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The Number 80: A Simple Score or a Reference Point for DIII College Golfers

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Abstract

There is an abundance of existing literature which shows the presence of behavioral biases in professional sports. Researchers have used reference dependent preferences and loss aversion, to explain athlete the behavior of professional golfers. Existing literature showed that par of the hole (Elmore and Urbaczewski, 2019), par of the round (Pope and Schweitzer, 2011) and par of the tournament (Stone and Arkes, 2016) have all been identified as reference points for professional golfers on the PGA tour. In this paper, I analyze a new sample of golfers: DIII college golfers. I use a 4 part analysis to examine whether the reference dependent preferences model can help explain the behavior and performance of DIII male college golfers. I hypothesized that there exists a single reference point for DIII golfers which is greater than par. Furthermore, I hypothesized that golfers exhibit loss aversion as they change their behavior relative to the reference point.

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1.0 Introduction

Although standard economic theory explains the majority of human behavior, there is an abundance of literature that exemplifies the fact that individuals violate standard economic assumptions (Camerer, et. al 2004). One theory which explains behaviors outside the scope of standard economic assumptions is prospect theory. Prospect theory explains reference dependent preferences, a frequently studied topic in behavioral economics, which is the notion that the utility from an outcome depends on a comparison to reference points or reference levels. This notion has been extensively explored within the lab (Kahneman and Tversky, 1979; Thaler et al., 1997; Camerer et al., 1999); as well as in the field (Bartling et al., 2015; Allen et al., 2015; Anbarci et al., 2017; Ge, 2018).

With regards to contexts within the field, sports are a commonly investigated area (Bartling et al., 2014; Allen et al., 2015; Anbarci et al., 2017). This is because scores from sports games provide researchers with a field dataset rather than create the need for experiments. This would include coaches using non-optimal kicking strategies in American football (Romer, 2002; Urschel and Zhuang, 2011), teams playing more aggressively in soccer (Bartling et al., 2015), and fans altering their tipping behavior following unexpected outcomes from basketball games (Ge, 2018). Thus, coaches, players and fans alike have been analyzed to highlight the presence of reference points within various sports.

Numerous pieces of literature utilize team based sports when attempting to identify reference points (Bartling et al., 2015); however, Golf, unlike many other sports, is an individual sport and thus provides a perfect natural setting to investigate reference dependent preferences. The fact that a golfer's results are solely influenced by his or her own decision making allows him or her to easily alter strategy in order to beat or obtain the reference point. For example, Phil

Mickelson, a Professional Golf Association (PGA) tour professional, was quoted at the 2015 U.S. Open saying "[I] get to like the 12th hole and I'm three under par and I don't want to have one hole hurt a round so I end up laying up." This quote highlights decision making that can be explained by prospect theory. With regards to the round-level reference point, Mickelson recognized that he was in the domain of gains, under par, and altered his strategy to act more conservatively by laying up rather than going for the putting surface (the green) in 2 shots. This was done in order to try prevent obtaining a final score that was above par. The concept of par, as explained above, is an arbitrary measure designed to inform a golfer of the number of strokes expected to play the hole. It is usually defined as predetermined number of strokes it should take a golfer to complete a hole. In the Mickelson example, we see a setting in which par for the round acted as a reference point; however, par in numerous settings within professional golf has been proven to act as a reference point. Par of the hole (Elmore and Urbaczewski, 2019), par of the round (Pope and Schweitzer, 2011) and par of the tournament (Stone and Arkes, 2016) have all been identified as reference points for professional golfers on the PGA tour.[1] Despite the recent rise in utilizing golf as a setting, there are other stakeholders, besides professional golfers, that have been blatantly ignored: amateur golfers. Amateur golfers are experienced decision makers that often act in high stakes environments; yet, amateur golf still remains a relatively untouched field of study. In fact, my paper is the first that I am aware of that utilizes amateur golf as a natural setting to test for reference dependent preferences.

In this paper, I focused on a subgroup of amateur golfers: college golfers. The motivation to focus on college rather than professional athletes stemmed from the popularity that college athletics continue to receive in the U.S. In recent years, there have been numerous accounts of revealed statistics that highlight that college sports are in fact more popular that professional

[1] Par of the round is defined as the sum of the pars of each hole, normally 18, on a golf course. Similarly, Par of the tournament is defined as the sum of the pars of each round.

sports. For example, in the NFL, the Dallas Cowboys had the largest average attendance per game of 91,619 attendees. In comparison, Michigan university in 2018 had an average home attendance of 110,737 attendees.[2]

Despite the widespread focus that college sports receive, a huge majority of this emphasis is centered around National Collegiate Athletic Association (NCAA) Division I (DI) sports. In fact, even within economics a large majority of literature is concentrated on DI and more focused toward the labor market characteristics of the NCAA (Parent, 2004; Sanderson and Siegfried, 2015). However, like professional athletes, DI athletes are not a good representation of the general population. For example, the average vertical for a U.S. male is around 12 to 16 inches. Whereas, the average vertical of a DI college basketball player is approximately 27 to 30 inches. Thus, it is clear that DI athletes are a select group of athletically talented individuals and would not be a good target sample to deduce results for amateur golfers in general.

Yet, the NCAA has broken college golf up into three divisions, with DI attracting the best quality players and Division III (DIII) attracting the worst quality players. This study explores this uncharted field of DIII, as it is a suitable sample that is closer to a general population in comparison to DI, and examines whether the reference dependent preferences model can help explain the behavior and performance of DIII male college golfers. I hypothesized that the number 80 serves as a reference point for DIII male college golfers. Moreover, I hypothesized that DIII male college golfers exhibit loss-aversive behavior.

To carry out the 4-part analysis I manually built 3 datasets. The first dataset utilized tournament results PDF's extracted from an online golf scoring platform: Golfstat.com. Tournament results show the scores individual DIII players shot in each respective tournament during the Fall 2016 – Spring 2017 season. In the end, I obtained a sample of 6,543 tournament

[2] https://www.sportsbusinessdaily.com/Daily/Issues/2018/12/05/Research-and-Ratings/CFB-Attendance.aspx

scores for DIII golfers. In the first part of the analysis I utilized a similar but abridged methodology adapted from Allen et al. (2015) where the authors focused on reference dependence amongst marathon runners by analyzing a distribution of running times for marathon runners. They found that 50.1% more runners finished within a minute before 3 hours than a minute after. Similarly, I analyzed the distribution of golf tournament scores and found that 28.1% more DIII golfers shoot scores within 2 shots less than 80 in comparison to 2 shots more than 80.

The second dataset consisted of survey responses from an online experiment that I conducted through Qualtrics Inc, an online survey platform, initiated in March 2019. The experiment was broken up into three sections: background information, golf scenario decision making test and golf performance statistics from the Fall of 2018. In the second part of the analysis I utilized the results from a series of decision-making tests in various golf scenarios. I found that DIII college golfers suffer from loss aversion. More specifically, when allowing golfers to choose their own reference point, rather than utilizing par as a reference point, DIII golfers take on more risk when faced with losses in comparison to when faced with gains.

In the third and fourth part of the analysis I utilized the answers from the golf performance statistics section of my survey and integrated that with scoring data from the Fall 2018 – Spring 2019 season to conduct linear and probabilistic regression analyses. I found that when a DIII college golfer has a reference point in mind, if he increases his greens in regulation (GIR) by 1% he will decrease his stroke average by approximately 0.229 shots.[3] Furthermore, I found that if a DIII college golfer has a reference score of 80 or below the probability that he will shoot a score under 80 is in fact 42.7%.

[3] Percentage of greens hit in regulation.

The overall takeaway of this study highlights that PGA professionals are not the only stakeholders in golf who are influenced by reference points. When I merged the results of the four sections of my analysis, I concluded that the number 80 was in fact a reference point in DIII golf, and in turn has an impact on not only their decision making but also influences their overall golf performance.

This paper differs from previous literature in two ways. First, this paper focused on amateurs golfers rather than professional golfers. Second, it hypothesized an alternative reference point to that of par. In addition, this study not only highlighted how the risk behavior of DIII college golfers changed in certain scenarios, but it also showed the impact of a reference point on a golfers performance variables.

This paper is structured in the following way: Section 2 explains the theoretical model; Section 3 reviews previous literature that examined reference dependence; Section 4 discusses my data and methodology; Section 5 analyzes the results from the 4-part analysis; Section 6 and 7 conclude my findings, provide suggestions for future research and discuss potential limitations with this study.

2.0 Theoretical Model

Prospect theory is defined by three main axioms: reference dependent preferences, loss aversion, and diminishing sensitivity. Existing literature uses prospect theory to explain different athlete behavior across different sports. It is important to note that this paper and previous literature mainly focus on the first two axioms mentioned.

As previously mentioned, reference dependent preference is the notion that the utility from an outcome depends on a comparison to reference points or reference levels. Prospect theory is captured in a value function in which a gain is a point greater than the reference point and a loss is a point less than the reference point. As shown in Figure 1, the inflection point in which the value function changes concavity is the reference point. In Figure 1, the reference point is zero, a dollar payout that is greater than zero is considered a gain. A dollar payout that is less than zero is considered a loss.

The second cornerstone of prospect theory is loss aversion. Loss aversion states that people dislike losses more than they like same-sized gains. This is demonstrated in Figure 1, the value function below shows that a gain of (x_2) generates less utility than a loss of (x_1) generates in disutility. The magnitude gained in utility is less than the magnitude lost in disutility.

Prospect theory can be applied to golf to explain golfers' behavior outside the scope of standard economic theory. Previous literature has shown that professional golfers use par as a reference point and measure a gain or a loss by comparing their score relative to par. When shooting "under par" this is considered a gain and "over par" is considered a loss, thus demonstrating reference dependent preferences. Furthermore, if we consider the example of shooting "one under par" versus "one over par" the magnitude of utility gained from "one under par" is less than the magnitude of disutility generated from shooting "one over par" thus demonstrating loss aversion. Loss aversion in golf results in a change in the strategy that a player utilizes on a given hole. This change in strategy could entail a move from a more aggressive approach (risk-seeking) to a more conservative one (risk-averse) or vice versa. This would occur if the golfer reaches their reference point before they complete the round, and instead of taking on a risky strategy the golfer decides to take a more conservative approach to ensure that they in fact achieve the reference point at the conclusion of the round. Lastly, when a golfer's score is already "over par" they will devote less focus on their putts as any additional loss will generate lower disutility than the loss incurred before it; thus, demonstrating diminishing sensitivity.

