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Measuring Earnings Through Performance: A Replication of the Return to Skill of PGA Tour Golfers

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ABSTRACT. The golfers on the Professional Golfers Association (PGA) Tour provide an opportunity to examine the relationship between performance and earnings. Using PGA Tour data from 2010 and the 2018-2019 season, this paper replicates previous studies exploring the returns to skill and changes in return to skill over time of PGA golfers. Average driving distance, average driving accuracy, greens in regulation (GIR), putts per GIR, sand saves, number of events competed in, and two interaction terms are found to be statistically significant. The idea that returns to skills for PGA golfers are changing over time is supported in this paper.

I. Teeing Off

"Practice isn't the thing you do once you're good. It's the thing you do that makes you good." *- Outliers by Malcolm Gladwell*

Seniors from college are released into the labor market and some may have concerns about how they will live up to the performance standards of the firm. In the labor market a scared graduating senior should be concerned with performance relative to other employees rather than the "pre-set" absolute performance demanded by the firm (Shmanske 2004, 239). The labor market is designed around the tournament compensation model where outperforming the employees around you will allow you to rise through the ranks and gain more earnings (Shmanske 2004, 239). To perform better a scared senior needs the right skills to advance. Knowing what skills are worth spending time on and will bring the biggest boost to performance is difficult in today's labor markets. As Rinehart says "Performance can be difficult to measure because many times it is subjective in nature" (2009, 57).

Professional golf can provide insight into the problem, as it is also set up in a tournament compensation model where the player who outperforms the competition receives the highest compensation for their performance. The difference is that the elite players in this market have

their performance statistics and earnings made available to the public. Because of this, empirical studies can look into how skills of PGA Tour golfers affect their earnings. This paper will use past studies' models in order to see if the old adage, "drive for show putt for dough" holds any weight.

II. Golfer Talk

Before moving forward, how the modern game of golf works needs some explanation. One standard round of golf is played over eighteen holes. A hole starts with a tee-box and a "green" where the grass is millimeters tall and a flagstick stuck in a hole in the ground, or the "cup", finishes the hole. The player counts each strike of the ball as a stroke. Tallying all strokes after one round is the player's score.

Par is the number of strokes a player should aim to score on a particular hole; they come in par 3, par 4, and par 5 types. The par system expects the player to make two putts on the green; that means the player should make it on the green in two strokes less than par for the hole. For example, on par 4 holes the player should be able to land the ball on the green after two strokes and putt the ball twice to finish the hole.

Between the tee-boxes and the cup is where the fairway, rough, and potential hazards lie. A fairway is where the grass is cut shorter to improve the chance of a good connection between the ball and the golf club, while the rough is longer, making the connection worse. Hazards are meant to punish the player for bad shots by making ball-striking difficult and sometimes impossible. Examples include sand traps, creeks, ponds, trees, and bushes. See figure 1 for a diagram of a sample golf hole.

The rules of golf are set by two governing bodies: United States Golf Association and The Royal & Ancient Golf Club of St. Andrews. The former sets the rules for the North American theater, while the latter sets the rules for the European theater.

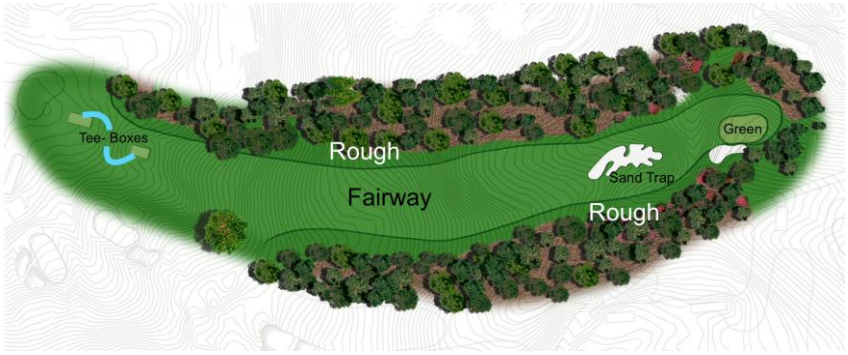
The following terms defined by the Professional Golfers' Association (PGA) are important to understand the rest of the paper:

- Greens in regulation (GIR)
    - It is determined by subtracting two from the par of the hole, for example the first stroke for a par 3, the second stroke for a par 4, and the third

stroke of a par 5. If a player's ball has any part of it touching the green on the GIR stroke the player has achieved a GIR.

