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The Hot Hand, Competitive Experience, and Performance Differences by Gender

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The Hot Hand, Competitive Experience, and Performance Differences by Gender

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Abstract

Using data on junior golf tournaments, we find evidence that the "hot hand" does exist, and that its prevalence decreases as golfers gain experience. This provides an explanation as to why studies that consider professional athletes conclude that the hot hand does not exist. We also show that females are much more likely to experience the hot hand compared with similar males, and provide evidence that this disparity is driven by differences in competitive experience. As golfers' experience increases, gender dissimilarities disappear. We argue that exposure to competition may also drive other gender differences identified in competitive environments.

(JEL) J16, J7

I. Introduction

The term "hot hand" refers to the idea that, controlling for skill, the probability an individual succeeds at a task in the current period depends on whether the individual succeeded or failed in previous periods. Despite the popular belief in the hot hand—the belief that people go through hot and cold performance spells—there exists little evidence that the hot hand actually exists (Camerer 1989, Camerer and Loewenstein 2004, McFadden 2006).

In their seminal paper, Gilovich, Vallone and Tversky (1985) find no evidence that runs of sequential successes or failures by professional basketball players occur more often then they would if a completely random process governed performance.[1] They refer to the popular belief in the hot hand as the "hot hand fallacy." Other papers extend Gilovich, Vallone and Tversky's analysis to other sport, and non-sport settings.[2] The majority of these papers find no conclusive evidence that the hot hand exists.[3] However, these analyses focus on professional or highly experienced individuals completing routine tasks they likely completed hundreds or thousands of times before. We argue that the hot hand, if it does exist, is likely driven by psychological factors including fluctuations in self-confidence, emotion and ability to remain focused, and that the impact these factors

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[1] For example, a baseball player who has a 30% probability of getting a hit during any at bat will still have occasional games in which he gets a hit each time he is at bat, and other games in which he does not get any hits. Some people believe that the player experienced a "hot" or "cold" game, even if his performance was completely random given his skill.

[2] The application to sports includes baseball (Albright 1993), putting and dart throwing (Gilden and Wilson 1995), horseshoes (Smith 2003), bowling (Dorsey-Palmateer and Smith 2006), PGA golf (Clark 2005), and tennis (Klaassen and Magnus 2001). Additionally, Cheng, Pi and Work (1999) look at the hot hand performance of mutual funds. Hindricks, Patel and Zeckhauser (1993) also consider the performance of mutual funds, but use a different definition of the hot hand compared with the other studies.

[3] The exception to this is Klaassen and Magnus (2001) who find evidence that a small hot hand effect exists in professional tennis, and that the prevalence of the hot hand decreases with experience. This paper represents the closest existing literature to our paper.

have on performance should decrease as individuals gain experience. Therefore, we would not expect these previous studies to find evidence of the hot hand.

Our analysis uses data on the performance of junior golfers between 12 and 17 years of age in American Junior Golf Association (AJGA) tournaments. We show that, in such a setting, the hot hand *does* exist and that its presence decreases as golfers gain tournament experience. There is a strong occurrence of the hot hand among golfers in their first year of AJGA tournament competition. However, by the third year of tournament competition, the prevalence of the hot hand among these same players is statistically indistinguishable from zero. The relationship between experience and the hot hand explains why analyses of professional athletes find little evidence in support of the hot hand.[4]

Additionally, we show that female golfers are more prone to experiencing performance streaks compared with similar males. This is consistent with a variety of recent papers that argue that males and females respond to competition differently. For example, Gneezy, Niederle and Rustichini (2003), and Gneezy and Rustichini (2004) show that men increase their absolute level of performance in response to competition more than women do.[5]

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[4] To the extent that the hot hand is related to a player's self-confidence, these results are in line with Lenney's (1977) argument that over- or under-confidence issues will be corrected over time if there is unambiguous feedback regarding one's ability.

[5] The gender differences in competitive settings, including those identified in this paper, may be related to differences in self-confidence. A variety of studies show that males tend to have higher expectations of their own ability relative to others, while females tend to have lower expectations regarding their relative ability (e.g., Lundeberg, Fox and Pucochar 1994, Barber and Odean 2001). If males are more likely to believe they can win a competition, they will be more likely to put in additional effort. Furthermore, the more certain a player is of his or her own ability, the less likely that player is to have their performance psychologically impacted by past successes or failures; therefore, the less likely the player is to experience the hot hand.

