attempts, yards, touchdowns, and interceptions

Rushing - attempts, yards, and touchdowns

Receiving: receptions, targets, yards, and touchdowns

Miscellaneous – fumbles lost and total games played during that season

For the kickers, the stats tracked are extra points attempted, extra points made, field goals attempted, field goals made, and made field goals from various distances. For defense/special teams, the stats tracked are sacks, interceptions, safeties, fumbles recovered, kicks blocked, touchdowns scored, passing yards per game, rushing yards per game, and total yards per game. Notably, there is no difference in the calculation of fantasy points between ESPN and TFP.

ESPN Data and Rankings

ESPN provides managers with a list of the top-300 fantasy players ranked in order from most valuable to least valuable according to their team of analysts. This is the list that ESPN’s auto-pick formula follows. Along with the player rankings, ESPN provides each player’s name, team, position, previous year’s fantasy points total, yearly projected point total, and a brief paragraph detailing their outlook. The team of analysts that ESPN employs to determine how rankings and yearly projections are formulated have never explicitly revealed their exact methodology; however, the analysts claim to have a “lengthy process that involve[s] statistical calculations and subjective inputs” (Clay, 2022).

ESPN’s projections and rankings have been heavily scrutinized over the years by fantasy managers for a myriad of reasons, the most prevalent being the rankings inaccuracies. Statisticians have taken it upon themselves to test the reliability of different websites rankings and projections to determine the superior forecasters. Isaac Petersen, a statistician who publishes small projects relating to fantasy football, reviewed the accuracy of various websites that produce projections over a 5-year period for this exact reason. Petersen used R^2 and mean absolute scaled error (MASE) to measure the accuracy of each website's yearly projections. When comparing the yearly projections of ESPN, Yahoo!, and NFL.com,

Table 2 – Big 3 Fantasy Platforms Player Prediction Correlations

Source	2012		2013		2014		2015		2016		Average	
	R^2	MASE	R^2	MASE	R^2	MASE	R^2	MASE	R^2	MASE	R^2	MASE
ESPN	**0.576**	0.669	0.5	0.705	0.498	0.723	0.615	0.585	**0.63**	0.551	0.564	0.647
NFL.com	0.551	0.65	0.505	0.709	0.518	0.692	0.582	0.632	0.605	0.584	0.552	0.653
Yahoo					0.547	0.645	**0.635**	0.554	0.624	0.562	**0.602**	**0.587**

Yahoo!'s projections were the most accurate with an average R^2 of .602 and average MASE of .587. The best website at forecasting fantasy points over this period is Fantasy Football Analytics (FFA), Petersen's own website. FFA's average R^2 and MASE were .634 and .557 respectively (Petersen, 2017).

Rankings are used to describe the value of players across distinct positions. While these correlate mediocrely with fantasy points projections, the highest projected players are rarely ranked first. Rankings also incorporate the scarcity of players at certain positions which results in the best QBs, the highest scoring types of players, to be ranked lower than RBs who will score similarly. In another paper by Peterson, he compares the effectiveness of using player rank versus player points projections to compare players within the same position. Using R^2 as the measurement to compare the ranking accuracies between positions to projections between positions, Peterson found that "in general, projections were more accurate than rankings, especially for QBs, WRs, and TEs. Projections were nearly twice as accurate as rankings". Thus, a player's yearly projection is more indicative of a player's relative values given that "projections tell you *how much* players are better than each other" (Petersen, 2016).

Table 3 – Accuracy of Player Rankings and Projections

Method	Pos					
	QB	RB	WR	TE	K	D/ST
Rank R^2	0.37	0.41	0.48	0.47	0.09	0.22
Projection R^2	0.5	0.36	0.44	0.43	0.02	0.08

While points projections are superior to rank when determining the relative value of players, neither method guarantees reliable inference. Yahoo!, the platform boasting the highest average R^2 value for projections among the major fantasy platforms, has an R^2 value of only .602. Thus, at best, managers will use lackluster information to select their players in the draft. Especially in the case of managers using ESPN as their platform, whose auto-pick function relies solely on the ranks of players, using rank as the *only* determinant is a poor strategy. It is worth noting that ESPN does consistently rank the best scorers at each position within the top-192; however, the initial rankings are often inaccurate. When considering total fantasy points scored in a year, ESPN consistently ranks most QB and TEs that finish within the top-12 players by total fantasy points scored. ESPN also consistently ranks most RBs and WRs that finish within the top-24 players. On the other hand, the projection of *who exactly* will finish as a top scorer is infrequently accurate as suggested by the R^2 of ESPN's yearly points projections.

ESPN ranks the top-300 players at the beginning of every fantasy season, but the players that are most frequently selected are from the top-192. The top-192 players list is a key area of study because that is the number of players that will be rostered during the draft—meaning it is the maximum number of players that can be rostered at any given time. In 2016 1 RB, 2 WRs, 3 QBs, and 3 TEs were not ranked within the top-192 and went on to finish within the top-12 of total points scored at their position (or top-24 if they were a RB or WR). Similarly, 1 RB, 0 WRs, 2 QBs, and 2 TEs were not ranked within the top-192 in 2017 and went on to finish highly among their respective positions in total yearly points. Finally, in 2018, ESPN failed to rank 4 RBs, 1 WRs, 1 QBs, and 3 TEs in the top-192 who ended the season fulfilling the same criteria. ESPN consistently ranks Ks and D/STs inaccurately as mentioned previously.

Thus, the respective tallies for these positions are not tracked in this paper and these positions are not regarded as important when draft—this means they are most often selected with the final two picks in the draft by the alternative draft selection tool.

Data Limitations

Using all information available to a manager during drafting is key to making an informed decision. Not all information is equally as important, though. While a bye week of a player is good to remember, knowing a player's position is far more important because there are only so many starting slots on each roster. Another important their designated rank—specifically their position rank—is far more important. As previously discussed, player points projections are the best indicator available to managers to assess the future value of a player. The analysis of this paper does not, however, use all provided data from ESPN as historical records of certain data are not available. ESPN preseason points projections are not used in the determination draft selections in this paper as they were not publicly available.

Although rank nor points projection have strong explanatory power when estimating players' worth, the omission of points projections in determining draft choices is not ideal. When making draft choices, this paper will assume that rank is the best distinguishing factor between players of the same position; however, relative value of players of various positions will be determined by opportunity costs that arise given a manager's current roster, the historical scoring distributions of all positions, and the historical scarcity of positions.

Chapter 4

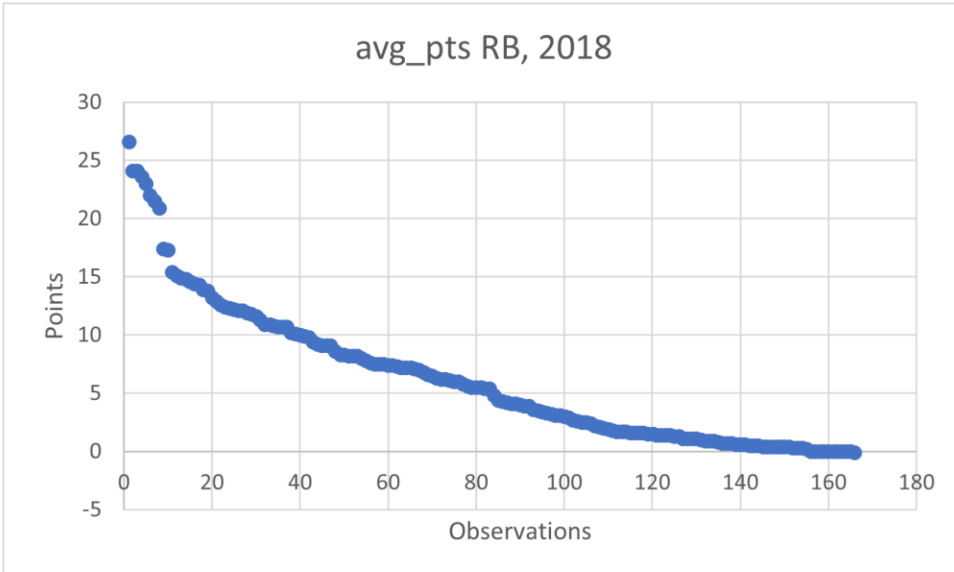
Data Analysis

When it comes to fantasy football players, not all positions are created equally. In contrast to the actual NFL which assumes quarterback to be the most prominent position, running backs continue to the most important position in the standard ESPN PPR format. To better understand the relative values of each position, and more specifically the tradeoffs between selecting one position over another, it is pivotal to look at historical performances of NFL players broken down by their position. The following chapter analyses historical fantasy points averages and totals to develop intuition about how to structure the alternative draft selection tool.

Running Backs

As the historical spreads suggest, the best RBs and WRs are among the highest scoring players in the game. What separates the RBs from WRs is their scarcity. For a general sense of how much more valuable the best RBs are, it is instructive to know that the "20th-highest scoring running back in fantasy football [in 2019] managed just 41.9% of the total points scored by the top running back" (Yates, 2020). The following graph represents weekly scoring averages of RBs in 2018—even when examining the average points scored, not total yearly points, there are obvious drop-offs that exist at the position. The years 2017 and 2018 are included in the Appendix. The graph shows average fantasy points from the season on the y-axis and each dot represents an observation from the year.

Figure 1 – Distribution of Running Back Scoring Averages, 2018



Some explanations this paper proposes for why this position is so valuable are NFL play-calling tendencies and the injury-risk of the position. In the modern NFL, most teams lean towards a pass-first offense, meaning that teams are passing more than they are running the football. In the 2021 season, the 32nd ranked team in passing play percentage still passed the ball 50.13% of the time. In the same year, the team who passed most frequently had a pass percentage of 66.46%. In the 2020 season, the average pass percentage was 56.62% (Fantasy Football Today, 2020). Finding a running back that will consistently get carries is difficult as there are only several teams that use primarily one running back, as teams often have a committee of running backs that share time equally. Additionally, running backs are among the most frequently injured players due to the dangerousness of their role on the field. The following chart describes the injury risk by position.

