SKILL AND EARNINGS AMONGST GOLFERS ON THE SOUTHERN-AFRICAN SUNSHINE TOUR

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Abstract
This paper estimates the determinants of the success of golfers on the Southern-African Sunshine Tour. Using a simultaneous-quantile regression approach and real earnings per tournament as a measure of success, a higher greens-in-regulation percentage and a lower number of putts per greens-in-regulation are associated with higher earnings. Calculations of the value of the marginal product of key golfer skills suggest a dynamic human capital acquisition process for many Sunshine Tour golfers at the earliest stages of their professional golf career.
JEL Classification: C31, Z2
Keywords: Golfer success, quantile regression, Sunshine Tour, value of the marginal product

1. INTRODUCTION

Professional golfers scored some of the world's richest sports endorsement deals in 2018. Virtually all touring professional golfers on the two top tours – the PGA Tour and the European Tour – earn at least $250,000 annually from endorsements. Endorsement deals typically cover the cost of competing but come with corporate responsibilities that likely take away from time spent practicing. Compared to golfers on some lower level professional tours, these golfers may experience additional human capital investment constraints in identifying the right mix of coaching, diet and practice (Callan and Thomas, 2007) even as skill acquisition and human capital investment are amongst their primary concerns (Moy and Liaw, 1998; Nero, 2001; Kahane, 2010). Little variation in the physical attributes exhibited amongst many professional golfers on top tours suggests that the most successful golfers on these tours optimally acquire a variety of skills through practice to improve their game and subsequently earn more money (Alexander and Kern, 2005). Although the link between skills and earnings for professional golfers is well established, it is not clear that golfers generally are engaged in human capital formation activities that lead to acquiring the optimal mix of skills. That is, estimates of the value of the marginal product (VMP) of key skills for golfers on the PGA Tour often differ by a lot and suggest that some golfers should alter their current practice habits (Nero, 2001; Callan and Thomas, 2007; Kahane, 2010). Additionally, if skill acquisition by PGA Tour golfers occurred earlier in their career

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when they were playing on a next-tier tour, estimates of the VMP of key skills for PGA Tour golfers may not reflect current efforts at human capital formation.

Professional tours other than the PGA Tour have not yet received much attention from researchers. One such tour is the Southern-African based Sunshine Tour, where endorsement deals are not as lucrative and golfers generally have fewer off-course distractions and responsibilities. With fewer off-course commitments, Sunshine Tour golfers may have a chance to develop the various elements of their game so they exhibit a mix of skills consistent with optimal human capital formation.

In this paper, we examine the determinants of success of professional golfers on the Sunshine Tour and estimate the VMP for two primary golf skills. Using data from the 2011 to 2019 seasons, the results show that the VMP for skills measured by greens in regulation (GIR) and putts per GIR differ by between five and twenty percent for golfers who play most of their professional golf on the Sunshine Tour. Compared to the existing research on this topic (Shmanske, 1992; Nero, 2001; Alexander and Kern, 2005; Callan and Thomas, 2007; Kahane, 2010), our result is unique in that it suggests golfers on the Sunshine Tour, unlike most golfers on the PGA Tour, exhibit a mix of skills with closely matched VMPs. The Sunshine Tour thus appears to provide a unique arena within which we can observe outcomes of human capital formation and the skills acquisition process amongst professional golfers, many of whom are currently engaged in the early stages of skill acquisition.

2. HUMAN CAPITAL FORMATION AND PROFESSIONAL GOLF TOURS

Professional golf tours offer some of the best settings to test the outcomes of human capital formation, with research in this arena generally focused on the PGA Tour. The earliest papers estimated the VMP of labour for PGA Tour golfers, but these early estimates generally tended to suffer as the non-linear structure of prizes in PGA Tour events leads to highly positively skewed earnings. Shmanske (1992) used survey data on practice time for some top PGA Tour golfers in 1986 to find VMPs were not equal across skills. While limited in the quantity of data available, this work continues as the only one to link practice time to skill and earnings, making it alone capable of measuring the VMP of the inputs into skill acquisition. All other estimates of VMPs of PGA Tour skills rely on an inferior approach that uses the output from the skill acquisition process to explain the earnings of golfers. Using a larger dataset of PGA Tour players, Alexander and Kern (2005) similarly find VMPs differ across skills. Callan and Thomas (2007) then used a structural model to better identify the link between skill and earnings and estimated VMPs that differed across skills for PGA Tour golfers.