The reason for the gender differences identified in the previous literature is unclear. One explanation is that differences in genetic makeup, instinctive nature, or other "hard-wired" characteristics drive the differences in reaction to competition. However, we find evidence in support of an alternative explanation: that apparent gender dissimilarities are driven by differences in past exposure to competitive environments between males and females. We show that although the hot hand has a significantly greater impact on the performance of females compared with males, this difference is essentially eliminated by the second year of AJGA tournament experience. This result suggests that differences in exposure to competitive environments may also explain other gender differences identified in the literature (e.g., Gneezy, Niederle and Rustichini 2003; Gneezy and Rustichini 2004; Niederle and Vesterlund 2005).

The paper proceeds as follows. Section II provides an overview of the junior golf tournaments and our data. Section III presents the empirical analysis. The paper concludes with a discussion of our results and their implications in Section IV.

II. Junior Golf Tournament Data

Our analysis uses data provided by the American Junior Golf Association (AJGA) on the hole-by-hole performance of individual golfers in golf tournaments from 2002 through 2005. The AJGA is the largest organization for junior golfers in the United States and runs roughly 75 open and invitational tournaments per year throughout the country with participants ranging in age from 12 to 17.

On each day of a tournament, each golfer participates in one round (18 holes) of golf. Most of the tournaments involve multiple days of golf with participation in the 2nd, 3rd, or 4th round depending on performance during the previous rounds. Boys and girls compete in each tournament against members of their same gender.[6]

Golfers attempt to minimize the number of strokes taken in each round of golf. The golfer with the lowest score wins the round. For each hole, a par is assigned that reflects the expected number of strokes required to complete the hole. The par on a given hole can be 3, 4, or 5 strokes. A golf course is typically made up of multiple holes at each level of par, with par-4 holes being the most common. A player's performance on each hole is judged relative to par, with scores at or below par being seen as successful holes, and scores above par being viewed as unsuccessful holes. Throughout our analysis, we will refer to achieving par or below as a "hit" and scoring above par as a "miss" in order to remain consistent with the terminology in the hot hand literature.

While we do not have data on the performance of players prior to 2002, we do have a list of participants for all of the tournaments in 2001. We exclude all players who participated in two or more tournaments in 2001 from our analysis. This insures that we have an accurate measure of a player's actual experience in the AJGA. We also limit our data to players who participated in at least three tournaments in a given calendar year. Our analysis includes 1,750 individual golfers, 540 of who participate in multiple years. In testing for the hot hand, we consider the probability of success on a total of 478,681 player holes (358,612 holes played by males, and 120,069 holes played by females). For each of these holes we know whether the player achieved par or better (which occurs

[6] This includes players being paired with (walking the course with) members of the same gender, and players' tournament ranking depending on their scores relative to members of the same gender.

about 61% of the time for women and 70% of the time for men). Table 1 provides a count of the number of players in our sample by first year of participation in an AJGA tournament and current experience.

III. Empirical Strategy and Results

This section outlines our empirical strategy for testing for the hot-hand effect and presents results on how the hot hand effect differs by gender and experience. The first two methods we use to test for the hot hand (conditional probability analysis and the runs test) are based on the approach of Gilovich, Vallone, and Tversky (1985). These two tests are similar to those used in the majority of past hot hand analysis and both test for the fraction of players for whom performance is not independent of past performance. As a third check, we use a logit regression that tests the impact of gender, experience and previous-hole performance on the probability of achieving par. The logit regression allows us to quantify the degree to which the probability of success is influenced by past performance.

Conditional Probability Analysis

The first method we use to test for the hot hand is a comparison of conditional probabilities that tests whether a player is more likely to achieve par following a series of good performances compared to a series of bad performances. We test the following null hypothesis:

H_0: *P(hit this hole | hit last hole) = P(hit this hole | missed last hole)*

where a player is said to achieve a "hit" if he or she did at least as well as par, and achieve a "miss" otherwise. We also carry out a similar test based on the previous two holes.

The results of this analysis are included in Tables 2 and 3. In Table 2, the rows labeled A-H in each panel represent the eight male or female players who participated in the most rounds of golf in a single year (around 26). Using the players for which we have the most observations insures that each cell has a sufficient number of observations to make meaningful comparisons. The results in table 2 show that the female players have a high prevalence of the hot hand (6 of the 8 women) while none of the men demonstrate the hot hand at a significant level. For some of these women the gap between the probabilities of achieving par following two successful holes compared to two failed holes is very large. For example, player D is six times more likely to achieve par (71.6% vs. 12.3%) following two par holes compared to when following two non-par holes and a similar gaps exist for players B and G.