Figure 2 – Injury Risk by Position, 2000-2014

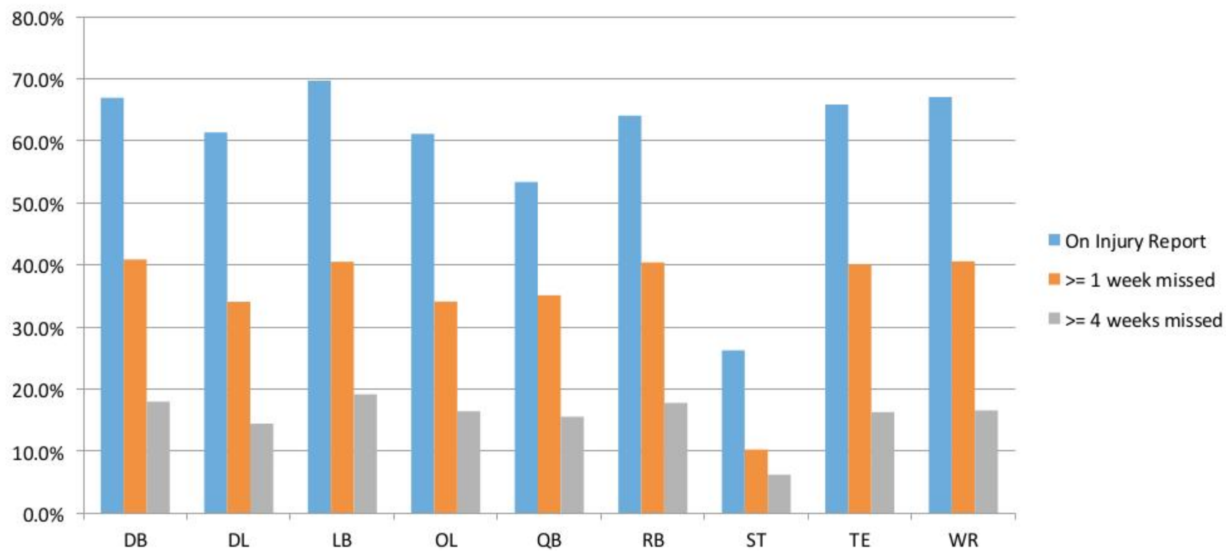


Table 4 – Summary of Total Points Scored by Running Backs

-> pos = RB

Points

	Percentiles	Smallest		
1%	0	-.4		
5%	.2	-.2		
10%	1.4	-.2	Obs	504
25%	7.9	-.1	Sum of wgt.	504
50%	39		Mean	72.94722
		Largest	Std. dev.	83.23552
75%	116.05	383.3		
90%	193.5	385.5	Variance	6928.151
95%	234	385.8	Skewness	1.453529
99%	354.2	407.8	Kurtosis	4.878009

As seen in the table above which includes the total yearly fantasy points scored by RBs over a 3-year period (2016-2018), there are very few RBs that score very highly—120 points difference separating 5% of the top performances over these 3 years. Given these attributes, the best RBs are the most sought-after players in the game. Prioritizing RBs whenever possible, especially when selecting backups and bench players, is a strategy that the alternative selection algorithm incorporates to outperform ESPN's auto-pick tool.

Wide Receivers

While running backs are the most important position, wide receiver is a close second. According to the *10 Simple Rules for Fantasy Football Draft Success*, an article written by ESPN Fantasy Football analyst Field Yates, managers must realize that "there's a supply shortage of reliable running backs in fantasy football. They matter a lot. Speaking generally, you're going to want to build your roster around running backs and… wide receivers". Historically, managers seem to follow this principle. Taken from aggregated historical draft position records that ESPN publish each year, participants use an average of 35 out of 40 of the first picks on RBs and WRs each year. Seemingly, managers stress the importance of drafting these high-scoring players early and often, too. These records are aggregated across several years from leagues of various sizes including tens of millions of participants.

Figure 3 – Distribution of Wide Receiver Scoring Averages, 2018

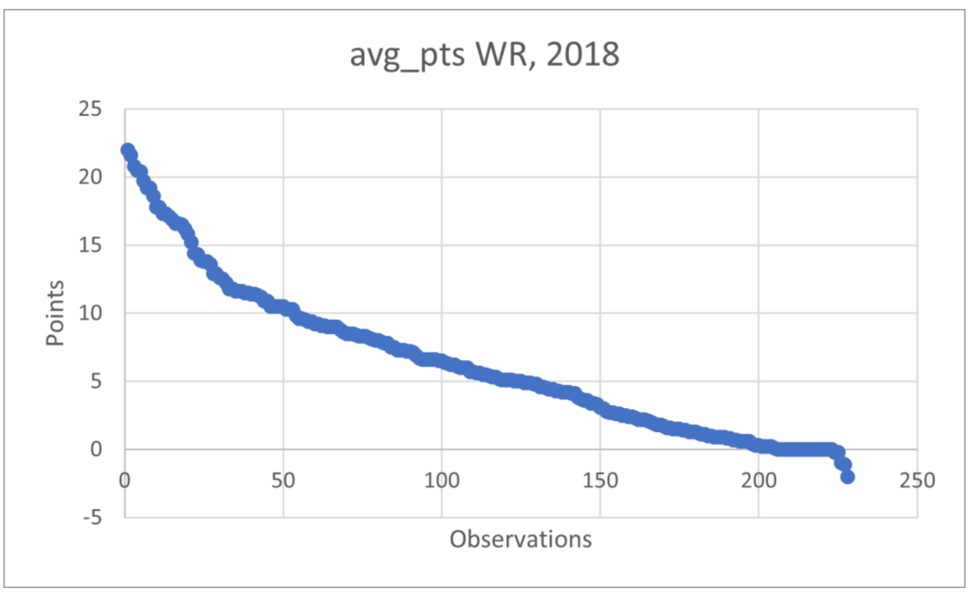


Table 5 – Summary of Total Points Scored by Wide Receivers

```
-> pos = WR

                          Points
-------------------------------------------------------------
      Percentiles      Smallest
 1%        -1.9              -2
 5%           0              -2
10%         1.5              -2       Obs                 650
25%        12.3              -2       Sum of wgt.         650

50%        52.5                       Mean           79.51677
                        Largest       Std. dev.        80.549
75%       132.3           325.8
90%       198.6             328       Variance       6488.142
95%       239.3           329.6       Skewness       1.035529
99%       310.3           333.5       Kurtosis       3.246655
```

Differently than running backs, there is more depth at the wide receiver position. Over the same 3-year span, there were 146 more WRs that played in NFL games to select from. This is due to NFL play-calling which favors larger quantities of WRs. Teams will often call passing plays with three wide receivers on the field at one time. Even within these multiple-receiver sets, an offensive formation that includes up to 4 WRs on the field at ones, certain wide receivers will still be targeted more frequently than their teammates and/or other WRs in the NFL. Especially in a PPR league, a receiver with lots of receptions each week can be unbelievably valuable. A wide receiver's primary job is to catch passes, so they naturally accrue points rather rapidly. In the 2021/22 season, WR Cooper Kupp averaged 4.4 more fantasy points than the second highest WR. To put that into perspective, the two best QBs that year were separated by1.6 points per game and the two best RBs were separated by only 0.6 points per game. While this gap is large, the differences between most top WRs is marginal, only a difference of a couple points. Only 70 total points separate the top 5% of WR performances over 2018-2018. Wide receivers are often the first or second choice for fantasy managers in the draft for these reasons.

Tight Ends

As a possible FLEX player, one might conjecture that tight ends are also great fantasy points producers; however, this has not proven to be true. Historically there are very few players each year that stand out at the position. ESPN's analysts hint that most teams should not typically start more than 1 tight end each week, noting that "there are very few tight ends who put up consistently robust point totals, and they are seldom used in your flex spot" (Yates, 2020). As for why this might be the case, there is one main conjecture: TEs frequently have less receiving ability than their WR counterparts because they are not expected to catch passes as often. Since they are not expected to be handling the ball as much, they are also not as adept at catching the ball, thus they are not frequently targeted. This information is reflected in the distribution of average tight end fantasy scoring in 2018 as shown below.

Figure 4 – Distribution of Tight End Scoring Averages, 2018

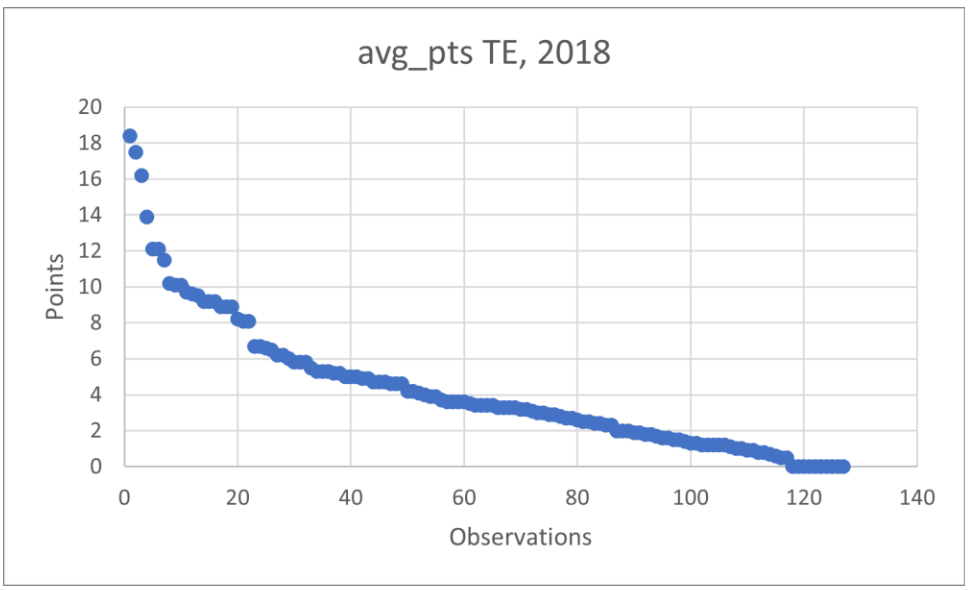


Table 6 – Summary of Total Points Scored by Tight Ends

-> pos = TE

Points

	Percentiles	Smallest		
1%	0	0		
5%	0	0		
10%	2	0	Obs	364
25%	8.7	0	Sum of wgt.	364
50%	30.3		Mean	50.81291
		Largest	Std. dev.	56.49578
75%	75.7	233.5		
90%	133.9	258.7	Variance	3191.773
95%	169	280.3	Skewness	1.572866
99%	233.5	294.6	Kurtosis	5.265666

As with any position, there are some players that are obvious exceptions to the status quo. While ESPN analysts, NFL play-calling tendencies, and historical scoring averages suggest that tight ends are not valuable fantasy football points producers, there are occasionally tight ends with abnormal receiving ability. Even in 2018, there are a couple of outliers that scored like the top-level WRs; however, there are *very* few that produce at this level. Moreover, TEs tend to be among the most predictable players in fantasy football, so their value is not subject to as much volatility as RBs. Finally, TEs only have one starting slot on each manager's roster, so fewer are demanded across the league. Unless an incredible TE falls into a manager's lap, patience at the TE spot will prove to be advantageous as insurance is built up for unpredictable, high-scoring positions such as RB. Even these outliers at TE still do not score nearly as many points as the best RBs and WRs—notably the top 5% of TE performances managed to score 169-233 total fantasy points compared to 234-354 and 239-310 total fantasy points by the top 5% of RBs and WRs respectively over the same timeframe.