3.0 Literature Review

The literature review is structured in the following the way: literature surrounding prospect theory, application of prospect theory on a team-based sport, investigations of prospect theory in individual sports, studies relating to prospect theory in golf, key differences between professionals and amateurs and lastly how my paper contributes to existing literature.

3.1 Background on Prospect Theory

Kahneman and Tversky (1979) suggested a reference dependent theory of choice in which individuals value gains differently than they value losses. Kahneman and Tversky (1979) utilized hypothetical choice problems, presented to students and university faculty members, and found that individuals valued gains and losses differently in two ways. Firstly, individuals valued losses more than they valued proportional gains. This behavior was termed "loss aversion." Secondly, individuals were risk-seeking in losses and risk-averse in gains. When combining these two factors a new utility function was proposed; there was a kink at the origin and the slope of the gain function was flatter than the loss function. Reference dependent preferences have been studied extensively within the lab (Kahneman and Tversky, 1979; Thaler et al., 1997; Camerer et al., 1999); however, there has been a recent movement within economics research which aims to utilize field-based data rather than analyzing individuals in a lab setting (Bartling et al., 2014; Allen et al., 2015; Anbarci et al., 2017). It is important to note that the assessment of reference dependent preferences literature is more skewed towards the fields of finance and sport. This paper, in turn, followed this newly formed trend by exploring prospect theory using field data on DIII golfers. Moreover, existing literature has often either used field-based data or behavioral oriented experiments, whereas this paper utilized both. The use of field-based data and an experiment would provide convincing support for this paper's results, as the results were driven and concluded from two different empirical settings.

Benartzi and Thaler (1995) utilized a field-based data to test for reference dependent preferences. The authors explained the equity premium puzzle, which is a long-standing financial anomaly, through the use of myopic loss aversion. The equity premium puzzle is the phenomenon that equities consistently outperform fixed income instruments, namely government bonds. Siegel (1991,1992) showed that during the periods of 1871-1925 and 1926-1990 the real compound equity returns were 6.6% and 6.4% respectively. While returns for short-term government bonds for the same time periods were 3.1% and 0.5% respectively. Benartzi and Thaler (1995) highlighted that stocks have outperformed bonds over the last century due to two factors. Firstly, investors are assumed to be loss averse. Secondly, investors tend to "evaluate their portfolios frequently" (Benartzi and Thaler, 1995). They named the amalgamation of these two distinct factors "myopic loss aversion." In simpler terms, investors are often worried about losses, and thus in order for them to invest in equities, investors demand higher return, in comparison to bonds, to justify holding equity positions.

The presence of reference points across various settings has resulted in the formation of four main candidates for reference points. Firstly, existing literature has shown that reference points are related to status quo (Knetsch, 1989; Samuelson and Zeckhauser, 1998). Secondly, various pieces of literature within psychology argue that goals and aspirations can also serve as the reference point (Markel et al., 2015). Thirdly, some authors argue that social preferences act as a reference point. In this instance, individuals would compare their outcomes to others around them. Neumark and Postlewaite (1998) provided evidence for this type of reference point when showing that social comparisons affect the labor-supply decisions of women. More recently, expectations as reference points have been explored (Koszeki and Rabin, 2006; Ge, 2018).

3.2 Prospect Theory in Professional Sport

Bartling et al. (2015) utilized professional soccer game data from 3,672 and 4,560 matches from the German Bundesliga and English Premier League respectively. For each match, they have detailed minute-by-minute information on goals, cards and substitutions. The authors analyzed this data and showed that professional soccer players exhibit reference dependent behavior during matches. They found that if a team is behind the expected match outcome (e.g. a team who is expected to win is in fact losing or the match is tied), the players of this team were issued more red and yellow cards in comparison to games in which the team is not behind the expectation. This finding still holds when they controlled for the state of the match as well as for unobserved match and team-specific heterogeneity. According to their results, if a team within the German Bundesliga and British Premier League is behind its expected match outcome, the probability that a player of that team will receive a card in a given minute is increased by 20% and 30% respectively. Furthermore, the authors showed that coaches implemented significantly more offensive substitutions when their teams were behind the expected outcome. This paper adds to the literature in support of the claim that expectations can act as reference points, and thus people's behavior depends on how a given outcome contrasts with this reference point. More specifically, this paper highlighted that when individuals in team sports were in the domain of losses, they altered their behavior and became more risk-seeking.

Ge (2018) showed that the behavior of those watching a game was influenced by a professional team's expectations relative to a game's outcome. The author utilized a high-frequency dataset on taxi rides in New York City to investigate how emotions due to sporting event outcomes affect passengers' tipping behavior. He used pre-game betting odds to determine the expectations of the game outcomes, which acts as the reference point, and found that passengers tend to tip more after unexpected close wins and tip less after unexpected close losses. Thus, there is an array of literature confirming the finding that expectations as references points influence behavior.

There are three main limitations to Bartling's et al. (2015) paper. The first limitation is formed due to the set-up of the empirical framework; the authors looked at the number of cards given to a team rather than specific individuals behavior. This could pose an issue as the players more aggressive attitude could be driven by "groupthink" rather than the reference point. The second limitation comes about because of data selection; the authors focused on the British Premier League and the German Bundesliga which are widely known as the most physically tough leagues in Europe (Hayes, 2013). In turn, there is a possibility that this paper's conclusions cannot be applied to other leagues and poses issues when applied to other fields (e.g. golf). Thirdly, they did not control for "rivalries" amongst teams. For example, Chelsea FC and Arsenal FC are two teams located in London and thus have a city rivalry: The London Derby. In these games, players tend to play more aggressively, and so there is a possibility that the results could have been driven by various derby games rather than the entirety of the two leagues.

The consistent takeaway from the two papers mentioned within this section is that reference dependence in sport is a worthy area of study as it not only dictates the behavior of the players themselves but also alters the behavior of those watching.

3.3 Prospect Theory in Individual Professional Sports

Although Bartling et al. (2015) contribute to this papers research by highlighting the salient reference point of scores in sports, soccer is a team-based sport and so does not directly investigate individual player's decision-making process. Focusing on individual sports rather than team sports may be less noisy in revealing reference points. This is due to the fact that team sports provide a setting in which various reference points could be present, e.g. status quo of the team, thus making it difficult to identify the effect that one specific reference point may bring about. There is strong evidence that the individuality of certain sports provides a robust natural setting for investigating reference dependence.

One paper which researched reference dependence in individual sports is Allen et al. (2015) in which the authors asked the following research question: do round numbers act as a reference point for marathon runners? The authors hypothesized that round number reference point serve as a discontinuity in a marathoner's utility function. They used time target as a reference point because of two main reasons: it acts as an internal targeting system, and the absence of financial incentives for marathon runners makes runners intrinsically motivated. The absence of the financial incentives strengthens the hypothesis that runners are driven by their "personal best" or an internal system as opposed to receiving a monetary reward. The authors used the results posted on websites of individual marathons globally from 1970-2013 as their dataset. The sample is 873,000 runners with an average finishing time for a full marathon of 4 hours and 41 minutes. They measured the amount of excess mass, higher density of running times in comparison to other numbers, around round numbers and tested whether the excess mass is statistically significant in an interval around a round number. The main finding was the existence of bunches when approaching round numbers; they found that 50.1% more runners finished within a minute before 3 hours than a minute after. Furthermore, they found the presence of left-digit bias for finishing times. Lastly, they concluded that round number reference points served as points of discontinuity in a runner's utility function. The main limitation of this study stems from the fact that there could be other reference points that marathon runner utilize when running a race, rather than solely round number finishing times.

The presence of pacesetters, personal best times and last race times could dampen the impact of round number reference.

Allen et al. (2015) are pioneers in the use of the nonparametric procedures in reference dependence analysis. Although the authors hypothesized the presence of a reference point of whole numbers before their analysis, they did not empirically estimate the reference point, rather the reference point "pops out" in the distribution of the data. Allen et al. (2015) actively contributes to our research through a variety of ways. As opposed to other literature, Allen et al. (2015) investigated reference dependence in an individual sport which lacks financial incentives, similarly to amateur golf. This paper provides empirical evidence for the impact of reference dependence on a runner's performance close to the reference point thus providing evidence that players are strongly influenced by reference dependence. Furthermore, this paper's study design, one which allows the data to dictate the reference point rather than choosing a specific reference point prior to analysis, is heavily based on the study design of Allen et al. (2015).

According to the PGA, five sports resemble a similar "mental and physical" approach to that of golf; the closest being tennis (PGA Tour, 2010). Anbarci et al. (2017) searched for similar behavioral anomalies in professional tennis. More specifically, they tackled the question: are professional tennis players loss averse? The authors used a self-generated dataset, that consisted of 32 matches of the Dubai Duty Free Tennis Championship in 2013, for which the Hawk-Eye technology was available.[4] They found that loss aversion was visible in three different settings. Firstly, when professional tennis players were behind in score, e.g. 0 - 40 down, they were more likely to take risks by increasing their serve speed. Serving with a higher speed can be viewed as a riskier strategy because as a player's serve speed increases their accuracy decreases and thus

[4] Hawk-Eye is computer system used in various sports to measure the trajectory, speed and placement of the ball.

the probability that the serve will hit its desired target falls. Secondly, players were more willing to take risks when the stakes were high (Anbarci et al., 2017). This was seen when average serve speeds were lower earlier in the tournament in comparison to average serve speeds in the final. The final is the part of the tournament with the highest stakes as the monetary gain from winning this particular match is the greatest compared to any other match during the event. Thirdly, they discovered that risk taking behavior is greater amongst lower ranked players. This was shown by the fact that as a players ATP ranking lowered the effect on serve speed increased. They found that lower ranked player serve statistically significantly faster on average. In contrast to what the PGA believes, that golf and tennis are somewhat similar, the authors highlighted that tennis and golf are different in their competitive nature. This is due to the fact that in tennis the game is played one on one whereas in golf players compete against the whole field. Thus, although this paper provides a baseline belief regarding individual sports, there remains the uncertainty of the ability to generalize their findings onto reference dependence in golf.