- Sand Save (SS)
    - When a player is able to complete an up and down from a greenside sand bunker.
        - Up and down is when a player takes two shots or less to get the ball in the cup from that point.

Figure 1. Augusta Nationals Camellia
https://www.masters.com/en_US/course/hole10.html



III. How to Play with the Big Boys

The PGA TOUR does not set any rules but is rather a cartel for the market of professional golf for highly sought-after professional golf tournaments, sponsors, prize money, media coverage, and a high-level competition for players (Shmanske 2004, 193). Once a player completes one of the thirty-nine performance criteria, the PGA grants the player a Tour Card, allowing access to the world of professional golf (PGA TOUR). A "seat at the table" does not mean a player can play in the prestigious tournaments directly from the start; the player has to rise through the rankings by playing well in smaller tournaments to be granted access to play in the larger tournaments.

A player then must decide whether the pursuit of a professional golf

career is viable. As Shmanske points out, "[T]he tournament player has to cover all the costs of travel, lodging, meals, childcare, caddies, equipment, entry fees, etc" (2004, 194). For a run-of-the-mill player, going to college to complete a degree in finance or going to a trade school is the better choice. For the player at the cusp of professional-level play the choice is not clear. Prior to 2013 the tournament season ran every weekend from January to early November with a Tour Championship in December where final rankings were determined before the start of the next season (Shmanske 2004, 195). In 2013, the PGA switched the start to September and the Tour Championship to late August (PGA TOUR). The change makes the golf season appear as a never-ending cycle. The player on the cusp of professional golf can experience difficulty gaining traction in a cyclical schedule. Players who are ranked higher on the PGA TOUR are able to pick and choose what tournaments best work in their schedule, while the lower-rated player is left with the tournaments with open spots.

Tournaments are four days of one round play: Thursday, Friday, Saturday, and Sunday. After play on Friday a "Cut Line" is determined; any player whose stroke count is above the Cut Line is removed from the tournament and does not receive tournament pay. The original field of players is reduced to the top 70 including ties. The purse is the total prize money the tournament will hand out; larger purses indicate bigger tournaments. At the end of the tournament the prize money is allocated as proportions of the purse, from eighteen percent for first place to two-tenths of a percent for 70th place (Shmanske 2004, 204). See table 1 for an example how the 2019 master purse of $11,500,000 would be handed out to the top ten players without ties.

Table 1 Purse total provided by CBS sports Golf News 2019 Masters Prize Money in 2019 dollars

Place	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
% of purse	18%	10.8%	6.8%	4.8%	4%	3.6%	3.35%	3.1%	2.9%	2.7%
Example: Masters 2019 millions of dollars	$2.07 million	$1.24 million	$.78 million	$.55 million	$.46 million	$.414 million	$.385 million	$.356 million	$.333 million	$.310 million

70th place would to receive $23,000. The variation between earnings structure of the PGA Tour means that players are here to compete against each other. If the large tournament earnings structure didn't exist, then players instead might scheme with other players to share tournament purses, but the payoff of beating another player is larger, limiting the motivation to scheme (Fort 2011, 224).

Because of the tournament earnings structure, placing higher means a larger chunk of the purse. Marginal improvement in one skill area might result in a million dollars in earnings. Players face an opportunity cost among the golf skills as working on one skill means time not spent working on other skills. This is not unlike gaining human capital for workers in general. In labor markets workers sell their skills to a firm for a wage (Shmanske 2004, 218). Similarly, the PGA Tour will provide wages to golfers who "sell" their skills to tournaments. Where golfers spend time practicing to improve skills, workers spend time training or acquiring more education to improve skills. Past empirical studies have looked into the old adage, "drive for show and putt for dough," to determine what skills are more valuable in practice, that is, which skills give players higher tournament earnings.