Table 3 carries out a similar analysis for the full sample of players and separates the results by the AJGA tournament experience level of each player. The upper panel provides the distribution of test statistics based on the difference in the probability of achieving par following a hit compared to following a hit. The lower panel is the same analysis but based on the difference in the probability of success following two hits compared to two misses.

The distribution is broken up into four categories representing natural cutoffs in the normal distribution. Under the assumption of independence, we should observe a test statistic of greater than 2.58 in only 1% of our observations. However, 5.9% of women

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and 3.2% of the men in our sample exceed this cutoff. This indicates that there are more hot-handed players in our sample than should occur if success is independent of past performance and that female players are more likely than male players to fit this category.

The second through fourth column of Table 3 separate the sample based on the experience level of the player. The results in these columns show that the hot hand effect is most prevalent in the first year of tournament player with 13% of women and 4% of men having test statistics greater than 2.58 (relative to the 1% we'd expect). By the second and third year of tournament play the gender gap in the hot hand has disappeared with only about 2% of both men and women having a test statistic greater than 2.58, and 5%-7% with a test statistic greater than 1.96.

Runs Test

Our second method, the *runs test*, looks at the degree to which successes and failures clump together. For this test, each sequence of consecutive hits or misses is referred to as a run. For example, the sequence "1101110" consists of 4 runs with two runs of ones and two runs of zeros. If misses tend to clump together then this would create a smaller number of runs than we would expect under the assumption of independence. The statistical test if based on the Wald-Wolfowitz runs test.

Table 4 is set up in an identical fashion as Table 3 with the test statistic referring to the runs test instead of a difference in probabilities. For the full sample, women are 60% more likely to exhibit the hot hand (9.1% vs. 5.7%) and are twice as likely to exhibit the extreme hot hand (5.9% vs. 2.8%, relative to the 1% we'd expect). Once again the

prevalence of the hot hand effect is most concentrated in first year players with 15% of women and 6.3% of men demonstrating a hot hand effect based on the degree to which their misses clump together.

Logit Regression Analysis

Our final method is a regression-based test for the hot hand that examines how the probability of achieving par depends on the performance of the previous hole. By including player-year fixed effects in the regression, we test whether a given player is more likely to achieve par (relative to his or her average performance) following a good performance compared to following a bad performance. We interact performance on the previous hole with the player's gender and experience to test for gender and experience differences in the response to past performance. Our logit regression takes the following form:

$$Prob(hit)_{it} = \alpha \cdot hit_{it-1} + \beta_1 \cdot gender \cdot hit_{it-1} + \beta_2 \cdot experience \cdot hit_{it-1} + \Sigma \gamma_i \cdot X_i$$
$$+ \beta_3 \cdot par3_t + \beta_4 \cdot par5_t + \varepsilon_{it}$$

where "hit" refers to whether the player scored at or below par. The subscript t refers to the particular hole, with hit_{t-1} indicating whether the player achieved par on the previous hole. The subscript i refers to the individual player (or player-year) with X_i representing a either a set of player characteristics, player fixed effects, or player-year fixed effects.

The results in table 5 provide the average marginal effect of each variable on the probability of achieving par. The 2nd column includes a set of player fixed effects and the 3rd column includes a set of player-year fixed effects. The results show that players are

influenced by the performance on the previous hole with the first column showing that a player is 9.8 percent more likely to achieve par following a successful hole than an unsuccessful one. The impact of past performance is reduced to 6.8 percentage points when we include player fixed effects and to 6.1 percentage points when we include player-year fixed effects.

The interaction between past performance and the player's gender show that men are less influenced by past performance. The interaction between experience and past performance show that hot hand decreases with experience with the largest drop occurring between the first and second year of tournament experience. The interaction between gender, experience, and past performance indicates that women are becoming less streaky at a faster rate than men. As a result, the gender gap in the hot hand effect disappears with experience such that by the third year of tournament play the overall hot hand effect results in only about a 2 percentage point difference in the probability of achieving par following a hit compared to following a miss.

The results obtained above were based on an unbalanced panel. However, when we run a similar model for the set of players that we observe for three years, we obtain nearly identical result. We also test for whether streaky players are more likely to stop participating in tournaments and find that this is not the case. These two results indicate that the level of streaky behavior is altered by experience and not merely the attrition of more streaky players.