3.4 Prospect Theory in Professional Golf

Pope and Schwitzer (2011) analyzed the prospect theory framework on PGA tour professionals. Their study was testing whether or not professional golfers on the PGA tour acted in a loss averse manner. They used the dataset of putts per hole relative to the golfers' score ("under par" or "over par"). The authors used a probit model which assessed the likelihood of making/missing a putt for eagle, birdie, par, bogey, and so on.[5]

There were two main findings in this paper: there existed a reference point of "par of the current hole" for golfers on the PGA tour, and golfers exhibited loss aversion. The authors found

[5] Eagle: is a score of two strokes under par on a given hole; Birdie: is a score of one stoke under par on a given hole; Par: is a score equal to the par on a given hole; Bogey: is a score of one stroke over the par on a given hole.

evidence for reference dependent preferences and its influence on performance; they found that when at an equal distance from a hole, a golfer is 2% less likely to make a one under putt than making a par putt. This can be explained using reference dependence: golfers care more about making par than they do about making under par since par acts as their reference point and thus are more likely to make par than one under par. Furthermore, there was evidence of loss aversion as golfers invest more focus when they are over par, the domain of losses, in comparison to under par, the domain of gains. Lastly, golfers behaved in a risk-averse manner in which they sacrifice success when putting for one under par to avoid hard, i.e., long distance, follow-up putts. In simple terms, the researchers' analysis showed that golfers avoid the possibility of loss by playing conservatively when they have the opportunity to do better than par, but will try harder if they are at risk of receiving a score worse than par. This was the first paper written on reference dependent preferences within golf; however, there is a key limitation. The authors did not control for extraneous variables that could have significantly impacted a golfer's score such as weather or golf course design.

However, Elmore and Urbaczewski (2019) showed that when golf course design is not altered, and purely the par of the hole is changed, professional golfers alter their decision making. Elmore and Urbaczewski (2019) investigated how prospect theory applies to decision making and performance in certain U.S. Opens. Elmore and Urbaczewski (2019) hypothesized that there is a psychological effect generated on a professional golfer "by labeling a hole as a par 3, 4 or 5" (Elmore and Urbaczewski, 2019). Under standard theory, altering the par of the hole, while keeping the distance and design of the hole constant, should not impact a golfer's score on the hole. From 1927 to 2016 the US Opens was held 14 times at two courses: Pebble Beach and Oakmont. During this period, the second hole at Pebble Beach and the ninth hole at Oakmont were moved from par 5's to par 4's, whilst only making slight changes to holes length to adjust the movement of the tee markers and flag. The alteration of the par of these two holes provided an ideal natural setting to test for loss aversion and answered the question that previously stood: whether or not it was extraneous variables that were dictating decision making. After obtaining scores from the United States Golf Association (USGA) shot by every professional golfer in these specific U.S. Opens they found U.S. Open golfers tend to put more effort into playing a hole rated a par 4 than a comparable hole rated a par 5. Using a linear regression model that included tournament fixed effects, they estimated that the loss aversion effect size was between 0.22 and 0.31 strokes. In simple terms, one would expect a professional golfer playing a hole as a par 5 to score between 0.22 and 0.31 strokes higher than when the same hole is rated a par 4. Thus, players seem to exert more effort when the hole is playing at a more difficult rating. This is a significant impact, as highlighted by the authors, because tournaments on the PGA tour are played over 4 rounds and thus the impact of the result grows to over one stroke, which is often the difference between first and second place.

From the two papers reviewed under this subsection it is clear that professional golfers are often influenced by reference dependent preferences; however, to what extent is this the dominant theory that is dictating their behavior? Arkes and Stone (2015) studied prospect theory predictions for three reference points: par for recent holes, par for the round, and par for the tournament. They asked the research question of: do hot hand effects dominate prospect theory effects for each reference point? They contributed to previous literature by exploring multiple reference points and investigated whether momentum dominates prospect theory or vice versa. The authors used the PGA ShortLink database: a public database which contains information on every shot at PGA tournaments from 2003-2015 excluding the four major tournaments. The authors conducted a linear regression with the following dependent variables: score from the last round above and below par, score from the current round above and below par, score for current tournament above and below par, and score from the current hole above and below par, and the independent variable is predicted score.

The main findings were that when in the domain of gains, prospect theory effects dominate hot hand effects: "recent success predicts a decline in quality of subsequent performance" (Arkes and Stone 2015). This is observed through greater conservatism with shots when scores are just below the reference point of par in order to maintain their scores, and less exerted effort since golfers care more about the reference point than the overall score. Alternatively, when scores are over par, there was evidence for diminishing sensitivity, as the further a golfers score is from the reference point the more risk-seeking the golfer is with their shots. They also found evidence that the reference points golfers used were influenced by both salience and expectations: "that players adjust expectations, and thus reference points, based on their own overall ability, how a play is going in a particular round, and the difficulty of the relevant holes" (Arkes and Stone 2015). The limitation of this paper, similarly to Pope and Schweitzer (2011), is the inability to control for extraneous variables such as weather and golf course design.

The previous three papers are instrumental for this paper; the common finding that there exists a reference point for professional golfers, which in turn impacts a professional golfer's decision-making, is the basis of this paper's hypothesis and research idea. However, there is a question that still remains: are all golfers decision making dictated by reference dependent preferences? What previous literature lacks which this paper hopes to bridge is the impact of reference dependence on amateur players as opposed to solely professional golfers.

3.5 Difference Between Professionals and Amateurs

Melton and Zorn (2000) found that the level and structure of the prize money in golf tournaments positively impacted professional golfer's performance. The authors collected data from the Official 1995 PGA Tour Media guide where results for the forty PGA tournaments played throughout the 1995 season are presented. The authors found that after the first two rounds of a tournament, golfers at the bottom of the leaderboard were willing to take on more risk than golfers at the top of the leaderboard. They argued that this is due to the fact that players at the bottom of the leaderboard were trying "to play catch up" (Melton and Zorn, 2000). This is due to the nonlinear reward system in PGA tour events (Adler et al., 2012). For example, the difference in rewards between first and second place is much larger than the difference in rewards between 36th and 37th place (Adler et al., 2012).

However, Adler et al. (2012) argued that this result could as easily be explained through risk asymmetry. In order to test this hypothesis, the authors examined whether recreational golfers would prefer to take greater risk when faced with likely losses than with likely gains, using par of the hole as a reference point. Their data set included responses from over 2100 active recreational golfer who were participants in a national panel. Their main finding was recreational golfers were more willing to accept risk when facing a sure bogey (45% chose the risky option) than a sure birdie (28% chose the risky option). This result is consistent with previous findings; golfers were risk seeking when in the domain of losses and risk averse in the domain of gains. Both sets of authors present logical arguments as to which theory influences golfers performance on a given hole; however, one set of authors used a sample of professional golfers and the other set of authors used a sample of amateurs golfers and thus trying to place Melton and Zorns' (2000) conclusions onto Adler et al.s' (2012) sample or vice versa would create some level of bias.

There is a plethora of research surrounding the question as to whether or not college athletes should receive financial rewards whilst in tertiary education (Parent, 2004; Sanderson and Siegfried, 2015). However, this research would not be relevant to this study. What is relevant is whether or not the lack of financial incentives influences amateur athletes' performance. Levitt et al. (2016) found that financial rewards improved academic performance among adolescents. Furthermore, Arbetron et al. (2005) found that financial incentives could increase program participation in after school clubs. Thus, it is clear that financial incentives have some level of impact on nonprofessionals. However, it is important to note that for both Levitt et al. (2016) and Arbetron et al. (2005), the samples were not specifically athletes. Thus, from the research provided in this section one could draw the conclusion that due to a lack of financial incentives amateur athletes will perform worse in comparison to professional athletes. This highlights a key issue with Adler et al,s' (2012) study design when the authors analyzed the risk behavior of recreational gofers as they used par as the reference point, which is a reference point that both Arkes and Stone (2015) and Pope and Schwitzer (2011) highlighted was specific to professional golfers. I hypothesized that due to a lack of financial incentives and a lower quality of play, amateur golfers, more specifically DIII college golfers, would have a reference point above par.

The reason as to why I chose to study DIII athletes over DI or DII athletes is due to the fact that DI and DII athletes have the possibility of receiving financial rewards in the future if they eventually turn professional. For many athletes, the idea they will one day play at the professional level is a seed that is planted long before they're even approached by colleges, said Gershon Tenenbaum, a sports psychology professor at Florida State University. This can be seen in a study conducted by the NCAA in 2015, which shows that 76% of NCAA Men's DI basketball players believe they will play professional basketball (New, 2015). However, in reality only 1.2% of these individuals will in fact turn professional, based on previous years statistics. Even though the probability that a DI athlete will eventually compete at a professional level is low, DI athletes still have a strong belief that they will. According to data from the 2017 NFL draft, 247 DI and 6 DII college football players were drafted into the NFL (NCAA, 2018). Moreover, according to data from the MLS SuperDraft in 2017, 78 male soccer players were drafted from NCAA colleges; 76 DI and 2 DII male soccer players. (NCAA, 2018) Thus, it is clear that DI and DII athletes have the possibility of competing at a professional level, which could be the factor that influences their decision making rather than being dictated by reference dependent preferences. In conclusion, DIII provides a suitable natural setting, due to a lack of financial incentives and almost negligible probability of turning professional, to analyze reference dependent preferences.

3.6 Contributions to Existing Prospect Theory Literature

Previous literature found that some clear quantity (purchase price in Shefrin and Statman, 1985; round numbers in Allen et al., 2015) serve as reference points. My paper expands previous literature on reference dependence by proposing and examining a reference point that is not based on rational expectations and is endogenous to the economic agent (similar to Allen et al., 2015). Furthermore, previous literature has examined reference dependence amongst professional athletes; however, this paper utilized a new empirical setting, DIII college golf, and thus adds to existing literature by investigating amateur rather than professional athletes.
As previously mentioned, there have been numerous papers that have highlighted that par in various settings acts as reference points for professional golfers (Adler et al., 2012; Pope and Schweitzer, 2011; Stone and Arkes, 2016); thus, this paper adds to the literature by highlighting an alternative reference point, the number 80, to that of par within the setting of golf.