Quarterbacks

Quarterback is the most important position in the NFL; however, this position's importance is not reflected in how fantasy managers value them. As managers can only start 1 QB each week and there are 32 teams in the NFL, there is always an unrostered QB for managers to pick up if necessary. While there is an excess of quarterbacks for the taking, the position does score very well in seasons past. Of the 2019 fantasy football yearly points totals list, one will find that 5 out of the top 10 over scorers were quarterbacks. On the other hand, ESPN's 2020 article about drafting tips nots that "of the 20 players who appeared on the most championship teams in 2019, only 2 of them were quarterbacks" (Yates, 2020).

Figure 5 – Distribution of Quarterback Scoring Averages, 2018

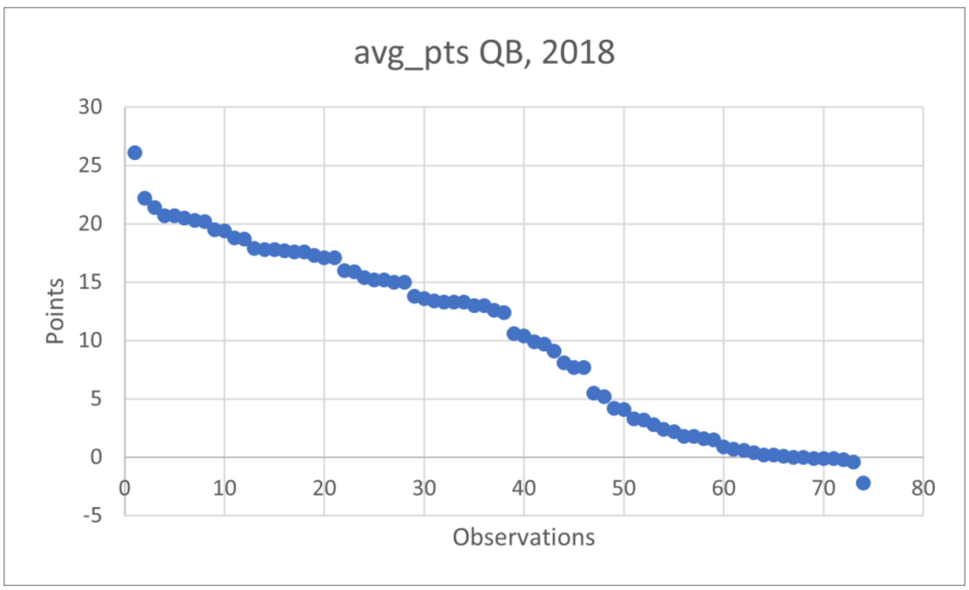


Table 7 – Summary of Total Points Scored by Quarterbacks

-> pos = QB

Points

	Percentiles	Smallest		
1%	-2	-2.3		
5%	-.5	-2.2		
10%	0	-2	Obs	219
25%	7.6	-1.5	Sum of wgt.	219
50%	64		Mean	114.9169
		Largest	Std. dev.	116.9765
75%	222.6	347.8		
90%	283.7	355	Variance	13683.5
95%	310.3	380	Skewness	.5723272
99%	355	417	Kurtosis	1.855958

Quarterbacks are usually the players that score the most points on a fantasy team, but their ease of substitutability is reflected in their middle of the road rankings each year. Looking at their average points per week below demonstrates this fact. The next best player at quarterback usually averages within 1-2 points of the previous player.

Kickers and Defense/Special Teams

Kickers and defense/special teams are by far the least important players to draft, and each manager is allowed to start one each week. These positions are so difficult to predict, as evidenced in ESPN's R^2 value of .09 and .22 for using rank as a predictor of ultimate total fantasy points at K and D/ST respectively. Thus, drafting them early is a not a good strategy. Kickers only score when then offense can get relatively close to the opposing endzone, suggesting a kicker from a good offense will perform relatively well; however, kickers do not score in high points quantities. According to the *10 Simple Rules for Fantasy Football Draft Success*, managers should "draft [a kicker] in the final round and target one on a good offense" (2020). And defenses are similar, also scoring unpredictably throughout the year. As a defense/special team is comprised of dozens of rotating players who are competing against a rotation of dozens of others on a week-to-week basis, projecting the success of a D/ST is very difficult. In 2019, the top ranked defense, the Bears, finished 16th overall in total points—likely frustrating many managers who drafted them. As seen in the charts below, most kickers and defense/special teams score similarly on a week-to-week basis, even between each position. Moreover, the spread between the top scorer and the 12th best scorer is much closer than any other positions.

Figure 6 – Distribution of Kickers Scoring Averages, 2018

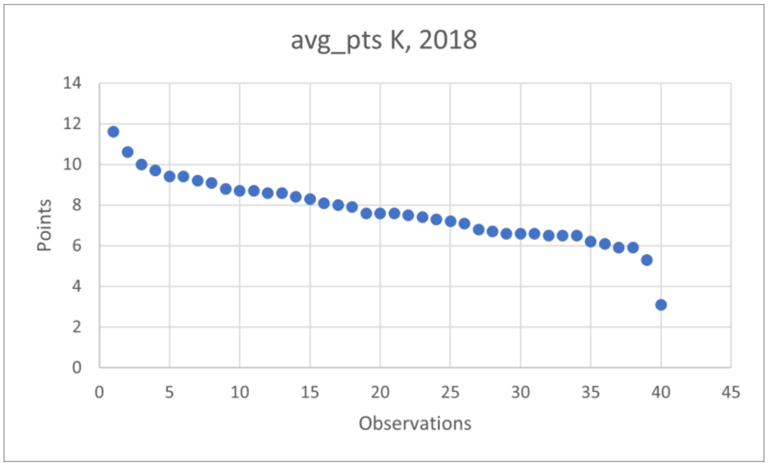


Figure 7 – Distribution of Defense/Special Teams Scoring Averages, 2018

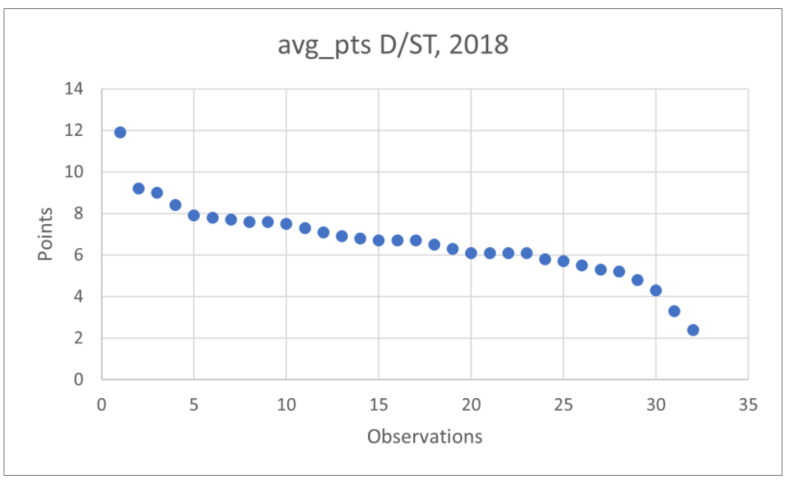


Table 8 – Summary of Total Points Scored by Defense/Special Teams

-> pos = DST

Avg Points

	Percentiles	Smallest		
1%	2.4	2.4		
5%	4.3	3.3		
10%	4.8	4.3	Obs	96
25%	5.9	4.3	Sum of wgt.	96
50%	6.9		Mean	7.210417
		Largest	Std. dev.	1.973748
75%	8.5	10.9		
90%	10.3	11.6	Variance	3.89568
95%	10.6	11.9	Skewness	.4347114
99%	12.7	12.7	Kurtosis	3.043568

Table 9 – Summary of Total Points Scored by Kickers

-> pos = K

Avg Points

	Percentiles	Smallest		
1%	3	1		
5%	5	3		
10%	5.6	3.1	Obs	118
25%	6.5	4.8	Sum of wgt.	118
50%	7.9		Mean	7.825424
		Largest	Std. dev.	1.93533
75%	9.2	11.6		
90%	10.1	12.3	Variance	3.745502
95%	10.9	13	Skewness	-.1340023
99%	13	13	Kurtosis	4.013142

Randomness Across Positions

As previous literature suggests, the ESPN ranking and prediction system is extremely lackluster which is why there are commonly over-valued and under-valued players. Each year, ESPN analysts fail to predict a handful of stars—often these are RBs and WRs who fill in for an injured player or have an unsuspected breakout year. For example, in 2019 there were 3 WRs who went undrafted in *every* ESPN fantasy league that finished in the top-30 for total points. As this relates to the importance of drafting positions, stockpiling positions that have the potential for high upsides is a good strategy that managers should employ especially during the later rounds of the draft. This can manifest itself in a variety of ways, but most commonly it means that drafting a RB or WR after all important needs are met is wise. More specifically, some positions may have no backup at all. ESPN analysts suggest not taking any backups at K and D/ST and suggest that backups are not always necessary at QB and TE due to their availability.