IV. Studying the Previous Courses

Empirical studies of this nature are one of two primary methods when using tournament earnings as the dependent variable. Shmanske focuses on tournament-by-tournament statistics and then weighting each tournament statistic with criterion to balance out results (2008, 645). Shmanske uses six two dimensional fixed effects equations to produce results (2008, 649). The purpose of the study is to show that golfing studies can be flawed (Shmanske 2008, 660). Altitude of the golf course, weather, width of fairway at one course compared to others, etc. all have an effect on how golf is played (Shmanske 2008, 645). Shmanske (2008) wanted to caution academia about the weight put on the studies carried out.

The other method looks at yearlong average statistics focused on the skills that lower scores. The lower the score goes the higher the chance that a player will earn more in the tournament compensation model. Berry (1999) set the stage by using multi-stage regressions to distinguish the importance of different golf skills. From this foundation Alexander and Kern (2005) applied Berry's models as the pure form of the individual golf skills. Alexander and Kern looked at whether returns to various golf skills have changed over time or if the old adage still holds

true. Examining data from 1992 to 2001, the pure variables of EVENTS, EVENTS squared, DRIVEAVG, DRIVEACCR, IRON, PUTT, SAND, CHIP, PURSE, and TIME where used. (Alexander and Kern 2005, 46). Alexander and Kern's regression results reveal a small increase in the marginal value of driving distance and a decline in the marginal value of putting (2005, 14). Replicating the study Baugher et al. (2016) uses data from 2006 to 2013 using the same pure variables that Alexander and Kern (2005) use. Baugher et al. found an increase in the marginal value of driving as well as putting (2016, 213). Baugher et al. continue by saying, "[Driving] may be now the most important skill determining earnings" (2016, 213).

Rinehart (2009), while along the same vain as the other two studies, decides to not use the pure form of the variables. Instead opting for the variables AvgDr, DrAccr, GIR, SS, AvePutt, Events, and YR2008 (Rinehart 2009,67). The raw forms of the variables are alongside interaction terms. "Each interaction term provides a direct comparison of the change in the average return to a specific skill" (Rinehart 2009, 65). Rinehart's (2009) regression results reveal that the increase in the marginal value of putting is a highly significant variable, and does not provide support that return to skills have changed over time for professional golfers.

V. Collecting the Tees and Presenting a Swing Path

My regression uses observations from PGATOUR.com/STATS, which is where the PGA tour has listed golf stats from the 1980 Tour season to the current 2019-2020 season. Professional golfers participating in the PGA Tour's 2010 and the 2018-19 seasons are included. Golfers are included if they have played in ten or more events for that year. The sample includes 217 observations from the 2010 season, and 222 observations from the 2018-19 season. 69 players in the sample played in the 2010 season and 2018-19 season. The 2018-19 season was selected due to it being the most recent season completed.

The regression's dependent variable is earnings in 1992 dollars for PGA Tour tournaments only. The 2010 and 2018-19 season earnings have been converted to 1992 dollars by using the historical CPI index that the U.S Bureau of Labor Statistics publishes (2020,3). The independent variables are several golf skills that affect the potential earnings of a player. The regression is based on Rinehart's (2009), Alexander and Kern's (2005), and Baugher et al. (2016) regressions. Rinehart's interaction terms will be used to look at the return to skills

between the 2010 and 2018-19 seasons. While the skill variables pertaining to driving and putting are based on what Alexander and Kern (2005, 5) used. The types of multi-stage regressions seen in Alexander and Kern (2005) will not be used in this study.