IV. Discussion

Our ability to control for both a golfer's experience and gender allows us to consider additional implications of our analysis that were not possible in the previous analyses of the hot hand, or previous tests of gender differences in response to competition. Most hot hand analyses focus on only one gender of athletes at the highest level of competition. Past studies of gender differences in competition do not control for competitors' experience. In the section below, we discuss the contributions of our analysis.

The Hot Hand and Experience

In contrast to most of the past literature, we show that the hot hand does exist, at least in certain situations. However, we also show that the hot hand decreases as golfers in our sample gain experience. The impact the hot hand effect has on the performance of junior golfers essentially disappears by the golfers' third year of tournament participation. This suggests that the hot hand also does not significantly impact the performance of more experienced (e.g., professional) golfers, or highly experienced participants in other situations to the extent that the relationship between the hot hand and experience carries over from golf to other activities.

False Consensus Effect

People tend to believe that the hot hand effect impacts performance in situations in which it does not exist (Camerer 1989). Gilovich, Vallone and Tversky (1985) label this incorrect belief as the *hot hand fallacy*, and show that the streaks people misinterpret as resulting from "hot" or "cold" performance can be explained as an expected occasional

outcome of a completely random process. Behavioral economists often refer to the hot hand fallacy as its own psychological tendency (e.g., Camerer and Loewenstein 2004; McFadden 2006). However, our analysis suggests that the belief in the hot hand may not define an independent tendency, but rather that it may be driven by the false consensus effect, a widely established psychological concept. Formulating a new hypothesis is possible given the relationship between the hot hand and experience that we identify.

The *false consensus effect* represents the idea that people overestimate the extent to which the behavior and preferences of others are similar to their own behavior and preferences. Such an effect has been widely documented in the psychology literature following its initial identification by Ross, Green and House (1977).[7] In the case of the hot hand, if people recognize that they (or other amateurs) experience the hot hand when participating in an activity, then they may overestimate the likelihood that others also experience the hot hand. This explanation requires that people do not recognize that the presence of the hot hand depends on one's experience. However, this is a reasonable explanation given that, until now, statistical analyses have not recognized the relationship between the hot hand and experience.

Similarly, even experienced athletes may believe the hot hand effect impacts performance if they formed their beliefs regarding the prevalence of the hot hand when they were less experienced.

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[7] Many other papers also find evidence of the false consensus effect. For an overview of the psychology analyses, see Mullen, et. al. (1985). Others, including Selten and Ockenfels (1998) and Engelmann and Strobel (2000), find evidence in economic settings.

The consensus effect is also related to models of projection bias from the economics literature. Projection bias models assume that people overestimate the degree to which their future preferences will be similar to their current preferences (Loewenstein, O'Donoghue and Rabin 2003).

Gender Differences and Competition

Of all of our results, those regarding the relationship between gender differences and competitive experience are likely to have the greatest implications for the economics literature. We find that female golfers are more likely to be influenced by past performance than similar males, and that this difference is eliminated after the females gain experience. Our favored explanation for the initial gender difference is that males are more likely to have more competitive experience prior to joining the AJGA than females.[8] Once females accumulate enough tournament experience, the gender difference is eliminated.

Although we analyze gender differences with respect to the hot hand, we see no reason why similar effects would not influence other measures of competitive performance. To the extent that differences regarding the hot hand are similar to other gender differences identified in the literature (e.g., Gneezy, Niederle and Rustichini 2003; Gneezy and Rustichini 2004; Niederle and Vesterlund 2005), our results suggest that recent papers that show males respond more favorably to competition compared to females may be driven by differences in competitive experience (or exposure to competition) rather than actual biological differences.

We do not further explore this implication here, but encourage further consideration of this question. Future analyses may test whether differences in

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[8] We collect data from the Junior World Golf Championships (JWGC) from 1995 through 2005 on the number of male and female golfers registered in each age category. While the AJGA data does not include the age of the golfers, the JWGC lists participants in narrow age ranges, and does not require golfers to be at least 12 years of age. This makes it possible to observe if male golfers begin participating in tournaments at an earlier age compared with female golfers. We find that on average males start competing in tournaments at an earlier age than females.

competitive experience drive the results of Gneezy, Niederle and Rustichini (2003),

Gneezy and Rustichini (2004) and Niederle and Vesterlund (2005); and whether

increasing exposure to competition can eliminate gender differences in less trivial

situations such as education and employment.