4.0 Methodology and Data

This section is broken up into 4 distinct segments. The first focuses on the field dataset of DIII college tournament scores to identify a clear reference point number, this information is displayed in sections 4.1 and 4.11. The second focuses on a behavioral experiment I conducted to test for loss aversion, this information is displayed in sections 4.2, 4.21 and 4.22. The third focuses on a linear regression model that analyzed the impact that a reference point has on golf performance variables, this information is displayed in section 4.3. The fourth focuses on a probabilistic regression model that analyzed the impact that certain reference scores had on the likelihood of shooting specific tournament scores, this information is displayed in sections 4.4 and 4.41.

4.1 Field Data – Institutional Setting

Golf is played over the duration of 18 holes in which a golf ball is struck with a club. The object is to use the fewest possible strokes to complete the course. 361 DIII golf tournaments were held in the U.S. during the Fall 2016 – Spring 2017 season. College golfers are a subset of a larger collection of indivuals termed "student-athletes." A student-athlete is a participant in an organized competitive sport sponsored by an educational institution in which the student is enrolled. The term "student-athlete" was produced in 1964 by Walter Byers, the first-ever executive director of the NCAA, to counter attempts to require universities to pay worker's compensation to athletes. A key difference between professional and college golfers is the absence of financial rewards for college golfers. DI and DII athletes do not receive financial compensation packages for playing a varsity sport in college. However, colleges within DI and DII offer athletic scholarships in various sports across the board. Thus, despite the absence of formalized salaries, there are financial gains, athletics scholarships, in DI and DII where as there are no financial incentives to play a DIII varsity sport.

Financial rewards are often explored as reference points within existing literature (Abeler et al., 2011). Despite the lack of financial incentives in DIII golf, there are various other reference points that a college golfer may use when evaluating his tournament performance. For example, it is reasonable to assume that a golfer may compare his tournament score to the tournament score of a fellow teammate or possibly the average score of individuals competing within the tournament. I hypothesized that the tournament score of 80 serves as a reference point for DIII college golfers. This hypothesis is driven by the fact that multiples of ten which are larger than sixty are widely referred to as reference points as derived from anecdotal research. The validity of the use of anecdotal research to find reference points was highlighted by Allen et al. (2015), where the authors used personal interviews with marathon runners to initially identify round numbers finishing times as possible reference points for marathon runners.

4.11 Field Data – Overview

There are no centralized publicly available datasets of tournament scores for DIII college golfers. Currently, Golfstat.com serves as the official scorer for all NCAA golf championships and provides free tournament software for college golf tournaments. Therefore, in order to conduct this research I generated a dataset by manually extracting tournament results PDF's for the Fall 2016 – Spring 2017 season from Golfstat.com.[6]

I used the Cisdem PDF tool to convert 126 tournament PDFs into excel form. I then manually cleaned the data to form a centralized dataset of DIII tournament scores. For this study,

[6] Golf is different from many other NCAA sports by having its season split between both the fall and spring, for example NCAA soccer is only played within the fall.

I want to examine reference dependent preferences amongst DIII male college golfers specifically, therefore I only included tournaments hosted by a DIII men's team. The final dataset contains 6,543 tournament round scores. It is important to note that, DIII college golf tournaments are either broken up into 1, 2 or 3 rounds. The summary statistics for DIII tournament scores are provided in Table 1 within the Appendix. According to Table 1, round 1 had the highest average tournament score of 82.35, whereas round 3 had the lowest scoring average of 77.89. Thus, scoring average fell as players within the sample progressed into further rounds. This insight hints towards the idea that golfers learn information when they play a golf course, then adjust accordingly in order to shoot a lower score. As highlighted in section 4.1, this data set was used to identify bunches around numbers in the DIII tournament score distribution.

4.2 Behavioral Experiment – Overview

All experimental work for this project was conducted online through the use of Qualtrics, an online survey platform.[7] Participants were asked three sets of questions. First, participants were asked to answer a few questions about demographic characteristics including identification information such as their name, age and college of origin. The purpose of collecting identification information is to be able to match a participants answers from the survey with his individual tournament score from the generated dataset.

Within the second section of the survey, participants were asked situational golf questions. The purpose of these questions was to test the risk tolerance of DIII college golfers and to test for loss aversion. The participants were asked six specific questions broken into two subgroups. The first subgroup included three questions that asked golfers what they would do when utilizing par as a reference point. The second subgroup included three questions that were

[7] This experiment was conducted in March 2019 and approved by the Institutional Review Board (IRB) at Skidmore College.

only presented to participants if they answered “yes” to the question: “When competing in a golf tournament, do you have a score in mind that you want to beat?” These three questions are the same as the previous three questions. However, instead of utilizing par as a reference point, these questions allow the participant to select their own reference point. This is done through asking the participant the question: “What is this score that you want to beat?” the number they select here was utilized as the new reference point.

Finally, in the last section of the survey, participants were asked questions about their performance during the Fall 2018 season. These questions were utilized to conduct a regression analysis to see the impact that the presence of a reference point has on a golfers’ performance variables.

4.21 Behavioral Experiment – Participant Recruitment

In order to recruit participants, I individually reached out to 10 DIII college golf coaches. In my email I asked whether they would be willing to forward the description of my online “golf skill analysis” study to their respective players. This accounted for approximately 100 DIII college male golfers. The response rate was in turn 51%, for a total of 51 participants. Prior to the survey, participants provided informed consent. Participants were not given any compensation for their participation in this study, and were not aware of the main objective of the study.

The typical participant was a 20 year-old male who played an average of approximately 4 tournament rounds in the Fall 2018 season. Golfers within this study are more involved in the game of golf in comparison to your “regular golfer.” The stroke average of a regular golfer is approximately 85.0 whereas the stroke average of my sample was approximately 77.59. Thus, my sample represents a group of players who are active within and knowledgeable about the game of golf. Furthermore, Table 2 highlights the fact that the average reference score for this sample was 76.96. Thus, both the average reference score and stroke average of this sample were 3 shots below my hypothesized reference point of 80. Furthermore, in support of my hypothesis, over half (54.9%) of the sample stated that they have a reference score that they aim to beat during tournament play. Thus, it seems as if DIII college golfers both aim and have the capabilities to shoot tournament round scores that are below the number 80.

4.22 Behavioral Experiment – Experimental Procedure

The first page of the survey gave a description of the experiment including information on the procedures, risks, duration and purpose of the study. However, I did not share the main objective of the study in order to avoid potential bias. Moreover, I gave individuals the opportunity to exit the study if they did not wish to participate. Individuals who provided informed consent were included within the sample.

To ensure that participants were paying attention and providing accurate responses two quality control measures were embedded in the survey. The first quality control measure was a question that asked indivuals to slide a bar to the right. Individuals who did not attempt to slide the bar to the right were removed from the sample. The second quality control measure was an accuracy cross checker question which was included to ensure that the golf performance statistics were accurate. Participants were asked what their respective stroke average was, I then cross checked if this value was correct based on scoring statistics provided by the respective teams websites. Thus, it is within reason to believe that participants who answered truthfully regarding their stroke average, as determined by the cross-check, were truthful throughout the survey. Thus quality control measure ensures honesty in answers and thus increases the reliability of the data.

It is important to note that this experiment is similar to that of Adler et al. (2012) as it utilizes par as a reference point. However, I hypothesize that there is a reference point other than par for DIII college golfers. Thus, as previously mentioned, I asked individuals whether they have a score in mind when competing in tournament play; 54.9% answered "yes" to this question. Following this question, I ask the same golf scenario questions but instead of using par as the reference point, I allowed participants to use their own self-selected reference point. The summary of responses to the golf scenario questions are displayed in Table 3 within the Appendix.

Furthermore, a graphical representation of the risky options chosen are displayed in Figure 3. It is noteworthy that the risk-taking in the scenario questions, taken from Adler et al (2012), result in a lower expected value than taking the "sure thing."

Upon the completion of the study, participants' answers were used in conjunction with Fall 2018 scoring data to form a regression model that analyzed the impact of a reference point on a college golfers' golf performance variables.

4.30 Behavioral Experiment and Field Data – Regression Model

The model used in this paper is similar to that produced by Moy and Liaw (1981) and Shmanske (2000); however, differs in that the dependent variable in their regressions were yearly earnings in dollar terms. Whereas, this paper utilized a model that has stroke average, ($score$), as the dependent variable. An linear regression model was used as the dependent variable is a continuous variable. The independent variables used within this regression are described below. The independent variables included long game measures ($drving\ accuracy$, $drving\ distance$ and GIR), short game measures ($scrambling$, $putts$), an experience factor ($college\ years$) and control variables for the number of events played during the year, the age of a DIII college golfer and the risk tolerance of a DIII college golfer ($events, age, risk\ tol$). The main variable of interest is the reference point dummy ($ref\ point$). The regression model is presented below:

$$score_i = \beta_0 + \beta_1 driving\ accuracy_i + \beta_2 driving\ distance_i + \beta_3\ GIR_i + \beta_4\ scrambling_i + \beta_5 putts_i + \beta_6 class\ year_i + \beta_7 age_i + \beta_8 ref\ point_i + \beta_9 college\ years_i + \beta_{10} freshman_i + \beta_{11} events_i + \beta_{12} risk\ tol_i + \varepsilon_i$$

These skill statistics and experience variables have a direct impact on a golfers performance and a more detailed clarification of RHS variables are given below and in Tables 6, 7 and 8 within the Appendix. The summary statistics for variables presented is given in Table 2.

$drving\_accuracy$. This variable measures the percentage of tee shots that come to rest in the fairway by a DIII male college golfer. It is expected that this coefficient will be negative because a player that is more accurate will have a better opportunity, and thus a higher chance, to shoot lower scores.