Chapter 5

Methodology

Opponent Behavior

Prior to testing ESPN's auto-pick tool and the alternative suggested strategy, it is important to develop a baseline for opponent behavior. As drafts are a series of choices between opponents who seek to create the best rosters possible, a general opponent strategy must be devised to play against. For the sake of comparability, all opponents will assume the ESPN auto-pick strategy. This guarantees that any roster generated using either method will face the exact same opponent strategy and skill. To create a baseline for comparison, 12 rosters were generated using the ESPN auto-pick strategy, each resulting from a different draft position each year. This process was repeated over the years 2016 to 2018. Thus, for a default league size of 12, there were a total of 36 rosters generated from the 3 pools of 300 ranked players. The rosters were then analyzed to confirm that the auto-pick formula will act irrationally, and this was confirmed.

Preliminary ESPN Auto-Pick Analysis

The two tables shown below breakdown select drafting mistakes that result from the ESPN auto-pick selections. While there are many ways to classify a mistake, this paper extrapolates advice from ESPN draft analysts and evaluates when a roster defies their suggestions. Of the 36 rosters that were generated from each of the possible 12 draft positions using the ESPN auto-pick selection tool over the 3-year period, most rosters, 64%, were missing at least one position on the roster. While it is important to note that no rosters were missing RBs or WRs, a roster is missing a QB and/or TE 39% of the time. As previously discussed, these four positions, QB, TE, K, and D/ST, are much less important than RB or WR; however, failure to secure a position during the draft will result in a manager having to acquire a player that is likely undesirable prior to the first weekly matchup. While this is not a season-ending issue, especially if a K or D/ST was not drafted, failure to secure a decent QB, one of the most effective fantasy points scorers, might prove to be costly.

Table 10 – ESPN Auto-Pick Misallocations I

Missing Position on Roster	
K and/or D/ST	RB, WR, TE, and/or QB*
24	14

Table 11 – ESPN Auto-Pick Misallocations II

Positional Imbalances				
>1 K	>1 D/ST	>2 QB	>2 TE	<2 RB or WR
10	10	8	8	2

Similarly, the ESPN algorithm over-selects players at various positions. Referring to the chart above, rosters selected 2 or more kickers 28% of time and 2 or more defense/special teams 28% of time—a key mistake. When the odds that any two players at these positions differs drastically from any other player at the position is almost zero, selecting players from a pool with higher upside and history of sporadic scoring is more advantageous. Rosters generated using the ESPN auto-pick selections also over-selected QBs 22% of the time.

Given that failure to roster a position and over-selecting the same position are mutually exclusive events, the odds that an ESPN auto-pick selection algorithm results in at least one strategic shortcoming is rather high. There were 32 instances in which strategic mistakes included kickers or defense/special teams, thus only 2 rosters out of 36, or 6%, selected the ideal draft composition according to historical averages and ESPN analysts' advice which is 1 kicker and 1 defense/special team.

Perhaps more concerning is the frequency of that QBs and TEs were over and under selected. This phenomenon occurred 30 times, thus managers have an 83% chance that their QBs or TEs were misallocated due to ESPN's auto-pick selection tool. While this is much worse than the problems presented by the misallocation of Ks or D/STs, it is still possible to overcome this issue throughout the season. There are historically plenty of mediocre QBs and TEs each year that can fill needs retrospectively for a manger; however, condemning a team to mediocrity at 2 or more positions would likely never have happened with any basic knowledge of fantasy drafting strategy.

The most concerning issue to overcome is not selecting 2 RBs or WRs, which occurred 2 times. While this represents only 6% of rosters generated using this technique, this scenario *should never* happen because the replacement will be drastically worse than a player that could have been secured in the first few rounds of draft. In contrast to the other player misallocations, this issue is likely going to cost a manager the season.

The rosters generated by the ESPN auto-pick strategy do not give most managers desirable distributions of positions. In the case of over-selection at an unimportant position, a manager will have slimmer chances landing a surprise-star at a more important position. In the case of under-selecting a certain position, players will have to be dropped from the current roster and an undesirable replacement will take its place. If the manager had simply drafted that position at during the round in which the eventually dropped player was selected, the manager would only have equal or better options according to preseason prediction and ranking as the eventual replacement went undrafted most likely due to poor projection and/or rank.

Translating Historical Data into Opportunity Costs

In determining an effective alternative to the ESPN auto-pick system, it is important to remedy the largest flaw with the current ESPN system: the failure to consider opportunity costs and evaluate trade-offs resulting in unbalanced rosters. ESPN auto-pick fails to consider any opportunity costs at each draft choice, creating unbalanced roster compositions. The summary statistics calculated from the 300 players that ESPN ranks over the years 2016 to 2018, the average fantasy point totals by position, and

ESPN historical notes about player performance will be the main drivers for general assumptions made about opportunity costs.

After analyzing the historical spreads of yearly total points and weekly average points broken down by position, it is apparent that running backs and wide receivers should be prioritized over other positions when appending players to a team's roster. RBs have the steepest drop off in the distribution of average fantasy points, 2-3 can be started each week, and they are historically projected poorly. Thus, neglecting to fill select these positions early and/or accrue alternatives at the position throughout the draft when presented with an appropriate opportunity will prove to be costly. As such, the alternative selection tool will consider a manager's current roster, a player's position, position rank, and total overall rank when selecting.

According to historical player data, the positions generally appear to be bucketed into 3 tiers which encapsulate their ability to score, the abundance of players at that position, and the relative demand of a position given the available number of starting slots they can possibly fill. They are as follows:

1. Running Back and Wide Receiver
    a. RBs are slightly more valuable than WRs
2. Quarterback and Tight End
    a. QBs are slightly more valuable than TEs, but not universally
3. Kicker and Defense/Special Teams
    a. These can be viewed as equally unimportant

These opportunity costs are considered each time a player has the chance of being selected and *will possibly not be a starter*. More concretely, the current roster will be consulted to make inference on the opportunity cost of selecting an additional RB given that the current roster consists of only 3 RBs and no other players, i.e. this scenario is in the 4^{th} round of the draft. Given that selecting a 4^{th} RB means one player will be guaranteed to not play due to starting roster size, it is not advantageous to select an additional RB. Especially considering that WR average points distributions follow similar, but slightly less steep drop offs, WRs are the second priority early in the draft.

To incorporate these facts into the player selection model, decisions regarding opportunity cost will not be considered until the 4th pick because the opportunity cost of selecting a player is primarily the inability to *start* an alternative player, not the inability to *select* another player. Outlier players at positions will be prioritized be the opportunity cost is assumed to be greater that at another position. For example, if two highly ranked players, a WR and TE, are projected to be similar producers of weekly fantasy points, the tight end will be prioritized in selection because there will be a steeper drop off at that position than WR. This fact will be considered less in later rounds where selected players are unlikely to start on a week-to-week basis and the differences in production between players at the same position is marginal.

Stage One: The first 7 picks

Most generally, the alternative selection method will select the highest ranked player unless it is advantageous to diversify the positions of the players on the roster. The first three picks are determined by the highest ranked player remaining among the possible draftees. While ESPN does not always predict player value well, the top-36 players by rank are often much more predictable. Moreover, the distributions of RBs and WRs—the primary players that are taken in the first few rounds—suggest that the drop-offs between players are steepest early which indicates that the difference in one rank can be rather dramatic. This fact holds especially true for the rare TEs that might find themselves ranked highly among RBs and WRs, suggesting that the cost of not choosing such an outlier is costly.

It is important to note that the players selected in the first 6-7 rounds are assumed to be players who will start in the weekly lineup or highly capable backups. After the first three picks are selected, there is a possibility that the 4th player will be the same position as the previous 3. In this case, the 4th player will likely not be started each week and an alternative player who will score similarly could have been selected in their place. In these sorts of scenarios, the opportunity cost of *not* selecting a player that can score relatively well *and* start in the weekly lineup is greater than later in the draft where the likely starters have been selected and managers are looking primarily for backups and/or players with the potential to outperform their projection. To account for the higher opportunity costs in the beginning of the draft, picks 4 to 7 ensure that the roster contains 2 RBs, 2 WRs, 1 TE, 1 QB, and 1 WR/RB for the FLEX spot.

To maximize the effectiveness of each pick, it is important to determine all other reasonable picks and consider the trade-offs between them. As such, developing a flexibility within the selection process to allow highly ranked/projected outliers at less important positions such as TE and QB to be selected. Specifically, the alternative selection process will select the top ranked player if the roster does not currently have enough as defined by internal counters of 2 RBs, 2 WRs, 1 TE, 1 QB, and 1 WR or RB. The counters do not allow for the algorithm to select the 3rd RB or WR until the 7th pick *unless this occurs coincidentally during the first 3 picks*. It is important to note that the process will *never* result in rosters containing 3 RBs *and* 3 WRs by the 7th pick. The 7th pick is key because a team that is currently missing a QB, TE, or has only 1 RB or WR will select one to ensure that the most important starting positions are accounted for before the players drop off too sharply. Typically, the highest-ranked QBs and TEs are ranked between 14-40, suggesting that these outliers be selected in the 2nd, 3rd, or 4th round, with most QBs and TEs being ranked at 60 or lower, suggesting that most players begin drafting them in the 5th or 6th round. Given that the positions can be picked in any order and that it is most common to pick QBs and TEs around the 5th, 6th, or 7th picks. The strategy of the first 7 picks ensures diversity in rostering and accounts for opportunity costs in a methodical way while still loosely respecting the ranks that ESPN provides managers.

Stage Two: Picks 8-14

As previously mentioned, the bucketed tiers of positions suggest that prioritizing the selection of RBs or WRs before a QB or TE will give a manger the biggest upside at a position—Ks and D/STs will almost never be considered as a contender for a draft pick until the final two rounds.

From picks 8-14, the top player on the board by rank will be picked in most cases, realistically accruing as much perceived value as possible each pick. Given that the 7 most important positions have already been accounted for, the remaining players are not expected to be starters and the order in which they are picked is less important. Thus, it is crucial to ensure that any one position, especially a historically less important position such as K or D/ST, is not over-drafted during this stage. As such, parameters ensuring that a maximum of 2 quarter backs, 2 tight ends, 1 kicker, and 1 defense/special teams will be drafted in these rounds. ESPN analysts even note that never acquiring a backup at QB or TE is not a bad strategy given that there are marginally worse substitutes readily available on a week-to-week basis after the draft. The algorithm incorporates these parameters by selecting the top player by rank if that player will not exceed any of the counters. If that player will exceed any specific counter, the next player by rank is considered. If the next considered player passes the counter check at their position, he is selected, and this process repeats until pick 14. There are no maximum number of RBs and WRs that the algorithm will choose.