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Table 1. Number players in our sample by first year of participation in an AJGA tournament and experience.

Women

first year	experience in AJGA (years)			Total
	1	2	3	
2002	60	68	76	204
2003	42	56	51	149
2004	59	98	0	157
2005	46	0	0	46
Total	207	222	127	556

Men

first year	experience in AJGA (years)			Total
	1	2	3	
2002	227	247	219	693
2003	154	269	189	612
2004	175	205	0	380
2005	143	0	0	143
Total	699	721	408	1,828

Notes: Our sample is restricted to all player-years in which the player participated in at least 3 AJGA tournaments in the calendar year.

Table 2. Probability of achieving par conditional on past performance

Women	P(H|2M)	P(H|1M)	P(H)	P(H|1H)	P(H| 2H)	P(H|1M)= P(H|1H) (t-stat)	P(H|2M)= P(H|2H) (t-stat)
A	0.667	0.696	0.720	0.728	0.729	0.66	0.77
B	0.142	0.331	0.614	0.789	0.787	9.36**	10.85**
C	0.808	0.762	0.710	0.690	0.665	-1.41	-1.47
D	0.123	0.363	0.559	0.712	0.716	6.89**	9.50**
E	0.261	0.490	0.628	0.709	0.699	4.31**	6.22**
F	0.253	0.482	0.641	0.731	0.750	4.92**	7.39**
G	0.172	0.297	0.541	0.740	0.733	8.73**	9.35**
H	0.279	0.468	0.577	0.650	0.698	3.56**	6.13**

Men	P(H|2M)	P(H|1M)	P(H)	P(H|1H)	P(H| 2H)	P(H|1M)= P(H|1H) (t-stat)	P(H|2M)= P(H|2H) (t-stat)
A	0.739	0.750	0.782	0.791	0.789	0.86	0.56
B	0.929	0.819	0.808	0.806	0.817	-0.27	-1.07
C	0.739	0.767	0.752	0.748	0.737	-0.39	-0.02
D	0.846	0.847	0.841	0.839	0.842	-0.17	-0.04
E	0.679	0.705	0.709	0.710	0.716	0.10	0.41
F	0.867	0.803	0.795	0.793	0.796	-0.20	-0.67
G	0.875	0.829	0.822	0.821	0.818	-0.17	-0.58
H	0.654	0.706	0.754	0.769	0.778	1.29	1.43

Notes: In the table "H" refers to whether the player achieved par or better (a hit) on a particular hole, while "M" indicates that they did not achieve par (a miss) and P(H|2M) indicates the probability of getting a hit following two misses. Thus reading across each row gives the change in the probability of achieving par as we condition on better performance over the last few holes. The first three holes of each round are excluded from the analysis. The eight men and women chosen for this analysis are those who participated in the most rounds (around 26) of golf in a single year. ** indicates significance at 99% level and * indicates significance at 95% level.

Table 3. Distribution of test statistic that performance is independent of performance on the previous holes by gender and experience.

H₀: P(H|1M)= P(H|1H)

Women

t-stat	Full sample N	Full sample Percent	1st year N	1st year %	2nd year N	2nd year %	3rd year N	3rd year %
≤-1.96	10	1.8%	4	1.9%	4	1.8%	2	1.6%
-1.96-1.96	492	88.5%	172	83.1%	205	92.3%	115	90.6%
1.96-2.58	21	3.8%	5	2.4%	9	4.1%	7	5.5%
≥ 2.58	33	5.9%	26	12.6%	4	1.8%	3	2.4%
N	556		207		222		127	

Men

t-stat	Full sample N	Full sample %	1st year N	1st year %	2nd year N	2nd year %	3rd year N	3rd year %
≤-1.96	47	2.6%	14	2.0%	18	2.5%	15	3.7%
-1.96-1.96	1670	91.4%	638	91.3%	661	91.7%	371	90.9%
1.96-2.58	52	2.8%	18	2.6%	20	2.8%	14	3.4%
≥ 2.58	59	3.2%	29	4.2%	22	3.1%	8	2.0%
N	1828		699		721		408	

H₀: P(H|2M)= P(H|2H)