$drving\_distance$. This variable measures the average number of yards per drive by a DIII male college golfer. It is expected that this coefficient will be negative because a farther drive leaves a golfer closer to the hole, thus making the next shot easier resulting in a lower score on a given hole and in turn a lower scoring average.

GIR. This variable measures the percentage of greens hit in regulation by a college golfer on average per round. A green is considered hit in regulation if any portion of the ball is touching the putting surface after the green in regulation stroke has been taken.[8] It is expected that this

[8] The green in regulation stroke is determined by subtracting 2 from par; 1st stroke on a par 3, 2nd stoke on a par 4, 3rd stoke on a par 5.

coefficient will be negative because a player that has a higher GIR value hits more greens thus providing more opportunities to putt for birdie and in turn shoot lower scores.

$scrambling$. This variable measures the percentage of time a DIII male college golfer misses a GIR, but still manages to make par or better.

$putts$. This variable is used to define the number of putts a college golfer hits on average per round. It is expected that this coefficient will be positive because there is a perfectly linear relationship between a tournament round score and number of putts; as a player hits more putts their scoring average will rise.

age. This variable is age of the player, measured in years.

$ref\ point$. This dummy variable is used to explain whether the presence of a reference point influences a golfers average score. This dummy variable equals one if a participant answered yes to the question "When competing in a golf tournament, is there a score that you want to ensure you beat?" The impact of a reference point on a amateur golfers stroke average is ambiguous; however, it is expected that this coefficient will in fact be positive as

$freshman$. This dummy variable equals one if a participant is a freshman. I use this variable to control for the variation in average scores that might be generated by being freshman relative to other class years. This variation could arise due to two key reasons. Firstly, college golf is significantly different to high school golf and thus freshmen often take time to adjust to these changes which often negatively impacts tournament golf performance. Jaki Hitzelberger, a certified mental game coaching professional, wrote that freshman athletes often struggle to perform due to "an inability to cope with mental challenges they face during their first year" (Hitzelberger, 2014). Secondly, college golf teams very often play the same tournaments, and thus the same golf courses, year over year, and thus a freshman is at an automatic disadvantage due to the fact that they have never played these events or played these courses before.

$events$. This variable measures the number of tournament events a DIII male college golfer played in the Fall 2018 season. It is expected that this coefficient will be negative as a player gains experience with every additional event played and thus improving their respective scoring average.

$college\_years$. This variable measures the number of years a participant has been in college and is an experience control variable. This variable is expected to have a positive sign because, as mentioned previously, college golf teams often play the same events and courses year over year; providing upperclassmen an advantage of course knowledge. This knowledge would allow players to perform better and thus causing stroke average to fall.

$risk\ tol$. This dummy variable equals one if a participant answered "$9 for sure" to the question "What would you rather do." This question is a lottery based question to test to risk tolerance of a DIII college golfer.

The model presented before will be used in part three of my analysis to conduct Ordinary Least Square (OLS) regressions. The OLS regressions will be used to analyze the impact created by a reference point on 56 DIII college golfers scoring average.

4.4 Panel Data – Overview

The panel dataset was formed by focusing on the sample of participants that stated that they do have a reference score. The summary statistics for this sample are shown in Table 9. Interestingly, the average score of this sample included within the panel dataset was 77.49, approximately 3.5 shots lower than the field data sample used within section 4.1 of this paper. Furthermore, the average score of this sample is a mere 2.5 shots lower than my hypothesized reference point of 80, and 70.3% of this sample shot tournament round scores below 80. The average reference score of this sample was 76.19, which is below the hypothesized reference score of 80, and ranged between values of 70 to 85. In support of my hypothesis, 97.1% of the sample had a reference score that was below or equal to 80. Thus, before running the probabilistic linear regression models, and purely looking at the summary statistics of this sample, it seems as if DIII college golfers both aim and have the capabilities to shoot tournament round scores that are better (lower) than the number 80.

4.41 Panel Data – Probability Model

4 Probabilistic regression models were proposed in this paper which analyzed the manually formed panel dataset. The motivation behind utilizing probabilistic regression models stems from the fact that an abundance of literature centered on reference dependence within sports has utilized probability models in order to determine the impact that a reference point creates (Pope and Schweitzer, 2011). For example, as previously highlighted, Pope and Schweitzer (2011) found that when at an equal distance from a hole, a PGA professional golfer is 2% more likely to make a putt for par in comparison to making a putt for birdie. The 4 probabilistic regression models used within this paper are listed below:

$$\Pr(score\ under\ 80_i) = \phi(\beta_0 + \beta_1 ref\ under\ 80_i + \beta_2 X(tournament\ controls_i)) \text{ – (1)}$$

$$\Pr(score\ under\ 80_i) = \phi(\beta_0 + \beta_1 ref\ equal\ 80_i + \beta_2 X(tournament\ controls_i)) \text{ – (2)}$$

$$\Pr(score\ under\ 80_i) = \phi(\beta_0 + \beta_1 ref\ under\ 75_i + \beta_2 X(tournament\ controls_i)) \text{ – (3)}$$

$$\Pr(score\ under\ 75_i) = \phi(\beta_0 + \beta_1 ref\ under\ 75_i + \beta_2 X(tournament\ controls_i)) \text{ – (4)}$$

The dependent variables used in these models are $score\ under\ 80_i$ and $score\ under\ 75_i$. $score\ under\ 80_i$ is equal to 1 if a player shoots a tournament round score under 80 and $score\ under\ 75_i$ is equal to 1 if a player shoots a tournament round score under 75. These two dummy variables are categorized as tournament score variables.

The independent variables included in all 4 models can be broken up into two sub-groups: reference score dummy variables and tournament control variables. The reference score dummy variables included in the models are: $ref\ under\ 80_i$, $ref\ equal\ 80_i$ and $ref\ under\ 75_i$. The reference score dummy variables are described below:

The dummy variable $ref\ under\ 80_i$ is equal to 1 if a player has a reference score of 80 or below. The dummy variable $ref\ equal\ 80_i$ is equal to 1 if a player has a reference score of exactly 80. The dummy variable $ref\ under\ 75_i$ is equal to 1 if a player has a reference score of 75 or below.

The tournament control variables included in the models are: par_i, $round_i$, $length_i$ and $year\_2018_i$. The tournament control variables are described below:

par_i. This variable controls for the par rating of the course. Values range between 70 and 73. It was expected that the sign of this variable's coefficient would be negative because as the par of the course decreases a shot cushion is formed increasing the likelihood of shooting a lower score.[9]

$round_i$. This variable controls for the tournament round in which a score was shot. College golf tournaments are generally played over 1, 2 or 3 rounds. Thus, as shown in Table 9, the minimum and maximum values for this variable are 1 and 3 respectively. It was expected that the sign of this variable's coefficient would be positive. This is because as the number of rounds in a tournament increases, a player is given the opportunity to become more accustomed to the

[9] Consider a player whose goal is to shoot 80. On a par-72 course, shooting a score of 80 is equivalent to shooting a score of 8-over par. Whereas, on a par-70 course, shooting a score of 80 is equivalent to shooting a score of 10-over par. Thus, playing a par-70 course rather than a par-72 course gives a player a 2 shot cushion making it easier and in turn increasing the likelihood of shooting a score under 80.

golf course layout and thus alter strategy according and in turn increase the likely hood of shooting lower tournament scores.

$length_i$. This variable controls for the length of the course played during a tournament. Values range between 6,063 yards and 7,156 yards.

$year\_2018_i$. This dummy variable controls for the year in which the tournament was held equals 1 if the tournament was held in 2018 and 0 if the tournament was held in 2019. It was expected that the sign of this variable's coefficient would be positive. This is because the panel data used was from just one season, Fall 2018 – Spring 2019. If the tournament was held in 2018, it would mean that the tournament was played during the Fall half season which tends to have better weather conditions in comparison to the Spring half season. Playing in the Fall would increase the likely hood of shooting better scores as the weather conditions are easier to play in.[10]

Equation (1), (2) and (3) analyzed whether having a reference score of 80 or below, exactly 80 and 75 or below impacted the likelihood of shooting a tournament round score below 80, respectively. Equation (4) analyzed whether having a reference score of 75 or under impacted the likelihood of shooting a tournament round score of under 75. Equation (4) was included to assess whether there was difference between the likelihood of shooting a tournament round score below 80, with a reference score of 80 or below, in comparison to the likelihood of shooting a tournament round score below 75, with a reference score of 75 or below.

[10] Majority of players within the panel data set originate from colleges within the Northeast. The Fall half season conditions are easier to play in as the half season is played between the months of August and October. Whereas the Spring half season is played during the months of March to April; thus, conditions during this period have a tendency to be harder as it is still cold and wet. For example, the Liberty League, a DIII conference made up of college teams from the Northeast, holds two tournaments at the Kaluhyat golf course in the Fall and Spring. The round 2 average score of the Spring event was 4.68 shots higher in comparison to the round 2 average score of the Fall event.

5.0 Results

5.1 Identifying the Reference Point

Figure 2 demonstrates the distribution of tournament round scores for my full sample of DIII golfers. The individual bars show the frequency of scores between 69 and 90 for the Fall 2016 – Spring 2017 season. I chose to limit the distribution to this window as 98.7% of total distribution lies within this window. We can conclude from Figure 2, that there is a large mass surrounding the number 80. This finding is reaffirmed by the fact that 16.0% and 12.5% of the distribution is accounted for between the numbers 78 to 79 and 81 to 82, respectively. Signs of loss aversion can be seen by the distribution because 28.1% more golfers shot 78 and 79 in comparison to 81 and 82. This fact highlights that many golfers seem to want to shoot lower than 80 as a much larger percentage of golfers shot tournament round scores that are slightly lower than 80 (1 or 2 shots lower) in comparison tournament round scores that are slightly higher than 80 (1 or 2 shots higher). This is similar to Allen et al. (2015) finding when the authors found that 50.1% more marathons runners finished within a minute before 3 hours than a minute after. The authors in turn concluded that marathon runners are in fact loss averse.