The empirical model is written as follows:

$$1992\$ = \alpha + \beta_1 AvDR + \beta_2 DrAcr + \beta_3 GIR + \beta_4 SS + \beta_5 AvPt + \beta_6 \ EVENTS + \beta_7 Y2010 + \beta_8 AvDr10 + \beta_9 DrAcr10 + \beta_{10} GIR10 + \beta_{11} SS10 + \beta_{12} AvPt10 + \beta_{13} EVENTS10 + \varepsilon$$

Driving skills are represented by the variables AvDr, and DrAcr. Driving is the first stroke of the hole for par 4's and par 5's. Driving is measured by distance and how accurate the stroke is. AvDr is the average yards a player drives the ball over the season. I expect AvDr to have a positive coefficient, as driving the ball further means a player will get closer to the hole allowing for fewer strokes then the par system anticipates, resulting in lower scores. Driving accuracy measures how consistent a player is in hitting the fairway. Landing in the fairway allows the player to have an easier following stroke. Curving a ball around a tree is more difficult than hitting through a large open-aired space. DrAcr measures a player's consistency in hitting the fairway over the season. I expect DrAcr to have a positive coefficient as the having a clear shot to the hole will end up being less shots than having to hit around a tree, resulting in lower scores.

Putting skills are represented by AvPt, and SS. Putting is the last strokes of the hole. Putting is measured by the number of putts a player takes and how the player deals with the opportunities to have fewer putts. Again this goes back to the par system because the last two strokes of par are reserved for two putts on the green. Golfers who limit putts to one are considered more skilled at putting. AvPt is the number of putts per GIR over a season. Putts in this variable only count when a player achieves GIR. For example, when the player misses the green but hits the ball within inches of the hole, the putt is pointless but still necessary. This is a better measure of putting ability by restricting the measure to just putts counted after a player achieves GIR. I expect AvPt to have a negative coefficient, as fewer putts mean fewer strokes and a smaller average, resulting in lower scores. The lower the score the greater the chance a player will beat out a competitor, resulting in more earnings for the player. SS measures the consistency that players are able to get out of a green side bunker and make an up and down. A player who has a

low percentage might be an indicator of poor putting skill, because lower percentages mean that a player is missing the hole more frequently and having to putt more times. I expect SS to have a positive coefficient, as fewer putts mean lower scores.

The variable Gir can be difficult to classify. For example, Rinehart categorized the skill in the driving skills as it showed a player's consistency to get the ball to the hole in an accurate manner (2009, 66). Alexander and Kern's (2005), and Baugher et al. (2016) considered it to be under the IRON variable as it showed the player's mid-game ability since the player had to use a club that is not a driver or putter to achieve a GIR. I will use Gir like the latter, since players do not have to be accurate or hit the ball a long distance to achieve GIR. A player could hit the ball into the next county as long as the ball is on the green with two strokes remaining to get par or better GIR is achieved. The variable Gir is similar to SS as players with lower percentage points in GIR mean the player is worse at using clubs other than the driver and putter. Gir measures the consistency of players achieving GIR over the season. I expect Gir to have a positive coefficient as having more opportunities to score par or better will keep the player's scores lower, resulting in more earnings.

EVENTS are the number of tournaments the player has attended over the season. I expect EVENTS to have a positive coefficient as the more tournaments a player goes to the higher the chance they will walkway with tournament earnings. The dummy variable, Y2010 is included to pick up any technology and course changes (Rinehart 2009, 66). The Y2010 one will pick up any changes from 2010 to 2018-19.

Table 2- Expected Variable Coefficients, and Variable Definitions

Abbreviation	**Variable**	**Expected sign**
1992$	Tournament earnings in 1992 dollars	N/A
AvDr	Average Season Long Driving Distance (yd)	+
DrAcr	Season Driving Accuracy Percentage	+
Gir	Season GIR Percentage	+

AvPt	Season Putting Average	-
SS	Season Sand Save Percentage	+
EVENTS	The number of total events played in the season	+
Y2010	Dummy Variable for 2010 technological improvements	**N/A**

Interaction terms are represented by the "10" attached to the variables. Rinehart used them for "changes in the returns to skill" (2009, 66). This allows for direct comparison between the 2018-19 season and 2010. In doing this the 2018-19 observations keep their values in the interaction term. For 2010 observations their values are set to zero. The examples below are to Rinehart's (2005, 65) method in action:

AvDr10= (AvDr)*(1 or 0)
1 for AvDr 2018-19 observations
0 for AvDr 2010 observations

For the interaction terms, if the coefficients are positive then a higher return for marginal improvement in 2018-19 than in season being directly compared. A negative coefficient signals that returns to marginal improvement in 2018-19 are smaller compared to the season being directly compared.