Another line of research also began to emerge that modelled the link between skill and earnings mainly through a log transformation but did not focus on computing VMPs for skills. Moy and Liaw (1998) build a non-linear model that can be used to show that VMPs are similar across certain, but not all, skills for PGA Tour golfers in 1993 but the VMPs computed from Nero's (2001) estimates of the impact of skill on earnings for PGA Tour golfers in 1996 are all different. Shmanske's (2000) non-linear model for PGA Tour golfers in 1998 does not incorporate the impact of practice on skill acquisition as in his earlier work (Shmanske, 1992) and his estimates continue to suggest VMPs amongst PGA Tour golfers differ across skill.

In order to better address the skewness found in PGA Tour earnings, Kahane (2010) estimated the returns to skill on the PGA Tour using a quantile regression approach. This more sophisticated and more precise method of modelling seems to have confirmed the

results from earlier studies about the impact of skills on earnings. In particular, whereas human capital formation suggests that VMPs should be comparable across skills for golfers, research has not generally found this for PGA Tour golfers' skills as measured by performance in tournaments. Kahane's (2010) VMP estimates for GIR and putts per GIR are within 10% of each other for golfers in the 25th quantile of real earnings per event but none of the other examined quantiles is any closer than 19%.

The body of research of the impact of skills on earnings for PGA Tour golfers may indicate that the skills acquisition process for professional golfers includes important elements that are generally not being modelled. With endorsement earnings covering virtually all costs of competition, it is not surprising that the best models suggest that VMPs are not equal across observable skills for PGA Tour golfers. These golfers likely have commitments to participate in corporate events, marketing and advertising promotions, and product testing and development that can be just as valuable as time spent working on their game. Therefore, any estimates of VMPs of the labour inputs into skills acquisition would need to include those other commitments as well. Understandably, these data are difficult or impossible to attain. Perhaps, then, the PGA Tour is not an appropriate arena within which to estimate VMPs for professional golfers by observing outputs from the skills acquisition process.

Instead, a next-tier golf tour where a golfer's main source of income comes from his tournament earnings is more likely to be an arena in which labour activities of participants are likely to be exclusively directed at developing their golf skills. Hamel *et al.* (2016) find that recent modifications of the PGA Tour's qualification process serve as a more restrictive barrier of entry to the PGA Tour and subsequently limit otherwise qualified Web.com (now Korn Ferry) Tour players from competing at a higher level. So although the Korn Ferry Tour ostensibly serves as a developmental tour for future PGA Tour players, there may be a reason to believe golfers on developmental tours like the PGA Tour's Korn Ferry Tour and the European Tour's Challenge Tour are strategically responding to entry barriers and qualification protocols in addition to acquiring and developing golf skills required for successfully competing at the highest levels of professional golf. The Sunshine Tour, Korn Ferry Tour and European Challenge Tour are all ranked similarly in the Official World Golf Ranking, but the fact that the Sunshine Tour does not serve as a direct promotion mechanism and qualifier to a higher tier professional tour makes it an ideal arena within which to observe the outcomes of human capital formation at the relatively early stages of skill acquisition. Estimates of VMPs from observing outputs from the skills acquisition process in this setting would thus be expected to be close to each other. We, therefore, focus our attention on the Sunshine Tour in this paper to observe labour market outputs from human capital formation and skill acquisition. The next section describes the data and introduces our model.

3. DATA AND METHOD

We restrict our analysis to Sunshine Tour only players who do not also hold a European Tour card.[1] We can, therefore, focus on examining outcomes for those golfers that (i)

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[1] Every year, some Sunshine Tour events are co-sanctioned with the European Tour. As a result, some of the top money winners on the Sunshine Tour are European Tour card holders. We do not include these golfers in our analysis.