5.2 Testing Risk Asymmetry and Loss Aversion

Results from the behavioral experiment for the full sample are displayed in under the column "Par as a Reference Point: What Would You Rather Do?" These golfers were more willing to accept risk when faced with a sure bogey (46% chose the risky option) in comparison to a sure birdie (25% chose the risky option). However, the finding that golfers did not accept more risk when faced with a sure par (19% chose the risk option) in comparison to a sure birdie (25% chose the risky option) is inconsistent with my hypothesis. Results for the individuals that stated that they had a reference point score and selected their own reference point score are displayed under the column “Self-Selected Reference Point: What Would You Rather Do?” These golfers were more willing to accept risk when faced with a sure bogey (29% chose the risky option) in comparison to a sure birdie (24% chose the risky option). The results from both samples of participants highlight that DIII college golfers are more risk seeking in a domain of losses in comparison to a domain of gains. This result reinforces the claim that DIII college golfers exhibit loss-aversive behavior which was made in section 5.1. The fact that

5.3 Linear Regression Model

The results from the OLS estimates for the full sample are discussed below. Table 4 shows the regression results of the model presented within the Methodology and Data section for the full sample of 51 participants (N=51).

My results, consistent within Moy and Liaw (1981) and Shmanske (2000), show that both greens in regulation and putts per round, GIR_i and $putts_i$, were vital in determining a golfers overall performance. The coefficients of GIR_i and $putts_i$ were found to be -0.161 and 0.480 ad were statistically significant at 1% and 5% levels respectively.. GIR_i coefficient can be interpreted in the following way: if a golfer increases the average percentage of greens he hits in regulation by 1%, his stroke average will fall by 0.161 shots. $putts_i$ coefficient can be interpreted in the following way: if a golfer increases the average number of putts he has per round by 1 putt, his stoke average will in turn increase by 0.48 shots. It is important to note that the coefficients for both GIR_i and $putts_i$ had signs consistent with expectations.

However, driving statistics, $driving\ accuracy_i$ and $driving\ distance_i,$ did not have signs that were consistent with expectations. In fact, $driving\ distance_i$ was statistically insignificant. This provides support for the belief that golfers “drive for show and putt for doe.” In simpler terms, it is commonly thought that short game statistics such as putting and scrambling are more important determinants of professional golf earnings in comparison to driving statistics. Thus, it seems as both *GIR* and *putts* are vital for both amateurs and professionals alike.

It is important to briefly discuss the performance variables' results; however, my main variable of interest was the reference point dummy variable. This variable was in fact statistically insignificant. However, purely including the dummy within the model only shows whether a having a reference point in mind influences stroke average, yet my hypothesis is focused on an individuals' score for a tournament round rather than a seasons' stroke average. Thus, a new model was proposed that included various interaction terms which were formed by interacting all the independent variables with the reference point dummy. This was done in order to assess whether having a reference point impacts an individual's golf performance variables. These results are shown in Table 5.[11]

The results were as follows: 2 of the interaction terms were statistically significant at a 5% level. Firstly, the coefficient of $GIR\_x\_ref_i$ was -0.229; which can be interpreted in the following way: when considering a college golfer who has a reference point in mind, if he increases the average number of greens he hits in regulation by 1% then his stroke average will in turn fall by 0.229 shots. Furthermore, if this same golfer increases his average GIR by 11%, this is equivalent to hitting approximately 2 more greens a round, his stroke average will fall by approximately 2.519 shots. This might seem like a small impact; however, it is in fact a sizable effect. To put this into perspective, currently the 65th ranked player in DIII has a stroke average of 75.240, if he decreased his stoke average by 2.519 shots he would be ranked within the top-10 players in DIII. One shot is often the difference between winning and losing in golf. Secondly, the coefficient of $driving\_acc\_x\_ref_i$ was 0.163; which means for a golfer who has a reference

[11] The coefficients of various interaction terms were dropped from the model due to collinearity.

point in mind, if he increase the average number of fairways he hits by 1% then his stroke average will in turn increase by 0.163 shots. This finding was inconsistent with predictions.

5.4 Probabilistic Regression Model

The results from the 4 probabilistic regression models for the sample of participants that stated they had a reference score is discussed below. Table 10 shows the results from the 4 models with 273 observations (N=273).

The results from Equation (1) showed that two of the control variables, par_i and $round_i$, and the dummy variable, $ref\ under\ 80_i$, had statistically significant coefficients at the 10%, 10% and 5% levels respectively. The variable of interest is $ref\ under\ 80_i$ and the value of its coefficient was 0.427, which was the largest magnitude, and can be interpreted as the following: if a player has a reference score of 80 or below, he will be 42.7% more likely to shoot a tournament round score that is under 80.[12] The magnitude of this result was relatively large in comparison to the magnitudes found in the three other models . For example, the median reference score was in fact 75, and Equation (4) utilized the median value to identify its impact on the likelihood of shooting a score under 75. The variable of interest for Equation (4) was $ref\ under\ 75_i$ and the coefficient of 0.223 was statistically significant at the 1% level. This result can be interpreted as the following: if a player has a reference score of 75 and below, he will be 22.3% more likely to shoot a tournament round score under 75. Thus, the impact of having a reference score of 80 or under seems relatively large.

However, this result does not reveal the impact of having a reference point of exactly 80. Thus, Equation (2) was included to assess whether or not having a reference score of 80 created downward or upward pressure on the likelihood of shooting a tournament score of under 80. The

[12] This could include scores such as 79, 78, 77, 76, etc.

coefficient for the independent variable of interest, $ref\ equal\ 80_i$, was positive suggesting upward pressure on the likelihood of shooting a score lower than 80, yet results were inconclusive as the coefficient was in fact statistically insignificant. This insignificant result could be driven by the fact that only 14.7% of the sample had a reference score of 80, which limits the sample size to a mere 44 observations (N=44).

6.0 Discussion

6.1 Alterative Explanations for Bunching around the Number 80

My findings suggest that the tournament round score of 80 acts as a reference point for DIII college golfers. However, doubt surrounding the validity of my findings spurs from the idea that the number 80 reflects the capabilities of a DIII golfer rather than acting as a reference point. In contradiction to this belief, golfers, especially golfers of a weaker ability similar to that of DIII, can improve their scoring ability significantly with small modifications. Cantwell et al. (2008) utilized a sample of 32 male county level golfers and showed that if they utilized PETTLEP-based imagery, a simple mental adjustment in which a golfer attempts to visualize the shot they will hit, they improved their bunker play significantly ($P < 0.01$). This is just one example of a small modification that could result in a major change in a golfers ability to shoot better scores. Another alternative explanation for bunching around 80 could be left-digit bias (Anderson and Simester, 2003; Laceter et al., 2012). Left-digit bias is the inclination of indivuals to place more attention on the most left digits of numbers in comparison to the digits further to the right (Allen et al., 2015). This type of bias is often used to explain why consumer products are priced utilizing 99 cents rather than a whole number; for example, $4.00 versus $3.99. In the DIII college setting, if left-digit bias was present we would see large bunches surrounding numbers such as 70 and 90. However, as shown in Figure 2, this results is not present within the sample.

6.2 Alternative Explanation for Likelihood of Shooting a Score Below 80

I found that DIII college golfers who have a reference score of 80 or below are 42.7% more likely to shoot a tournament round score below 80. The significant probabilistic result can be explained by loss aversion. Consider a golfer who has a reference score of 80 or below, he might exert more effort when approaching the over par equivalent of shooting 80, as he does not want to finish the tournament round with a score above 80, and in turn alters his strategy in order increase the likelihood of shooting a score under 80. However, to undeniably draw the relationship between loss aversion and this result hole by hole data would need to be utilized.

A possible alternative explanation to that explained by prospect theory is: having a reference score of 80 or below could simply mean you are a better player, and thus shoot lower tournament scores, in comparison to those who have a reference score of above 80. If this claim was in fact true, individuals who have a reference score of 75 should be classified as better golfers in comparison to golfers with the reference score of 80.[13] However, a comparison between the estimates from the probabilistic regression models (3) and (1), shown in section 5.4, provided evidence against this claim. A golfer who has a reference score of 75 and under (proposed better player) is 20.9% more likely to shoot a tournament score below 80. Whereas, a golfer who has a reference score of 80 and under (proposed worse player) a golfer is 48.2% more likely to shoot tournament scores of below 80. This results goes against standard economic

[13] This belief can be supported by the fact that college golfers' performance during a season is solely based on the scores they shoot during college tournaments. For example, national ranking, and honors such as all DIII Ping All American status, in DIII golf is exclusively based on tournament stroke average.

theory as better quality players should have a higher likelihood of shooting tournament scores below 80. One could argue that the reference score of score of 75

6.3 Explanation for Unexpected Risk Taking Behavior When Faced with a Sure Par

As predicted, I found that DIII college golfers accept greater risk when they are faced with a sure bogey in comparison to when they are faced with a sure birdie. This finding is consistent with the reference dependent preferences model proposed by Kahneman and Tversky (1979) in which individuals were risk-seeking in losses and risk-averse in gains. However, in contrast to my prediction, DIII college golfers did not accept less risk when they were faced with a sure birdie in comparison to when they were faced with a sure par. It is not clear why this occurred. Yet, these results are consistent with Adler et al. (2012), when the authors utilized a sample of recreational golfers. The Authors discussed the possibility that obtaining par may not be an "emotionally neutral event." They argued that par could possibly act as a positive event rather than an a neutral event and thus golfers "would be less prone to take risk." This could possibly act as an explanation of my inconsistent result; however, my sample of golfers do vary in comparison to the sample utilized by Adler et al. (2012) as their sample had an average handicap of 14, which is equivalent to a stroke average of 85, whereas my sample had a stroke average of approximately 77.59.

6.4 Contributions to Prospect Theory Literature

Previous literature found that some clear quantity (purchase price in Shefrin and Statman, 1985; round numbers in Allen et al., 2015) serve as reference points. My paper expands previous literature on reference dependence by proposing and examining a reference point that is not based on rational expectations and is endogenous to the economic agent (similar to Allen et al., 2015). Furthermore, previous literature has examined reference dependence amongst professional athletes; however, this paper utilized a new empirical setting, DIII college golf, and thus adds to existing literature by investigating amateur rather than professional athletes.