This strategy during these rounds aims to maximize the value of each pick while also providing the possibility of some insurance at the QB and TE position and prioritizing picking players with historically high upsides. Since there is no maximum on the number of RBs and WRs that can be selected, the selection process recognizes that ESPN will fail to recognize a player who will have a large role in their offense, like AJ Brown who was ranked 214th and went undrafted in 2019 only to finish 10th overall amongst WRs in total fantasy points that year.

Stage 3: The final 2 picks

If, by chance, a position is still not drafted by this point, it will be considered in the final two picks. In rounds 15 and 16, the priority is filling in the kicker and defense/special teams spots, but there is a slim chance that either one has been selected prior to these two rounds if the ranking happens to fall that way due to a highly ranked K or D/ST in the previous couple rounds. It is important to recall that the first 7 picks accounted for the 2 RBs, 2 WRs, 1 QB, 1 TE, and 1 FLEX and the final two picks will ensure that a kicker and defense/special teams will be rostered, hence completing a starting roster of 9 players in a scenario where this has not already occurred.

As Kickers and Defense/Special Teams have historically have the smallest average scoring per week and smallest standard of deviation between total scoring each year, it is alright to account for these with the last couple of picks. Moreover, more than one kicker and one defense will not be drafted. Since there are 32 kickers and defense/special teams that play each week, a bad draft pick can easily be replaced throughout the season by an undrafted one of relatively similar caliber. Occasionally, a defense or kicker is suspected to score more than others, but these instances are very rare and barely affect the standard deviation of points at the position. Thus, depending on which position(s) is/are missing, the top player by ranking filling either missing position (or simply the one missing position) will be selected. If, at round 16, the roster is still missing a position, the highest ranked player at that position is selected.

Generalizing this process

This process is repeated for each possible draft position over a three-year period, thus generating 12 rosters per year for a total of 36 rosters. While it may be convenient to compare the results of ESPN's strategy at draft position X to the results of this paper's alternative strategy at the same draft position, it will be more effective looking at how the two strategies performed more wholistically. Given that players are also randomly assigned a draft position, it is important to gauge how well each method performs *on average*. Thus, draft position will not be analyzed closely in the following sub-section.

Chapter 6

Evaluation

The evaluation technique will hinge on two main elements: the first being general analysis of the roster compositions and the second being the number of ultimate “Elite picks”, “A picks” and “B picks” as defined soon in this paper. The first method will analyze how frequently the ESPN strategies from the baseline drafts selected rosters comprised of 3 or more QBs, 3 or more TEs, 2 or more Ks, and 2 or more D/STs. The proposed alternative strategy avoids any such scenarios. Analysis of the baseline shows how frequently the ESPN auto-pick will choose undesirable roster profiles. Simultaneously, it shows how many times the alternative strategy *does not* select undesirable profiles as it was designed specifically to avoid over-selecting unvaluable positions and neglecting to draft any position. The second type of analysis will concern “Elite picks”, “A picks”, and “B picks”. A “B pick” will refer to a player that at least one manager would have ideally started on their team each week. This method of evaluation aims to quantify the value that was accrued throughout the draft without trying to estimate the weekly average of points that a team with any roster would score. To develop more understanding for why these cutoffs occur where they do, it is important to think of the league size of 12 and total available slots on a manager’s starting roster.

Each week, managers can only start 1 QB, K, and D/ST. For a 12-person league, this means that 12 QBs, Ks, and D/STs will start each week. Thus, if all managers were to maximize weekly fantasy points production, the top-12 players at each position would be started each week on a different team. In another light, accruing multiple players that fall into the top-12 means that a manager holds a player that is guaranteed to improve another team’s roster, thus providing both mangers with the potential for gains from trade at some point in the season. A team with multiple of players of this caliber will not only perform well but can leverage their assets better than a team who has fewer players of this caliber to switch to.

“Elite picks” will be reserved for the very best players at the most valuable positions. Thus, the top-6 RBs and WRs by average fantasy points who also played 9 or more games will be considered elite picks. As the drop-off within these positions is stark after the first few players at these two positions, measuring the ability of a selection method to retain these calibers of players is critical. To be classified as a “A pick”, or a player that most managers would have ideally started on their team each week, QBs and TEs must fall into the top-6 of average fantasy points in that given year and must have played at least 9 games and RBs and WRs must fall into the top-12 of average fantasy points in that given year and must have played at least 9 games. The top half of “A picks” are the “Elite picks”. Lastly, to be classified as a “B pick”, or a player that at least one manager, but likely many, would have ideally started on their team each week, QBs and TEs must fall into the top-12 of average fantasy points in that given year and must have played at least 9 games and RBs and WRs must fall into the top-24 of average fantasy points in that given year and must have played at least 9 games. And

When concerned with the FLEX, K, and D/STs positions, “A”, and “B” picks will not be counted. Since the top candidate that can improve at least one manager’s FLEX position *begins* at the 25th best RB or WR or the 13th best TE, these players will not score substantially more points that any alternatives. Moreover, their consistency will be highly questionable. Ks and D/STs were also not considered as their scoring ability is historically marginal and undiscernible from other players within the same position. “Elite picks” will only be counted for RBs and WRs as they are the most valuable positions.

Alternative Strategy Evaluation

When it comes to roster balance, the alternative strategy solves all the main issues that occur in the rosters generated by ESPN’s auto-picking algorithm. By following the methodology laid out in the previous sub-section, the alternative drafting strategy will continuously consider opportunity costs which will distribute value across all important positions (RB/WR/QB/TE) and generating well-rounded rosters that can perform well in weekly play. Notably, it is guaranteed that any roster generated using the alternative method *will not* produce a roster with multiple kickers or defenses as the opportunity cost of acquiring multiple is too costly. The alternative strategy, as a result, will *consistently* produce well-rounded rosters and not simply generate a series of lopsided rosters that have good players but massive gaps in other areas.

When it comes to examining the value generated by each selection method, both methods are systematically picking players who finish well within the season with a slight edge going towards the alternative selection method. The following table describes the total number of effective picks that each selection method produced from each draft position over the 3-year period. Each cell refers to the sum of all effective picks among the 12 rosters from the given year at each of the 4 most important positions.

Table 12 – Total "Effective Picks" by year and strategy

ESPN				Alternative Strategy			
2016	Pick Type			2016	Pick Type		
	Elite	A	B		Elite	A	B
RB	6	11	12	RB	5	9	13
WR	6	11	11	WR	6	9	10
QB	-	5	4	QB	-	4	7
TE	-	5	4	TE	-	13	2
2017	Pick Type			2017	Pick Type		
	Elite	A	B		Elite	A	B
RB	6	13	10	RB	6	12	9
WR	6	12	12	WR	6	10	12
QB	-	6	4	QB	-	7	5
TE	-	5	5	TE	-	8	6
2018	Pick Type			2018	Pick Type		
	Elite	A	B		Elite	A	B
RB	6	10	10	RB	6	10	19
WR	6	13	10	WR	6	14	8
QB	-	6	5	QB	-	5	10
TE	-	3	6	TE	-	3	7

In examining the table, it is important to understand that the total number of effective picks is equal to the total number of available effective picks when playing the ESPN strategy. This will always be the case because when the ESPN strategy plays itself, the top-192 players are selected in a 12-person league. Thus, if any player in the top 192 turns out to be an effective pick, they will have been selected to one roster. While this guarantees a good summary showing that the "effective" players were always selected, the general roster composition severely undermines this highlight. Given that roster imbalances will cause managers to rearrange their roster, a manager will have to trade away value and/or drop players to resolve the issues that arise from ESPN's auto-pick selection.

Chapter 7

Conclusion

Ultimately, ESPN's own analysts' recommendations conflict with the strategy of its auto-pick selection tool. This conflict results in systematic selection mistakes and ultimately generates unbalanced rosters that leave managers with problems to solve before their first matchup occurs. While this is true, the ESPN auto-pick selection is still able to generate valuable draft selections at the 4 most important positions. Still, most ESPN-generated rosters have glaring issues that managers must solve. To do so, managers will have to trade away valuable players to balance their rosters and retain the value in players that are worth starting—the value of undrafted players at the beginning of the season is likely low and wildly unpredictable, so dropping/adding players is a lackluster solution. For example, the ESPN roster from 2017 that drafted 7th overall resulted in 3 "A picks" and 1 "B pick"; however, all A picks came from the same position: QB. Moreover, this roster includes 5 QBs, another major issue. While these 3 QBs are valuable to the manager, their value is not fully realized until the QBs have played for a few weeks and prove their worth. Thus, this manger is relying on the willingness of other mangers to trade for QBs, a position that is not in high demand, for other players such as RB or WR. This situation is one of many that arise from the lopsided ESPN rosters. While other managers can be leveraged to experience gains from trade, a strategy relying on the decisions of other managers is very risky. Trading with teams is not always advantageous as one manager's suffering team directly helps one opposing manager during weekly play. Looking at the same example, if the manager who drafted 5 QBs proposed trades to the opposing managers in any of their next 3 weekly matchups, all of them will have a large incentive not to trade to improve their opponent's roster given that it is currently very poorly constructed.

Given that both strategies systematically select similar quantities of players that ultimately perform well, the alternative method is a much safer and effective option for managers. Distributing players across positions and selecting all starting positions in the draft does not force managers to trade away their valuable players. Moreover, the valuable players will be evenly distributed on rosters selected by the alternative. In the case of the roster with 3 “A picks” at QB, the opportunity cost of selecting the third QB is too great even though the player is a top player at the position. The manager can ultimately only start 1 of these QBs, so there is no way to extract the value of them during weekly matchups.

Of course, conclusions reached in this paper are built upon a series of limiting assumptions. Firstly, strictly forcing all opponent strategy to the ESPN auto-pick strategy is not indicative of how human opponents draft. To better develop an understanding of how either method performs in fantasy drafts, testing against more complex opponent strategy is necessary. For example, incorporating opportunities for opponent deviation from the ESPN auto-pick algorithm is one sensitivity test that can solidify the results reached in this paper.