Women

t-stat	Full sample N	Full sample Percent	1st year N	1st year %	2nd year N	2nd year %	3rd year N	3rd year %
≤-1.96	8	1.4%	3	1.5%	3	1.4%	2	1.6%
-1.96-1.96	486	87.4%	169	81.6%	201	90.5%	116	91.3%
1.96-2.58	22	4.0%	3	1.5%	13	5.9%	6	4.7%
≥ 2.58	40	7.2%	32	15.5%	5	2.3%	3	2.4%
N	556		207		222		127	

Men

t-stat	Full sample N	Full sample %	1st year N	1st year %	2nd year N	2nd year %	3rd year N	3rd year %
≤-1.96	22	1.2%	9	1.3%	11	1.5%	2	0.5%
-1.96-1.96	1675	91.6%	634	90.7%	656	91.0%	385	94.4%
1.96-2.58	59	3.2%	22	3.2%	27	3.7%	10	2.5%
≥ 2.58	72	3.9%	34	4.9%	27	3.7%	11	2.7%
N	1828		699		721		408	

Notes: Under the assumption of independence we would expect a test-statistic of more than 2.58 for only 1% of the players and more than 1.96 for only 5% of the players. The test statistic is based on a simple difference in proportions.

Table 4. Distribution of test statistic that hits and misses clump together by gender and experience.

H_0: Runs = Expected Runs

Women:

	Full sample		1st year		2nd year		3rd year	
t-stat	N	Percent	N	%	N	%	N	%
$\leq$ -1.96	13	2.3%	4	1.9%	5	2.3%	4	3.2%
-1.96-1.96	492	88.5%	172	83.1%	204	91.9%	116	91.3%
1.96-2.58	18	3.2%	5	2.4%	9	4.1%	4	3.2%
$\geq$ 2.58	33	5.9%	26	12.6%	4	1.8%	3	2.4%
N	556		207		222		127	

Men

	Full sample		1st year		2nd year		3rd year	
t-stat	N	%	N	%	N	%	N	%
$\leq$ -1.96	72	3.9%	17	2.4%	32	4.4%	23	5.6%
-1.96-1.96	1652	90.4%	638	91.3%	649	90.0%	365	89.5%
1.96-2.58	53	2.9%	18	2.6%	19	2.6%	16	3.9%
$\geq$ 2.58	51	2.8%	26	3.7%	21	2.9%	4	1.0%
N	1828		699		721		408	

Notes: A run is defined as the number of sets of consecutive hits and misses are in a sequence of holes. For example, 1101 has three runs (2 runs of ones and 1 run of zeros). The test statistic is based on the Wald-Wolfowitz test.

Table 5. Average marginal effects of various factors on the likelihood of achieving par using logit regression

	(1)	(2)	(3)
hit_{t-1}	0.098	0.068	0.061
	[0.011]	[0.005]	[0.005]
male $\cdot$ hit_{t-1}	-0.038	-0.031	-0.027
	[0.012]	[0.006]	[0.006]
2nd year $\cdot$ hit_{t-1}	-0.040	-0.044	-0.040
	[0.013]	[0.007]	[0.008]
3rd year $\cdot$ hit_{t-1}	-0.051	-0.046	-0.041
	[0.014]	[0.008]	[0.009]
male $\cdot$ 2nd year $\cdot$ hit_{t-1}	0.024	0.031	0.028
	[0.013]	[0.008]	[0.009]
male $\cdot$ 3rd year $\cdot$ hit_{t-1}	0.028	0.032	0.027
	[0.014]	[0.010]	[0.010]
par 3 hole	0.009	0.010	0.009
	[0.002]	[0.002]	[0.002]
par 5 hole	0.114	0.129	0.134
	[0.002]	[0.002]	[0.002]
male	0.117		
	[0.012]		
2nd year	0.080	0.108	
	[0.012]	[0.006]	
3rd year	0.094	0.133	
	[0.012]	[0.008]	
male $\cdot$ 2nd year	-0.045	-0.070	
	[0.015]	[0.008]	
male $\cdot$ 3rd year	-0.036	-0.073	
	[0.016]	[0.010]	
Fixed effects	none	player	player-year
Observations	452,089	452,089	452,089
Number of groups		1,750	2,384

Notes: The results presented in this table are average marginal effects of each variable on the likelihood of achieving par on a given hole. Standard errors are presented in brackets. The standard errors in the first column account for within player-year correlation of the error terms. The indicator "hit_{t-1}" refers to whether or not the player achieved par on the previous hole. The unit of observation is the individual hole for each player. All of the estimates are significant at the 99% level with the exception of the interactions between gender, experience, and past performance in the first column.