As previously mentioned, there have been numerous papers that have highlighted that par in various settings acts as reference points for professional golfers (Adler et al., 2012; Pope and Schweitzer, 2011; Stone and Arkes, 2016); thus, this paper adds to the literature by highlighting an alternative reference point, the number 80, to that of par within the setting of golf.

6.5 Application in the World of Business

There are no direct policy implications due to my study; however, the findings within this study could act as a positive resource for various stakeholders. Firstly, if a DIII college golfer wants to improve their stroke average they should focus more on golf skills such as putting and GIR rather than golf skills such as driving distance. Secondly, these findings could prove to be useful to organizations such as The First Tee. The First Tee is an international youth development organization that attempts to aid junior golfers to being recruited into the various divisions with the NCAA. The First Tee publishes a yearly journal which provides recruiting tips to junior golfers in hopes of assisting them in getting recruited. Thus, my study would prove to be useful as it would provide an insight into the capabilities and mindset needed in order to get recruited to play DIII golf.

Furthermore, similar to Allen et al. (2015), the results from this paper highlighted that having a reference point significantly impacted the performance and decision making of individuals. Reference points are similar to intrinsic motivators in that they are internal goals that individuals either strive to attain or beat. Thus, one could argue that the results from this paper revealed the fact that intrinsic motivators do in fact influence the performance and decision making of individuals. This is a vital finding as many companies have a tendency to try motivate workers with extrinsic motivators, such as financial incentives, rather than providing work environments that allow workers to achieve their internal goals. The latter could prove to be successful in hopes of motivating workers.

6.5 Limitations of Findings

Admittedly, there are a number of limitations to my study. Firstly, when I conducted the simplified bunching analysis, I only used data from the Fall 2016 – Spring 2017 season. This raises doubt about my results. There is a possibility that the concentration of the distribution around the tournament score of 80 was only present for the Fall 2016 – Spring 2017 season and disappears when analyzing data from other DIII golf seasons.

Secondly, my behavioral experiment lacked a large sample size, N = 51, due to a relatively low response rate and time restrictions for data collection. Therefore, my study has potential for a type II error, accepting a non-true hypothesis. Secondly, within my various regression models, I was unable to control for weather and course design. This could be the reason as to why my R^2 value was 0.789. However, this is an issue that various papers have faced and is thus a minor limitation in comparison to the others mentioned within this section.

Thirdly, due to data restrictions I was not able to attain hole by hole data during tournament play of DIII golfers. This prevented me from truly assessing whether golfers adjust their strategy accordingly when faced with sure losses in comparison to sure gains. Nonetheless, The behavioral experiment I conducted attempted to fill this data gap by asking participants golf situational questions.

6.6 Further Areas of Study

Due to the fact that reference dependence in amateur sports is an untouched field of study, this paper offers a gateway for numerous studies to follow. For example, analyzing college level tennis players rather than professional tennis players. Based on my findings, there are several possible extensions of my study. A basic extension is to examine reference dependence in DI or DII. A comparison of reference dependent preferences amongst DI and DIII athletes would be an interesting study as it would either highlight or disprove the belief that DI athletes are of a significantly different caliber and thus act and think differently when faced with similar golf situations.

Secondly, similar to methodology used in Bartling et al. (2015), when the authors found that soccer players act more aggressively when behind the match expected outcome, utilizing hole by hole data would allow researchers to identify whether golfers alter their strategy during tournament play, when faced with sure losses (over par) in comparison to sure gains (under par), and thus effectively assess whether or not golfers exhibits loss-aversive behavior.

7.0 Conclusion

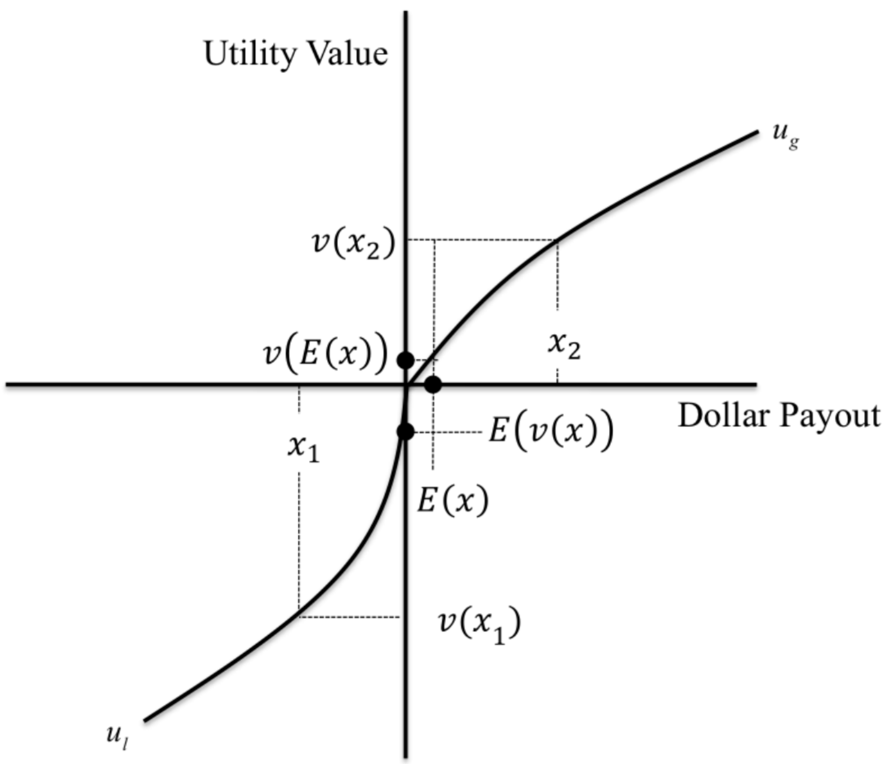
Unlike previous literature, my study examines whether the reference dependent model of preferences can explain the behavior of DIII college golfers, and further investigates the impact that a reference point has on commonly discussed golf performance variables. In my study, I carry out a 3-part analysis utilizing DIII tournament score data for the Fall 2016 – Spring 2017 season manually extracted from Golfstat.com and from a behavioral experiment analyzing the risk behavior of DIII college golfers ($N = 51$).

When I analyzed the distribution of tournament scores, my results show that the tournament score of 80 acts as a reference point for DIII college golfers. This was shown by utilizing a simplified method to that of Allen et al. (2015), highlighting that there was bunching surrounding the number 80. Furthermore, I found signs of loss aversion due to the fact that that 28.1% more DIII golfers shoot scores within 2 shots less than 80 in comparison to 2 shots more than 80. The finding that DIII college golfers are in fact loss averse is further supported by the findings within the behavioral experiment. I found that golfers were more willing to accept risk when faced with a sure bogey (29% chose the risky option) in comparison to a sure birdie (24% chose the risky option). Thus, it is clear that the reference dependent preference model fits to the setting of DIII golf. However, the reference point is not only present within this setting, but also influences specific golf performance variables. My linear regression analysis shows that when a DIII college golfer has a reference point in mind, if they increase their greens in regulation (GIR) by 1% they will decrease their stroke average by approximately 0.229 shots. This is a large impact and could allow a DIII golfer to significantly impact their stroke average and thus improve their overall ability to shoot better scores. Furthermore, I found that if a DIII college golfer has a reference score of 80 or below the probability that he will shoot a score under 80 is in fact 42.7%.

The overall takeaway of this study highlighted that PGA professionals are not the only stakeholders in golf who are influenced by reference points. When I merged the results of the four sections of my analysis, I concluded that the number 80 was in fact a reference point in DIII golf, and in turn has an impact on not only their decision making but also influences their overall golf performance.

Appendix

Figure 1. Prospect theory value function



Retrieved from: Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, 47(2), 263.