Additionally, the scope of the years studied was relatively small. By studying only 3 years of data, singular random events can drastically affect the results of the success of a selection tool. As fantasy point totals do not historically correlate well with player rankings, testing over several years reduces the probability a strategy succeeds purely by chance. While the alternative strategy aims to leverage this unpredictability, more years will always make results more robust. Moreover, this strategy can be tested across different league conditions for robustness. For example, the roster size could be changed from 12 to 8, 10, and/or 14. Seeing how the strategy performs in various situations will further solidify its effectiveness as an alternative to ESPN’s auto-pick formula.

Lastly, the omission of player projections, the best predictor of a player’s value at their position, is costly as it reduces the effectiveness of player evaluation. By using rank to determine player value, the minutiae in player differences are mostly forgotten. It is then difficult to know exactly when the outliers at a position are assumed to have been completely selected. As such, general assumptions are made about where these cutoffs lie using past quantities of outliers at QB and TE specifically and historical averages of the ranks of these players. These lines constantly change, so this process cannot be generalized well without this key information. Moreover, real-world occurrences are not always included in projection or rank. For example, Le’Veon Bell, the #1 ranked player in the 2018 fantasy draft, entered a contract dispute with his team prior to the season and ultimately did not play a game that year. Any manager that used the ESPN auto-pick selection tool automatically selected him, a key mistake. Managers with knowledge of this preseason dispute would more frequently select another option, avoiding this mistake. Neither of these methods account for outside information affecting the risk of player selection like an actual manger would, thus they are subject to make irrational choices occasionally.

This paper systematically displays the shortcomings of the ESPN auto-pick function, suggesting that some action should be taken to improve its functionality. As fantasy football is ultimately a way for companies like ESPN, Yahoo!, and the NFL to make money, delivering the best possible experience to users should be a top priority; however, the relatively new game is still evolving. If more literature is published solving additional issues in ESPN's auto-pick tool, the removal of the current inefficient tool is more likely. Additional proposed features to test would be strategic backups, or "handcuffs". This is when managers draft the backup of the fantasy player on the real team so that in the case of injury, there is a player readily available in the same role as the injured player. This is an especially common strategy for players who draft highly valued RBs.

Finally, this strategy can be generalized to other fantasy sports so long as general inferences can be made about the value of different positions in a sport as they relate to fantasy scoring. As draft selection tools exist for all fantasy sports to aid those who cannot attend, providing the tens of millions of yearly players with a more efficient tool will aid millions of fantasy sports participants.

Appendix A

Table 13 –Yearly Fantasy Points Projection Accuracy by Website

Source	2012		2013		2014		2015		2016		Average	
	R^2	MASE	R^2	MASE	R^2	MASE	R^2	MASE	R^2	MASE	R^2	MASE
FFA: Average	**0.67**	**0.545**	**0.612**	**0.573**	0.618	**0.577**	**0.626**	**0.553**	**0.645**	**0.535**	**0.634**	**0.557**
FFA: Robust Average	0.667	0.549	**0.612**	**0.573**	0.613	0.581	0.628	0.554	0.644	0.536	0.633	0.559
FFA: Weighted Average							0.626	**0.553**	**0.645**	**0.535**	**0.636**	**0.544**
CBS Average	0.637	0.604	0.479	0.722	0.575	0.632	0.5	0.664	0.559	0.625	0.55	0.649
ESPN	0.576	0.669	0.5	0.705	0.498	0.723	0.615	0.585	0.63	0.551	0.564	0.647
FantasyData									0.531	0.639	0.531	0.639
FantasyFootballNerd					0.37	0.785	0.281	0.767	0.501	0.641	0.384	0.731
FantasyPros			**0.613**	**0.572**	0.608	0.585			0.61	0.561	0.61	0.573
FantasySharks					0.529	0.673			0.606	0.592	0.568	0.633
FFtoday	0.661	0.551	0.55	0.646	0.53	0.659	0.546	0.626	0.574	0.618	0.572	0.62
NFL.com	0.551	0.65	0.505	0.709	0.518	0.692	0.582	0.632	0.605	0.584	0.552	0.653
WalterFootball					0.472	0.713	0.431	0.724	0.483	0.718	0.462	0.718
Yahoo					0.547	0.645	**0.635**	0.554	0.624	0.562	0.602	0.587