VI. Posting the Scores & Comparing the Scores

Table 3 presents the summary of the statistics extracted from pgatour.com. The average professional golfer on the Tour during the 2010 and 2018-2019 seasons earned $850,972.5 per year and entered an average of 24 events. The golfers average driving distance is 291.02 yards. 62% of the time the average professional will land on the fairway with his drive. The average professional golfer hits a GIR around 66% of the time. After making GIR the professional averages 1.77 putts to finish the hole. The average professional makes a sand save 49% of the time.

Table 3- Descriptive Statistics

Variable	Variable Description	Mean	Standard Deviation	Minimum	Maximum
1992$	Tournament earnings in 1992 dollars	850,972.5	746891.8	33,570.7	5,314,410
AvDr	Average Season Long Driving Distance (yd)	291.0206	9.049982	266.4	317.9
DrAcr	Season Driving Accuracy Percentage	62.99842	5.114756	48.47	76.08
Gir	Season GIR Percentage	66.78401	2.460271	57.89	73.06
AvPt	Season Putting Average	1.772314	.0273447	1.694	1.856
SS	Season Sand Save Percentage	49.99443	6.15252	33.78	66.39
EVENTS	The number of total events played in the season	24.23219	3.710263	15	35
Y2010	Dummy Variable for 2010 technological improvements	.5065963	.5006174	0	1
AvDr10	Interaction term for AvDr between 2018-2019 and 2010 seasons	145.3673	147.6116	0	317.9
DrAcr10	Interaction term for DrAcr between 2018-2019 and 2010 seasons	30.89694	31.55251	0	75.72
Gir10	Interaction term for Gir between 2018-2019 and 2010 seasons	32.8885	33.40768	0	73.06
SS10	Interaction term for SS between 2018-2019 and 2010 seasons	25.05309	25.77035	0	65.33
AvPt10	Interaction term for AvPt between 2018-2019 and 2010 seasons	.8690079	.8818747	0	1.856
Events10	Interaction term for EVENTS between 2018-2019 and 2010 seasons	11.70185	12.13628	0	35

The regression results are presented in Table 4. The AvDr, AvPt, and EVENTS variables are significant at the 1% level. EVENTS expected sign was positive; instead the coefficient is interpreted as a decrease in annual earnings of $29,338.2 for each event entered. Rinehart (2009)

found EVENTS to decrease for each event entered while Alexander and Kern (2005), and Baugher et al. (2016) did not. Rinehart provides a reason for the negative coefficient stating professional golfers who are worse have to play more to make an income (2009, 69). All three studies found AvPt to be negative and here the coefficient is interpreted as a decrease in annual earnings of $12,400,000 for an increase of one putt in a professional golfer's average season putts. The AvDr coefficient is interpreted as an increase in annual earnings of $25,245.7 for each yard longer a professional golfer hits his drive. All three studies found AvDr to be positive as well.

Variables DrAcr, Gir, SS, and Y2010 are significant at the 5% level. Alexander and Kern (2005), and Baugher et al. (2016) found the variable DrAcr to be positive, while Rinehart (2009) did not. The DcAcr coefficient is interpreted as an increase in annual earnings of $27,038.9 for each percentage point increase in driving accuracy. The Gir coefficient is interpreted as an increase in annual earnings of $47,470.9 for each percentage point increase in greens in regulation. The variable Gir is not directly seen in Alexander and Kern (2005), and Baugher et al. (2016) as multi-stage regressions have hidden the direct impact of Gir. Rinehart's results show Gir as positive (2009, 68). All three studies found SS to be positive and here the coefficient is interpreted as an increase in annual earnings of $129,100.9 for each percentage point increase in a professional golfer's season sand save percentage.