Figure 2. DIII College Tournament Scores Distribution

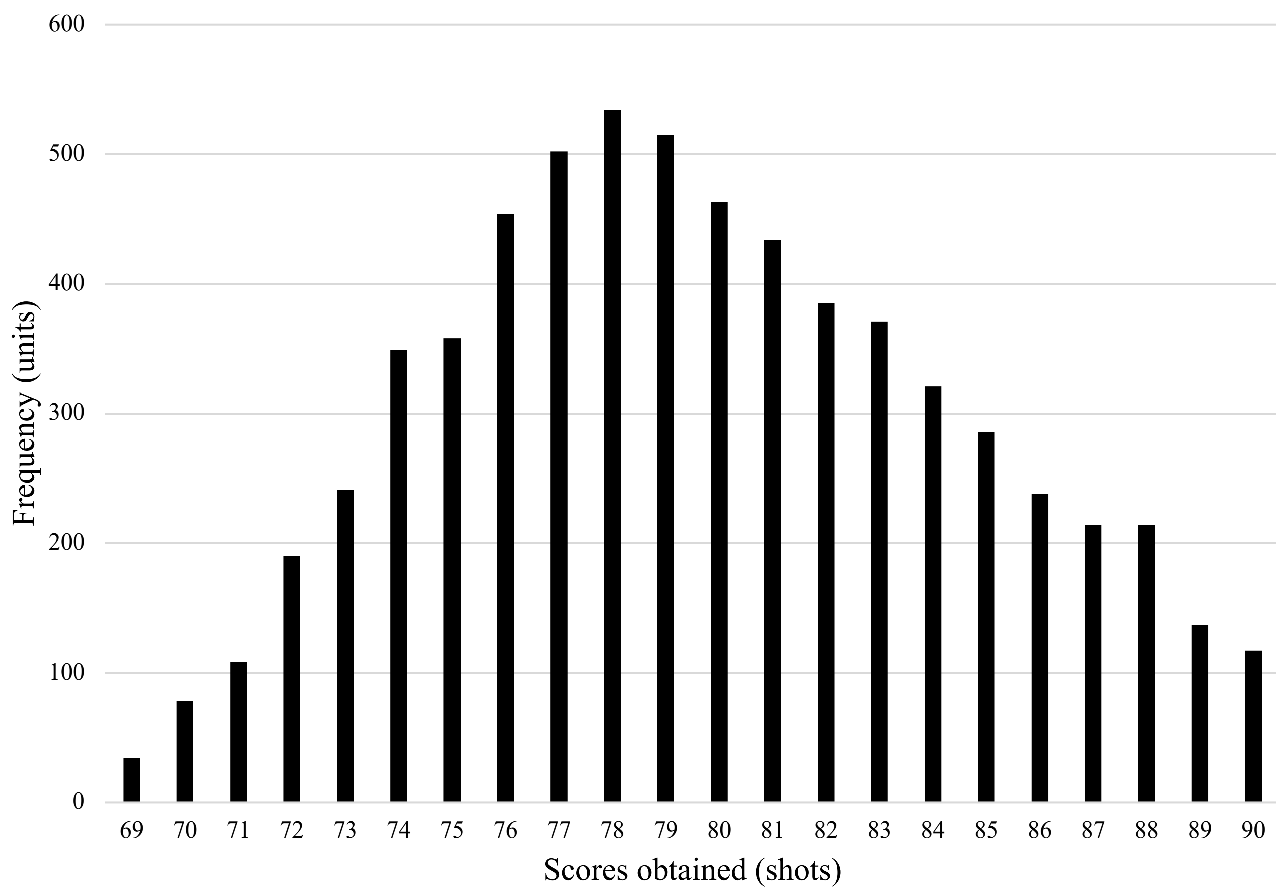


Figure 3. Percentage of Golfers who Chose the Risky Option

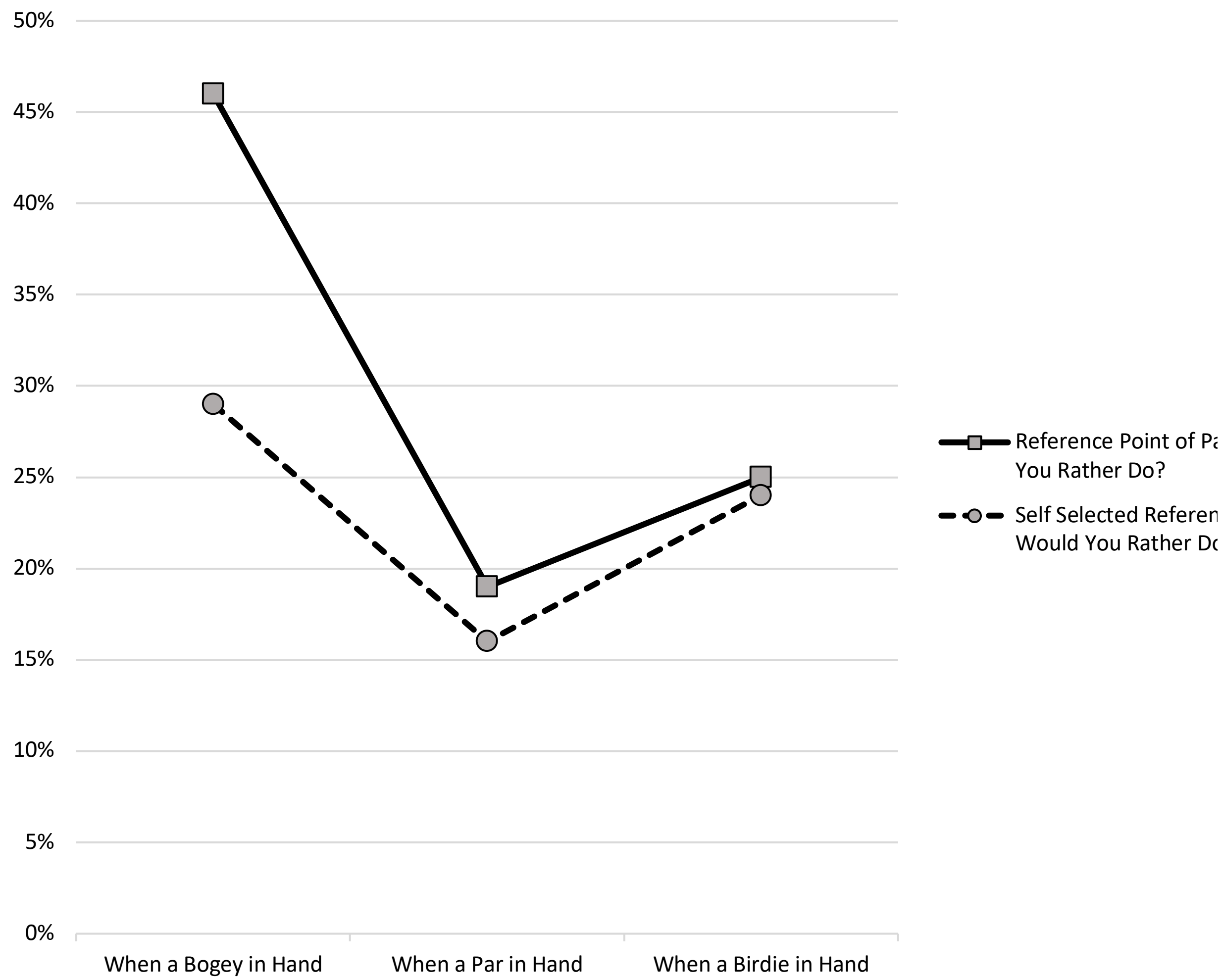


Table 1. Summary Statistics for DIII Golf Tournament Scores

	Mean	Std. Dev.	Observations
Round 1 Score	82.35	8.71	3857
Round 2 Score	80.84	7.38	2309
Round 3 Score	77.89	5.01	377

Table 2. Summary statistics for the full sample

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
age	51	20.16	1.173	18	23
reference_score	28	76.96	2.808	70	85
number_tournaments	48	3.458	2.601	0	12
stroke_average	44	77.59	2.949	72.58	84.62
GIR	43	58.26	14.27	7	80
driving_average	43	61.61	13.81	10	80
driving_distance	44	277.6	17.72	210	315
putts	44	31.73	2.234	26	36
scrambling	44	45.31	17.11	3	70
freshmen	51	0.196	0.401	0	1
college_years	51	2.529	1.046	1	4
risk_tol	51	0.392	0.493	0	1
ref_point	51	0.549	0.503	0	1

Table 3. Percent of Participants Who Selected Each Option

Choice	**Reference Point of Par: What Would You Rather Do?**	**Self-Selected Reference Point: What Would You Rather Do?**
Domain: Gains		
I would rather take a sure birdie.	Safe 75%	Safe 76%
Make a risky shot that would either end with eagle (30%) or par (70%).	Risky 25%	Risky 24%
Domain: Neutral		
I would rather take a sure par.	Safe 81%	Safe 84%
Make a risky shot that would either end with birdie (30%) or bogey (70%).	Risky 19%	Risky 16%
Domain: Losses		
I would rather take a sure bogey.	Safe 54%	Safe 70%
Make a risky shot that would either end with par (30%) or double bogey (70%).	Risky 46%	Risky 29%

Table 4. Full Sample Regression

VARIABLES	(1) Stroke_average
GIR	-0.161***
	(0.040)
driving_acc	0.072*
	(0.039)
driving_dist	0.014
	(0.023)
putts	0.480**
	(0.202)
scrambling	0.013
	(0.026)
freshmen	2.557*
	(1.418)
college_years	-0.628
	(0.869)
age	0.830
	(0.711)
number_tournaments	-0.592**
	(0.265)
risk_tol	-0.688
	(0.862)
ref_point	1.020
	(0.843)
Constant	49.371***
	(13.706)
Observations	37
R-squared	0.632

Table 5. Regression with Interaction Terms

VARIABLES	(1) Stroke_average
GIR_x_ref	-0.229**
	(0.088)
driving_acc_x_ref	0.163**
	(0.063)
scrambling_x_ref	0.049
	(0.036)
Constant	51.991**
	(21.227)
Observations	20
R-squared	0.789

Table 6. Definition of player characteristics variables.

Variable	Definition
freshmen	Dummy variable that takes the value of 1 if a player is a freshman.
age	The age of the player, measured in years. The value is obtained from the online survey.
college_years	The number of years the player has been in college.
events	The number of tournament events the player participated within during the Fall 2018 season.
risk_tol	Dummy variable that takes the value of 1 if a player is risk-seeking.

Table 7. Definition of golf performance variables.

Variable	Definition
driving accuracy	Percentage of tee shots that come to rest in the fairway.
driving distance	Average number of yards per drive.
putts	Average number of putts per round.
scrambling	Percentage of successful up-and-downs.
GIR	Percentage of greens hit in regulation.

Table 8. Definition of reference point variable.

Variable	Definition
ref point	Dummy variable that takes a value of 1 if a player has a score in mind the he wants to beat in tournament play.

Table 9. Summary statistics for sample of players with reference scores.

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Tournament Control Variables					
Par	273	71.73	0.530	70	73
Round	273	1.612	0.655	1	3
Length	273	6,638	241.5	6,063	7,156
year_2018	273	0.641	0.481	0	1
Reference Score Variables					
Reference Score	273	76.19	2.903	70	85
ref_under_80	273	0.971	0.169	0	1
ref_equal_80	273	0.147	0.354	0	1
ref_under_75	273	0.531	0.500	0	1
Tournament Score Variables					
Score	273	77.49	4.558	67	97
score_under_80	273	0.703	0.458	0	1
score_under_75	273	0.278	0.449	0	1

Table 10. Probabilistic model – results for sample of players with reference scores.

VARIABLES	(1) score_under_80	(2) score_under_80	(3) score_under_80	(4) score_under_75
Par	-0.118*	-0.132**	-0.100	-0.0877
	(0.0677)	(0.0671)	(0.0687)	(0.0643)
Round	0.0738*	0.0716*	0.0690	0.0420
	(0.0438)	(0.0434)	(0.0435)	(0.0424)
Length	-3.32e-05	-1.35e-05	-8.66e-05	3.82e-05
	(0.000142)	(0.000141)	(0.000143)	(0.000142)
year_2018	-0.0393	-0.0605	-0.0650	-0.0171
	(0.0589)	(0.0578)	(0.0575)	(0.0579)
ref_under_80	0.427**			
	(0.170)			
ref_equal_80		0.0593		
		(0.0743)		
ref_under_75			0.203***	0.223***
			(0.0554)	(0.0523)
Observations	273	273	273	273

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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