Figure 8 Average Fantasy Points Per Week Scored by Defense/Special Teams, 2016

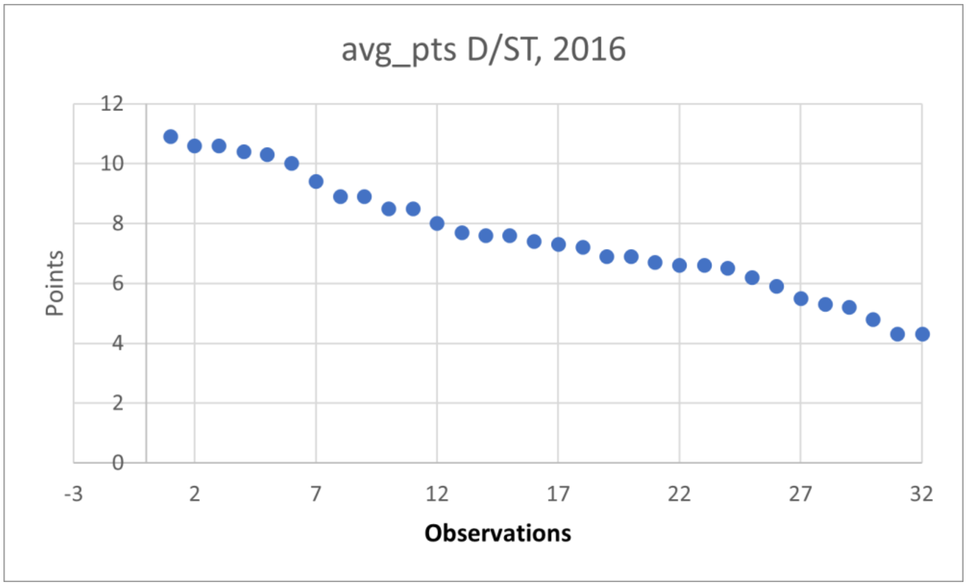


Figure 9 Average Fantasy Points Per Week Scored by Defense/Special Teams, 2017

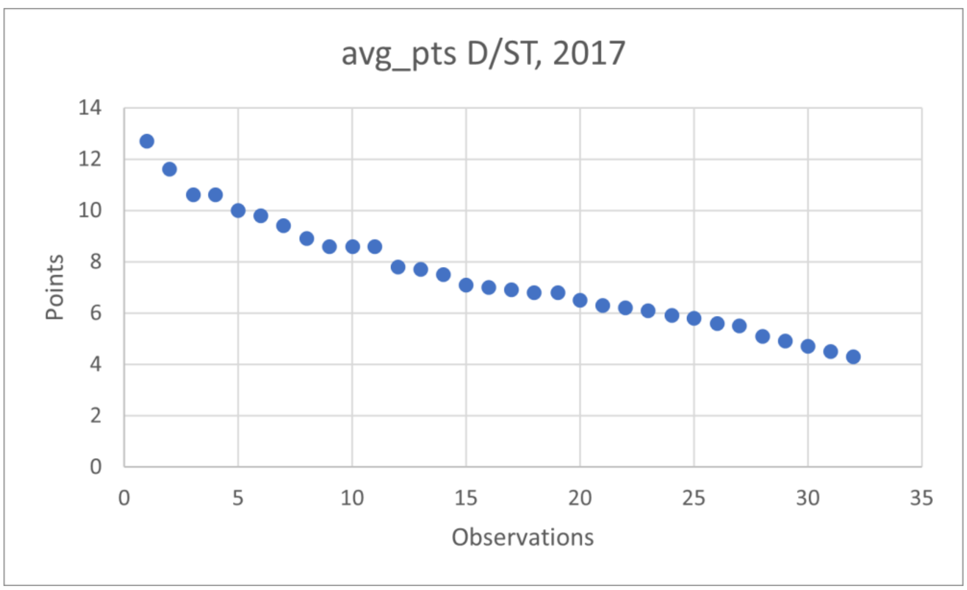


Figure 10 Average Fantasy Points Per Week Scored by Kickers, 2016

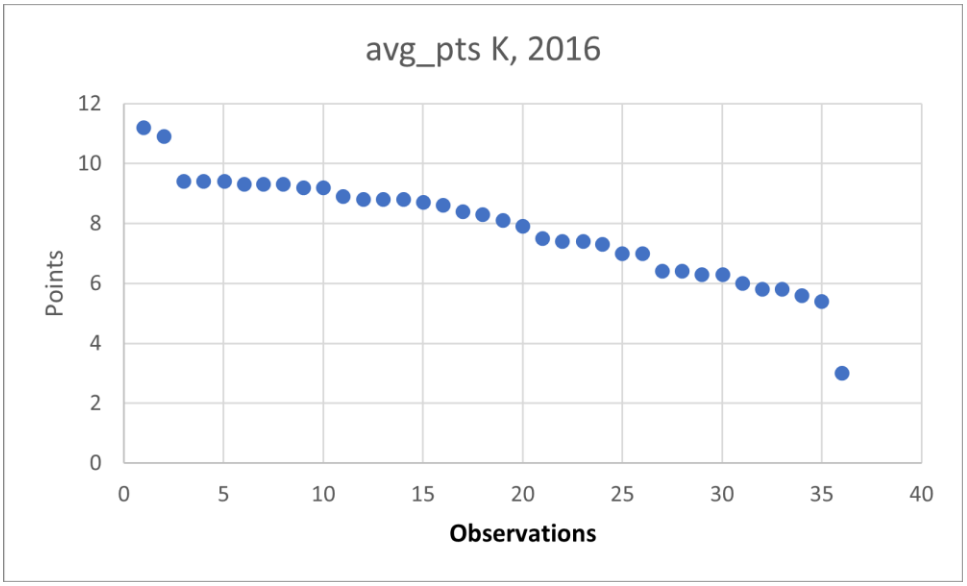


Figure 11 Average Fantasy Points Per Week Scored by Kickers, 2017

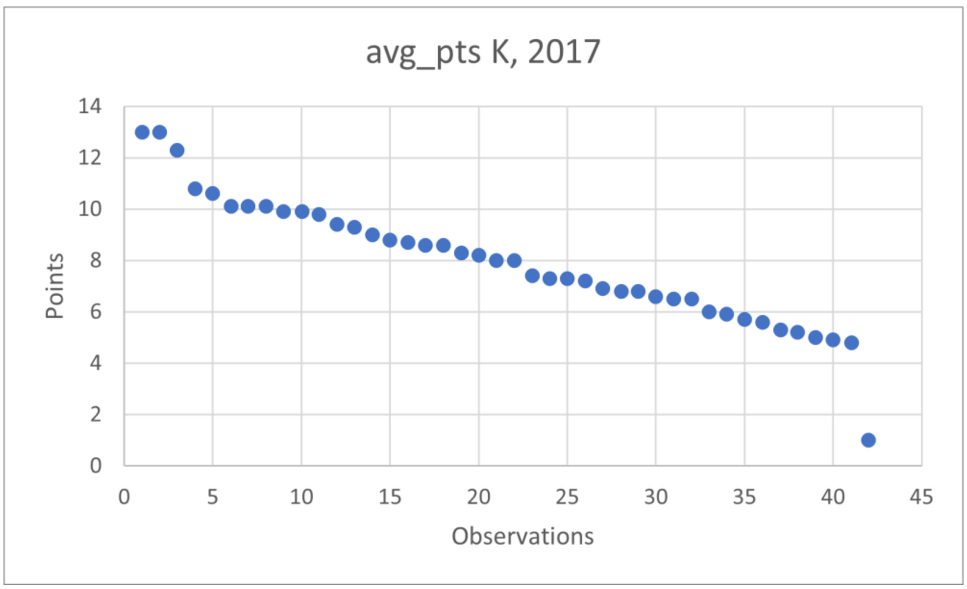


Figure 12 Average Fantasy Points Per Week Scored by Quarterbacks, 2016

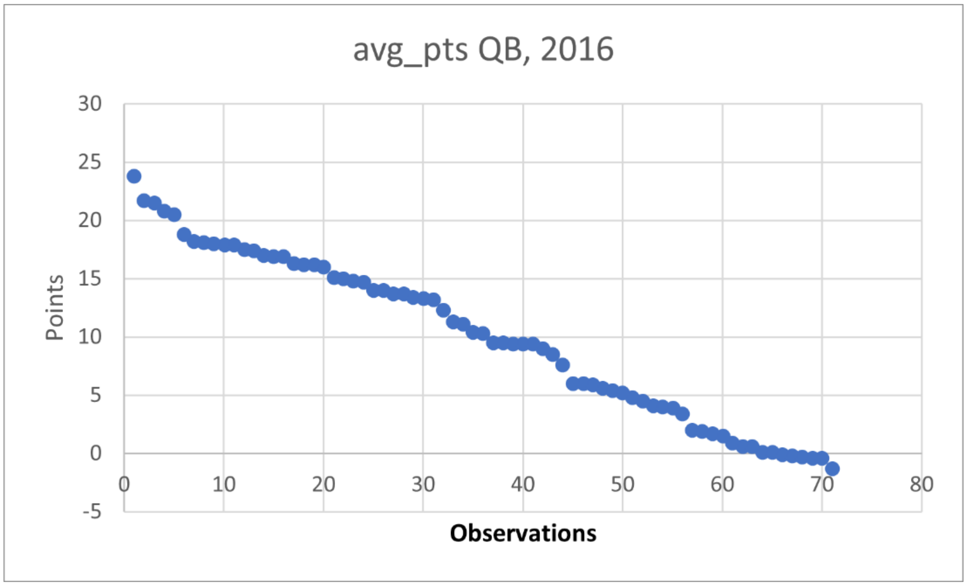


Figure 13 Average Fantasy Points Per Week Scored by Quarterbacks, 2017

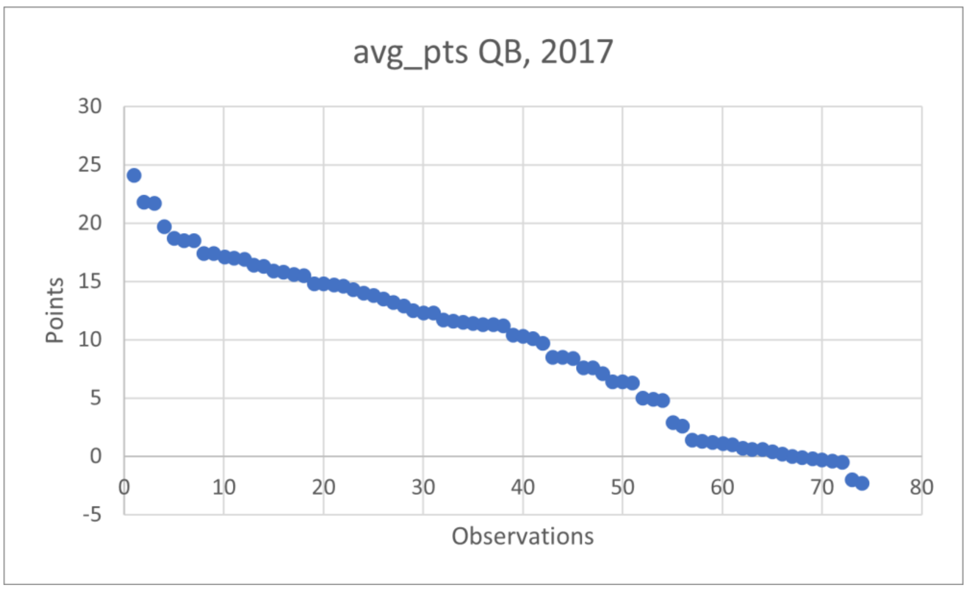


Figure 14 Average Fantasy Points Per Week Scored by Running Backs, 2016

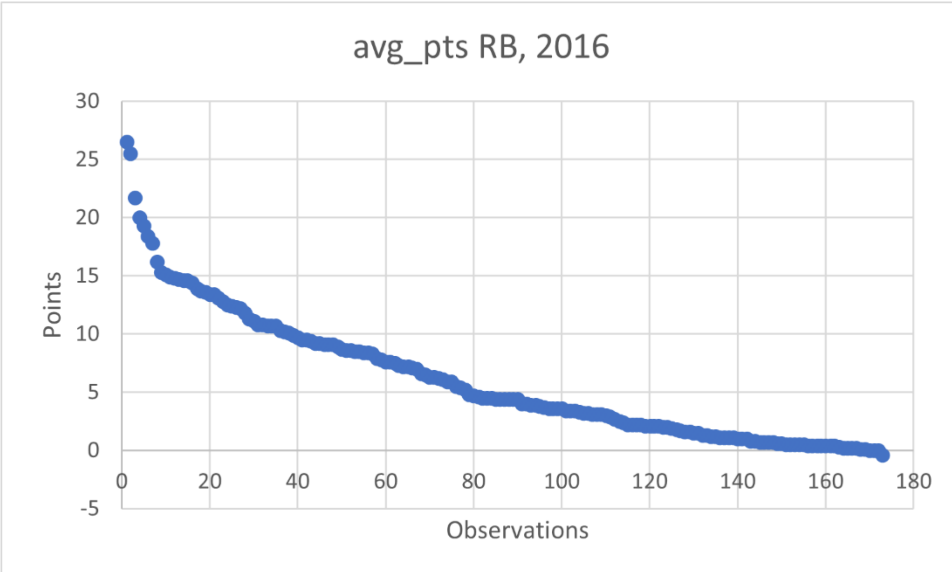


Figure 15 Average Fantasy Points Per Week Scored by Running Backs, 2017

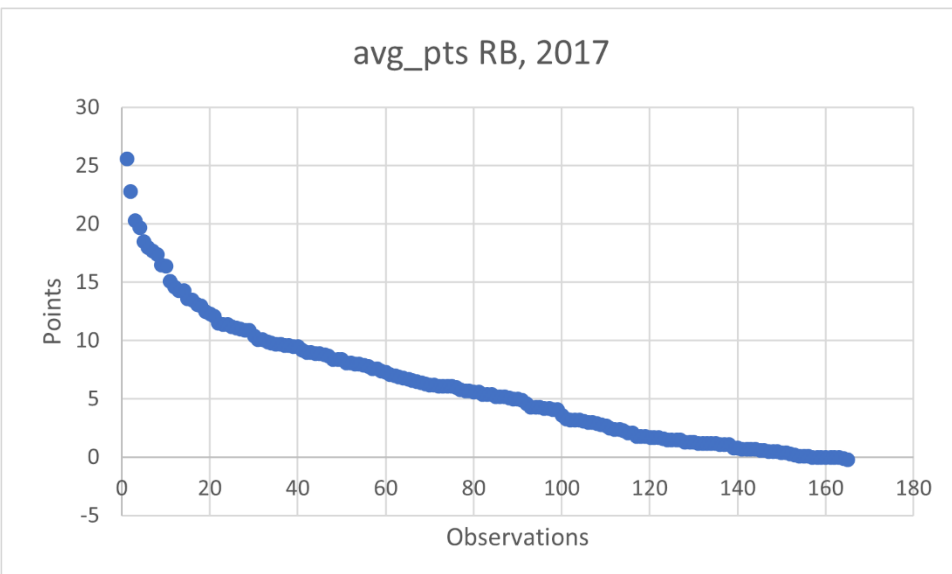


Figure 16 Average Fantasy Points Per Week Scored by Tight Ends, 2016

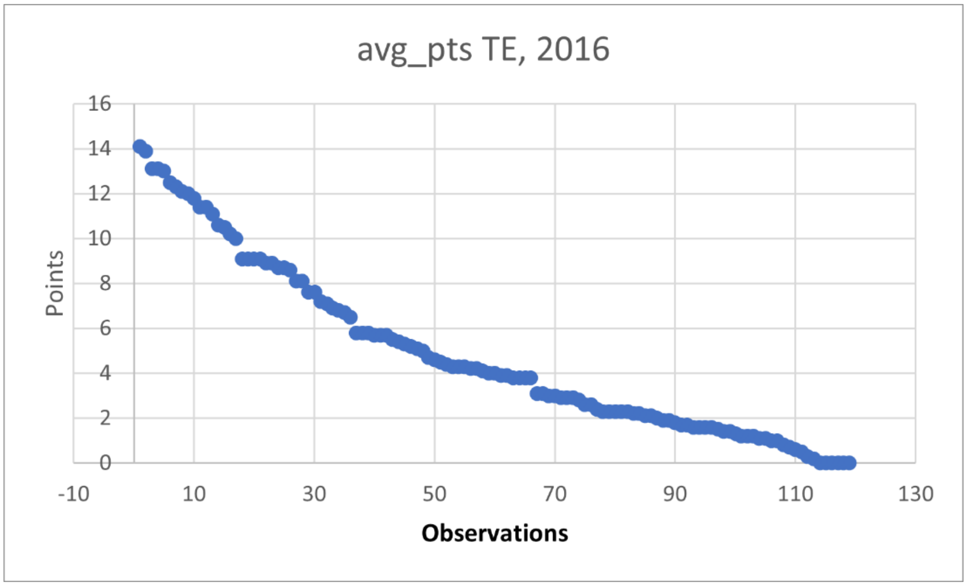


Figure 17 Average Fantasy Points Per Week Scored by Tight Ends, 2017

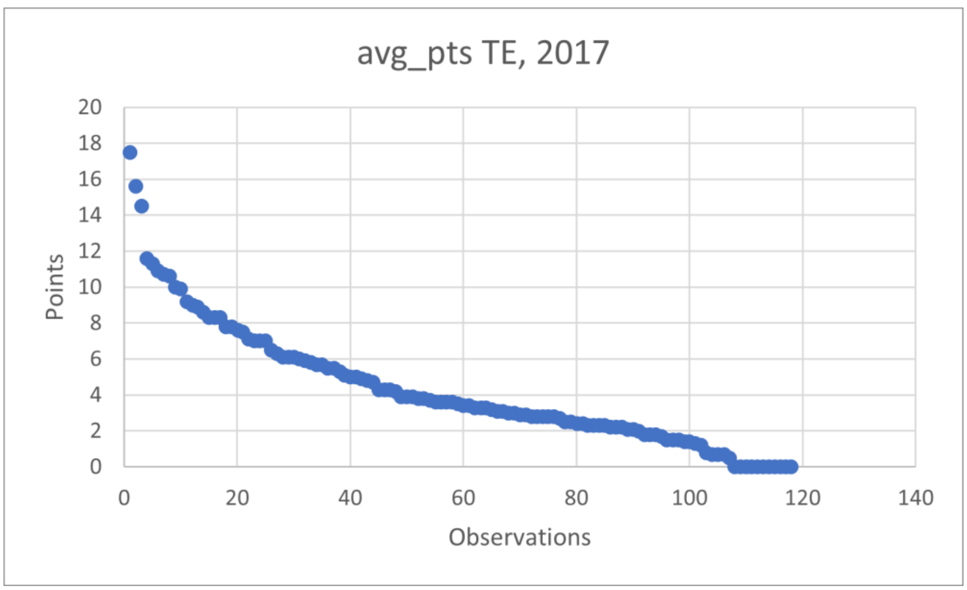


Figure 18 Average Fantasy Points Per Week Scored by Wide Receivers, 2016

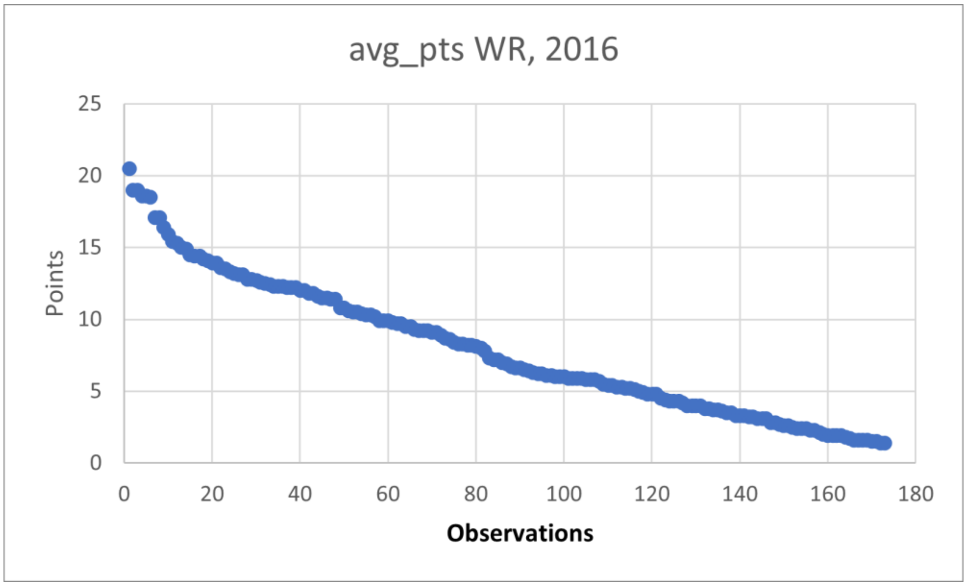
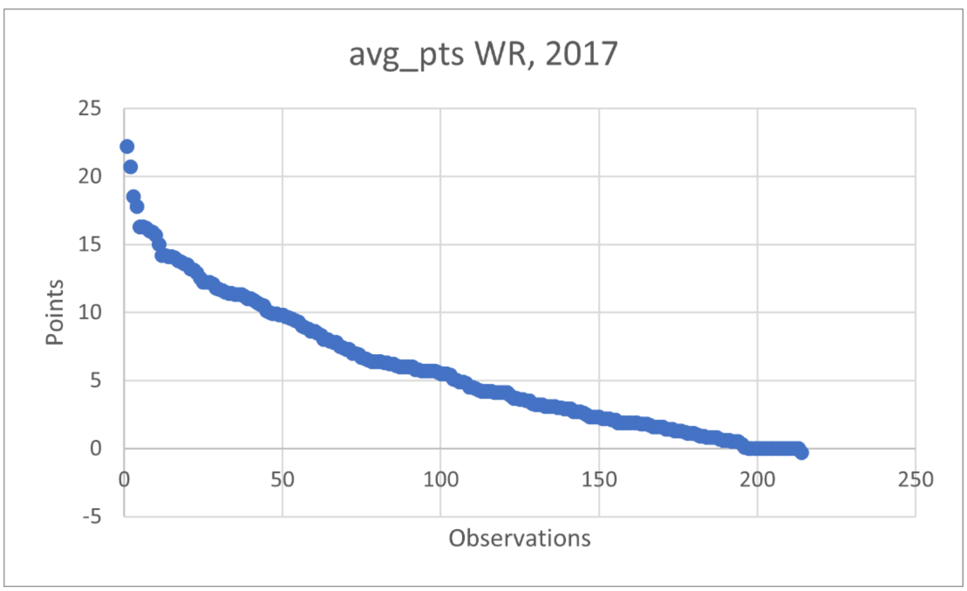


Figure 19 Average Fantasy Points Per Week Scored by Tight Ends, 2017



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ACADEMIC VITA

EDUCATION

The Pennsylvania State University | Schreyer Honors College **University Park, PA**
Eberly College of Science | Bachelor of Science in Mathematics Graduation: May 2022
College of the Liberal Arts | Bachelor of Science in Economics & Minor in French
Université de Franche-Comté **Besançon, France**
Center for Applied Linguistics | B1 Certification on the D.E.L.F. Exam *May 2019 – Jul 2019*

- Developed proficiency in French through classwork with an emphasis on the culture of the region and life in contemporary France via 60 hours of class each week, host-family lodging, and dozens of weekend regional and international excursions

PROFESSIONAL EXPERIENCE

Aronimink Golf Club **Newtown Square, PA**
Caddie | GAP Presidents Endowed Scholar | J. Wood Platt Endowed Scholar *Mar 2016 – Present*

- Counsel over 300 distinct members and guests by providing insightful advice, calming support, and a fulfilling golf experience
- Welcome golfers and guests to the club and assist in general organization of the members' personal belongings/equipment
- Interact with diverse group of highly successful individuals and recognized by the caddie master for strong interpersonal skills

Bates White Economic Consulting **Washington, D.C.**
Summer Consultant *Jun 2021 – Aug 2021*