Table 4- OLS Regressions Results

Variable	Coefficient	Significance	Standard Error	P-value
1992$	$-2,600,678		4,205,004	0.537
AvDr	$25,245.7	***	7,854.83	0.001
DrAcr	$27,038.9	**	12,506.7	0.031
Gir	$47,470.9	**	21,178.4	0.026
AvPt	$-12,400,000	***	1,843,475	0.000
SS	$19,109.9	**	7,569.22	0.012
EVENTS	$-29,338.2	***	11,374.2	0.010
Y2010	$13,100,000	**	5,835,978	0.025
AvDr10	$18,020.1	*	10,937.2	0.100
DrAcr10	$19,585.4		17,727.5	0.273
Gir10	$2,513.86		32,135	0.938
SS10	$23,101.9	**	10,727.5	0.032
AvPt10	$2,783,644		2,627,563	0.290
Events10	$-1,887.65		16,495.9	0.909

N	379			
R-squared	0.4275			
Adjusted R-square	0.4071			

* Denotes significance at p≤.10
** Denotes significance at p≤.05
*** Denotes significance at p≤.01

Interaction terms SS10 is significant at the 5% level, and AvDr10 is significant at the 10% level. The coefficient for AvDr10 is interpreted as an increase of $18,020.1 for each yard longer a professional golfer hits his drive in 2018-2019 compared to in 2010. The coefficient for SS10 is interpreted as an increase of $23,101.9 for each percentage point increase in a professional golfer's season sand save percentage in 2018-2019 compared to in 2010. Rinehart did not have any significant interaction terms (2009, 69).

VII. The 18th Green

The idea that returns to skills for PGA golfers are changing over time is supported in this paper. Putting continues to be a highly significant variable as shown in previous studies. Baugher et al. (2016) found average driving distance to be highly significant, and is shown to be highly significant in the model. Alexander and Kern (2005) and Rinehart (2009) did not show average driving distance to be significant. The interaction term AvDr10 was shown to be significant. An additional average yard added to a drive in 2018-2019 earns a professional golfer higher earnings compared to in 2010. More emphasis is put on driving the ball further now than in the past seasons.

Further studies should look into how much the purse size has changed over the years. The popularity of golf over the years could influence what tournaments professionals are playing and the disparity of prize money in different tournaments could show that professionals in the larger tournaments need different skills, compared to the skills needed for the up-and-coming professionals playing in the smaller professional tournaments. The adage "Drive for show and putt for dough" does not show the whole picture. A professional golfer who focuses on getting distance on his drive and making more putts will see the largest returns.

References

Alexander, Donald L. and William Kern. 2005. Drive for Show and Putt for Dough?.*Journal of Sports Economics* 6, no. 1:46-60.

Baugher, Carson D., Jonathan P. Day, and Elvin W. Burford, Jr.. 2016. Drive for Show and Putt for Dough? Not Anymore. *Journal of Sports Economics* 17, no. 2:207-215

Berry, Scott M. Column Editor. 1999. A Statistician Reads the Sports Pages: Drive for Show and Putt for Dough. *Chance* 12, no. 4:50-55

Fort, Rodney D. 2011. *Sports Economics.* Upper Saddle River: Prentice Hall.

PGA Tour, https://www.pgatour.com/stats.html

Rinehart, Kelsey L. 2009. The Economics of Golf: An Investigation of the Returns to Skill of PGA Tour Golfers. *Major Themes in Economics*: Vol 11, Article 6:57-70

Shmanske, Stephen. 2004. *Golfonomics,* River Edge: World Scientific Publishing Company.

Shmanske, Stephen. 2008. Skills, Performance, and Earnings in the Tournament Compensation Model: Evidence From PGA Tour Microdata. *Journal of Sports Economics* 9, no. 6: 344-662

United States Department of Labor. 2020. U.S. Bureau of Labor Statistics. *Historical CPI-U. https://www.bls.gov/cpi/tables/historical-cpi-u-201709.pdf*