Table 1. Summary statistics

Variable	Mean	Standard deviation	Minimum	Maximum
Driving accuracy (%)	58.12	8.35	34.69	97.19
Greens-in-regulation (GIR) (%)	66.29	5.58	38.89	87.78
Putts per GIR	1.80	0.05	1.64	2.13
Tournaments	19.45	5.68	1	30
Real earnings (in ZAR)	315 689.00	375 850.80	3 772.68	4 382 457.00
Experience (years)	9.00	6.61	0	31

Note: n = 802. Summary statistics for Sunshine Tour players for 2011-2019 seasons.

likely have little corporate responsibilities and off-course distractions because they are not playing on the highest level tour; (ii) do not have direct connections to a higher level tour, so their practice and training decisions are tied to their performance in Sunshine Tour events only; and (iii) do not experience barriers restricting qualified players from competing at a higher level that could create incentives taking focus away from acquiring and developing golf skills. Data emanate from the 2011-2019 season ending statistics of the top 100 golfers on the Sunshine Tour that do not hold a European Tour card and for whom complete data were available (n = 802). All data were collected from the official Sunshine Tour website (see https://sunshinetour.com/stats).

Informed by previous research (Shmanske, 1992, 2000; Moy and Liaw, 1998; Alexander and Kern, 2005; Callan and Thomas, 2007; Kahane, 2010), we measure golfer success in terms of real earnings per tournament (in Rand) (*earn*). Earnings are assumed to be a function of driving accuracy (*drive*; the percentage of total drives hit in the fairway), greens-in-regulation (*gir*; percentage of greens hit in the regulation number of strokes, which are at least two strokes below the par score of the hole), putts per GIR (*putt*; number of putts made if the green was hit in regulation) and player experience (*exp*; years of experience as a professional golfer).[2]

Summary statistics are presented in Table 1. Average real earnings are about R315 689 (about $19 000). The average driving accuracy is 58%, with 66% of greens hit in the regulation number of shots. The average player has 9 years of experience as a professional golfer.

Because earnings can be unequally distributed across players, with a relatively small proportion of players earning the largest proportion of the money, we make use of quantile regression. It is possible that the relationships between earnings and golfer skills may vary depending on golfer quality. Simultaneous-quantile regression also allows for testing hypotheses within and across different quantiles. Hence, it is possible to test whether the VMPs within each quantile are equal across skills and whether the VMP for each skill is equal across quantiles.

We estimate a simultaneous-quantile regression for five percentiles (10th, 25th, 50th, 75th and 90th) of the form:

$$Q_i\left(\text{earn}_k\right) = \alpha_i + \beta_{1i}\text{drive}_k + \beta_{2i}\text{gir}_k + \beta_{3i}\text{putt}_k + \beta_{4i}\text{exp}_k + \beta_{5i}\text{exp}_k^2 + \delta_i\text{year}_k + \varepsilon_i$$

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[2]   Sand save percentage and driving distance could also be potentially important variables to consider (Rishe, 2001; Callan and Thomas, 2007), but these measures were not available in the Sunshine Tour data.

where all variables are as defined previously, $year_k$ denotes year dummies for each survey year and ε_i is the error term.

4. RESULTS AND DISCUSSION

The regression results are presented in Table 2. The results indicate that driving accuracy is not a significant predictor of real earnings in any quantile. Additionally, there is not much of an association between player experience and real earnings at the lower quantiles. For players in the 75th and 90th percentiles, years of experience is positively related to real earnings, which diminishes after about 14 years.

In contrast, the two other skills, namely GIR and putts per GIR, do matter for golfers in all quantiles. We focus our attention on only these two skills for the remainder of this discussion. Across quantiles, the coefficients for GIR ($F = 3.18$, $p < 0.05$) and putts per GIR ($F = 4.84$, $p < 0.01$) are significantly different from each other, which is consistent with Kahane's (2010) result that golfers' earnings on the PGA Tour generally increase with skill across quantiles. As expected, hitting more greens in regulation and having fewer putts per GIR are associated with higher real earnings, with the effect magnitudes increasing with the real earnings quantile. For instance, at the 25th quantile increasing greens hit in regulation by one percentage point is associated with higher per tournament earnings of about R521, compared to R1 274 at the 75th quantile. Because the putts per green hit in regulation is a relatively small number to begin with and in order to provide a feasible working example, we decrease putts per GIR by just 0.01. This amounts to a golfer lowering his per tournament score by about one-half shot (or by about one shot every other tournament) and leads to an increase in earnings of roughly R452.34 per tournament for players at the 10th quantile and R1 666.09 per tournament for players at the 90th quantile.[3] This finding of the relative importance of the short game is consistent with previous studies in relation to the saying of "drive for show and putt for dough" (Alexander and Kern, 2005).