- Assisted in the production of two expert reports for a collusion case and merger in the firm's antitrust practice by compiling, processing, and analyzing large data sets in Stata and Excel
- Delivered weekly progress reports to clients by compiling complex findings into easy-to-interpret excel spreadsheets and graphs

Schreyer Honors College Scholar Assistant Team **University Park, PA**
Career Development Lead *Aug 2019 – Jul 2020*

- Served as liaison between scholars, administrative staff, alumni, and Penn State recruiters to host career development events, including networking and company information sessions to bolster professional aptitude and post-graduation opportunities
- Built camaraderie within Honors College's 460 inductees by organizing college-wide community builders and special events

LEADERSHIP AND INVOLVEMENT

Schreyer Consulting Group **University Park, PA**
President | Vice President of Corporate and Alumni Relations *Oct 2018 – Present*

- Improved Honors College's exposure to consulting firms by identifying a network of diverse alumni consultants; organized multiple treks to different firms to meet partners, practice cases, and see life as a consultant first-hand
- Collaborated with executive board and administration to advertise, design, and create first-ever Schreyer Case Competition

Club Ski Race Team **University Park, PA**
Giant Slalom, Slalom, Slopestyle *Aug 2018 – Present*

- Trained extensively and competed in Giant Slalom and Slalom for 20+ hours each week in several regional and state competitions
- Contributed to two championship seasons for PSU Men's and Women's Race Teams in the Allegheny Collegiate Ski Conference
- Maintained team equipment, set varieties of courses, and assisted in officiating several weekend races as a starter and judge

Alpha Kappa Psi Co-Ed Professional Business Fraternity **University Park, PA**
Rush Chair | Fraternal Development Chair *Feb 2018 – Present*

- Increased interest in fraternity by developing detailed marketing strategy attracting largest applicant pool in previous 8 semesters
- Coordinated 4 recruitment events and conducted professional interviews to select newest inductee class from over 150 applicants
- Planned and executed weekly bonding events to encourage brotherhood participation such as brother blind dates, movie nights, and various IM Sports teams within the budget constraint of $750

SKILLS AND HONORS

Skills: Stata, Microsoft Word & Excel, Advanced Proficiency in French, Elementary Python, LaTeX
Honors: Magnum Cum Laude, Euler Memorial Scholarship, GAP Presidents Endowment, William B. Forest Honors Scholarship in Mathematics, Rosenberg Scholarship in Economics, B. Mullen Scholarship in Mathematics, J. Wood Platt Caddie Scholarship, Broomall Lions Club Scholarship