As expected, the coefficients of the two skills of interest are not statistically equal within each quantile. In responding to how the market values each skill through competition on the Sunshine Tour, golfers are likely to engage in human capital formation activities so the VMPs are similar across skills within each quantile. For each quantile, VMPs for GIR and putts per GIR are calculated by multiplying the estimated skill coefficient by the standard deviation of that skill. Table 3 summarises these calculations, together with Kahane's (2010) PGA Tour estimates for comparison purposes. For Sunshine Tour players the VMPs for GIR range from R1 799.12 to R9 442.44. Similarly, for putts per GIR the VMPs range from R2 242.06 to R8 258.11. Across all quantiles, VMPs for GIR and putts per GIR differ by no more than 20% for Sunshine Tour players. For the 10th and 25th quantiles, VMPs for GIR are lower than the VMPs for putts per GIR, suggesting that these golfers could benefit by focusing more practice and training on improving their putting. This is reversed for golfers in the 50th, 75th and 90th quantiles and suggests the

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[3]   For shots per round, multiply the average GIR of Sunshine Tour players (see Table 1) by 18, thus $0.66 \times 18 \approx 12$. For shots per tournament, the average GIR is multiplied by 72, thus $0.66 \times 72 \approx 48$. Decreasing putts per GIR by 0.01 will therefore lead to a decrease in shots per round of about 0.12 and a decrease in shots per tournament of about 0.48.

Table 2. Simultaneous-quantile regression results

Variable	q10	q25	q50	q75	q90	$H_0^\#$
Driving accuracy	-0.018 (0.026)	0.008 (0.030)	0.052 (0.049)	0.166 (0.138)	0.159 (0.325)	0.28
Greens-in-regulation (GIR)	0.322*** (0.064)	0.521*** (0.083)	0.986*** (0.110)	1.274*** (0.188)	1.692*** (0.423)	3.18**
Putts per GIR	-45.234*** (7.679)	-69.853*** (9.276)	-105.719*** (13.724)	-121.645*** (26.650)	-166.609*** (42.481)	4.84***
Experience	-0.001 (0.085)	0.101 (0.111)	0.287 (0.180)	0.769** (0.375)	1.863** (0.906)	
Experience squared	0.002 (0.004)	-0.003 (0.005)	-0.009 (0.007)	-0.028** (0.013)	-0.065* (0.035)	
Constant	67.280*** (11.563)	99.626*** (14.111)	135.543*** (22.613)	144.514*** (46.619)	204.802*** (75.631)	
Pseudo R^2	0.1398	0.1601	0.1878	0.1885	0.1827	
H_0^*	28.70***	28.70***	42.16***	21.43***	11.00***	

Note: n = 802. Dependent variable is real earnings per tournament, in thousands. Bootstrapped standard errors (in brackets) with 1,000 replications. Year dummies included but not shown. # *F*-statistics consistent with the null hypothesis that VMPs of each skill are equal across quantiles (driving accuracy, GIR and putts from GIR). * *F*-statistics consistent with the null hypothesis that VMPs of all skills are equal within quantiles.

***p < 0.01; ** p < 0.05; *p < 0.10.

Table 3. VMPs for golfer skills

	VMP(GIR)	VMP(Putts per GIR)	VMP(GIR)/VMP(Putts per GIR)
Sunshine Tour (only) players			
q10	R1 799.12	R2 242.06	0.80
q25	R2 909.04	R3 462.34	0.84
q50	R5 501.80	R5 240.03	1.05
q75	R7 110.87	R6 029.44	1.18
q90	R9 442.44	R8 258.11	1.14
Kahane (2010)			
q10	$4 339.12	$3 642.42	1.19
q25	$6 301.36	$5 739.40	1.10
q50	$12 004.12	$7 480.82	1.60
q75	$18 942.04	$9 972.60	1.90
q90	$18 620.84	$14 351.26	1.30

Note: VMPs for GIR (putts per GIR) obtained by multiplying the relevant coefficient for GIR (putts per GIR) by the standard deviation of GIR (putts per GIR). Because Kahane (2010) did not calculate VMPs for all the quantiles that we are looking at, we used Kahane's reported estimates to calculate relevant VMPs for this comparison.

nature of human capital formation – that is, practice, training, coaching and diet – may change across these groups of Sunshine Tour players.

Note that Kahane's (2010) estimates of VMPs for GIR and for putts per GIR for PGA Tour players are not as close to each other as a whole and that VMPs for GIR are greater than they are for putts per GIR on the PGA Tour at all quantiles. While we did not observe practice habits or training routines for Sunshine Tour players, a ratio of VMPs that is less than one for those Sunshine Tour players in the 10th and 25th quantiles suggests that human capital formation for those players may be different than those golfers on the top professional golf tour in the world. Further research on practice habits and training for golfers on the Sunshine Tour may lend some insight into human capital formation at the earliest stages of skill acquisition for professional golfers.

5. CONCLUSION

Many Sunshine Tour golfers are at the earliest stages of their professional golf career and are, therefore, in the earliest stages of acquiring human capital to be used when competing in professional golf tournaments. A next-tier golf tour like the Southern-African Sunshine Tour, where many golfers' main source of income is tournament earnings, is likely to allow golfers a chance to work on developing their tournament golf skills via a mix of coaching, diet and practice with minimal interference from outside corporate or off-course responsibilities.

The findings from simultaneous quantile regression revealed that driving accuracy is not a significant determinant of Sunshine Tour golfers' earnings. However, the percentage of greens hit in regulation and especially the number of putting strokes taken significantly affect golfer earnings: Hitting more greens in regulation and reducing the number of putts are associated with higher earnings.

Notably, our results, although consistent with optimal human capital formation, did not come from observing actual skill acquisition decisions directly. Future research in this arena should include a strategy like Shmanske's (1992) survey of the practice times and habits of professional golfers on the PGA Tour but on a broader scale and with golfers on next-tier tours such as the Sunshine Tour. This approach could provide deeper insight

into why our estimates of VMPs across skills are comparable for Sunshine Tour golfers even as other studies have not found the same for PGA Tour golfers. A research strategy that explores how golfers acquire human capital on a lower tier tour would go a long way towards giving economists a better understanding of early career human capital acquisition and the formation and the incentives that drive the process.

REFERENCES

ALEXANDER, D. L. and KERN, W. (2005). Drive for show and putt for dough? An analysis of the earnings of PGA Tour golfers. *Journal of Sports Economics*, 6(1): 46-60.

CALLAN, S. J. and THOMAS, J. M. (2007). Modeling the determinants of a professional golfer's tournament earnings: A multiequation approach. *Journal of Sports Economics*, 8: 394-410.

HAMEL, S., CAUDILL, S. and MIXON Jr., F. (2016). A good walk foiled: Monopoly power and barriers to entry into the PGA Tour. *Managerial and Decision Economics*, 37: 574-584.

KAHANE, L. H. (2010). Returns to skill in professional golf: A quantile regression approach. *International Journal of Sport Finance*, 5(3): 167-181.

MOY, R. L. and LIAW, T. (1998). Determinants of professional golf tournament earnings. *The American Economist*, 42: 65-70.

NERO, P. (2001). Relative salary efficiency of PGA Tour golfers. *The American Economist*, 45(2): 51-56.

RISHE, P. J. (2001). Differing rates of return to performance: A comparison of the PGA and senior golf tours. *Journal of Sports Economics*, 2(3): 285-296.

SHMANSKE, S. (1992). Human capital formation in professional sports: Evidence from the PGA Tour. *Atlantic Economic Journal*, 20(3): 66-80.

——. (2000). Gender, skill, and earnings in professional golf. *Journal of Sports Economics*, 1(4): 385-400.