Undergraduate Economic Review

Volume 4 | Issue 1 Article 4

2008

The Incentive Effects of 'Minor League' Tournaments: An Empirical Analysis of the PGA Tour Qualifying Tournament and the Nationwide Tour

Adam Hanna
Saint John's University

The Incentive Effects of 'Minor League' Tournaments: An Empirical Analysis of the PGA Tour Qualifying Tournament and the Nationwide Tour

Abstract

This paper uses two original data sets from the world of professional golf to test tournament theory's basic prediction that increasing prize levels lead to increased effort among tournament participants. The realm of professional golf was chosen because the incentive structure (prizes) and player output levels (scores) are readily available. Specifically, this paper uses time series data to determine if the rising prize money on the PGA Tour influences competitors' scores at the PGA Tour Qualifying Tournament, and it uses cross-sectional data to determine if prize levels influence Nationwide Tour competitors' scores as they attempt to move to the PGA Tour. The results from the PGA Tour Qualifying Tournament were consistent with the theory, while the Nationwide Tour analysis revealed contradictory results. This difference of results is not attributed to a failure of tournament theory but rather a difference in the time period that prizes are awarded. Nationwide Tour prizes are awarded immediately following a tournament, while the PGA Tour Qualifying Tournament prize is the opportunity to obtain very high rewards on the PGA Tour in the coming year and is therefore more like the awards proposed in tournament theory. This fundamental difference in the awarding of prizes may help clarify the incentive effects of current prizes versus the expectation of future prizes in future studies of tournament theory in the sports arena as well as the proper structure of compensation tournaments in the business world.

Undergraduate Economic Review

A publication of Illinois Wesleyan University

Vol. IV – 2007 - 2008

Title "The Incentive Effects of 'Minor League' Tournaments: An Empirical Analysis of the PGA Tour Qualifying Tournament and the Nationwide Tour"

Author Adam Hanna

Affiliation The College of Saint Benedict and Saint John's University

Abstract This paper uses two original data sets from the world of professional golf to test tournament theory's basic prediction that increasing prize levels lead to increased effort among tournament participants. The realm of professional golf was chosen because the incentive structure (prizes) and player output levels (scores) are readily available. Specifically, this paper uses time series data to determine if the rising prize money on the PGA Tour influences competitors' scores at the PGA Tour Qualifying Tournament, and it uses cross-sectional data to determine if prize levels influence Nationwide Tour competitors' scores as they attempt to move to the PGA Tour. The results from the PGA Tour Qualifying Tournament were consistent with the theory, while the Nationwide Tour analysis revealed contradictory results. This difference of results is not attributed to a failure of tournament theory but rather a difference in the time period that prizes are awarded. Nationwide Tour prizes are awarded immediately following a tournament, while the PGA Tour Qualifying Tournament prize is the opportunity to obtain very high rewards on the PGA Tour in the coming year and is therefore more like the awards proposed in tournament theory. This fundamental difference in the awarding of prizes may help clarify the incentive effects of current prizes versus the expectation of future prizes in future studies of tournament theory in the sports arena as well as the proper structure of compensation tournaments in the business world.

Introduction

The theory of tournaments posits that an individual's compensation is determined by the relative rank of their output level compared to the output levels of competitors. This is in direct contrast with the traditional economic theory of marginal productivity, where a person is compensated by virtue of what they add to the production process. Typically, compensation tournaments are used when measuring the value of output levels is imprecise or difficult to absolutely determine. Tournament compensation levels are, therefore, generally fixed in advance and serve as a motivation for placing relatively high, or 'winning', in the tournament. Tournament theory predicts that an individual's effort level will increase as the difference between 'winning' and 'losing' prizes increases.

While numerous examples have been identified where tournament compensation structures have relevance in traditional business settings, such as business executives competing to become CEO's, professors competing to make tenure at esteemed universities, law associates competing to make partner, and firms competing for architectural projects (Lazear 1998), the obvious connection between tournaments and sporting events has dominated the economics literature. Professional sports, and especially professional golf tournaments, are an ideal setting to test the basic predictions of tournament theory because the measured outputs (scores) are assumed to be a reflection of the athlete's effort level. As a result, numerous studies have been conducted in this arena.

However, every one of these studies has focused on professional golf played at the highest level; the PGA Tour in the United States and the European PGA Tour in

Europe. This paper will focus exclusively on golfers from the two primary 'minor league' systems in professional golf; the PGA Tour Qualifying Tournament and from the Nationwide Tour. To all but the die-hard golf fan, the existence and workings of 'minor league' professional golf requires a brief introduction.

The PGA Tour Qualifying Tournament was originally started in 1965 as a training program for aspiring golf professionals. Over the years, it has developed into a complex tournament that assists in determining a small number of the players that will be eligible to compete in PGA Tour tournaments the following year. The three-stage tournament is set up with many first stage tournaments, fewer second stage tournaments, and one final stage tournament. The top finishers in the first stage tournaments move to the second stage tournaments, and so on. The final stage tournament can then be considered the 'cream of the crop' of those attempting to gain membership on the PGA Tour through the tournament. Since 1982, the final stage has consisted of six consecutive rounds of golf where the top 30 finishers (this number has been reduced many times, varying from as many as 50) receive playing privileges on the PGA Tour for the following year, while everyone finishing outside of the top 30 does not. This 'survival' structure of the PGA Tour's Qualifying Tournament has earned it a reputation as the toughest test in all of professional golf.

The Nationwide Tour (formerly named the Hogan Tour, Nike Tour, and Buy.com Tour) was formed in 1990 by the PGA Tour to serve as its primary development tour. The tour holds approximately 30 tournaments a year, operated in a similar fashion as PGA Tour tournaments. The goal of the tour is to develop and promote its players to the PGA Tour, which it accomplishes in two ways. A player finishing in the top 20 on the

Nationwide Tour money list at the conclusion of the season receives PGA Tour privileges the following year, and a player who wins a third Nationwide Tour event (in the same season) is instantly promoted to the PGA Tour for the remainder of the year. The latter avenue was established in 1997 and is commonly referred to as a 'battlefield promotion'.

Two original data sets were drawn from these golfers to test whether tournaments produce desired incentive effects at the 'minor league' level. The paper will first discuss the relevant tournament theory literature, both theoretical and empirical, followed by an explanation of why 'minor league' golfers fit the theory better. Next, the data collection process will be described, followed by description of the regression models. The final section will detail the results, potential problems, and organizational implications.

Literature Review

Lazear and Rosen (1981) initiated the study of tournament incentive effects. They examined rank-order tournaments, where prize structure was fixed in advance and where payoff solely depended on how one's output ranked relative to the output of others. The Lazear and Rosen paper showed that participants selected their effort levels based upon the size of payoffs associated with rank order. Using a two-person model, they showed if both participants were paid equally at the end of the contest, the incentive to exert effort is non-existent because both contestants know their payments in advance. However, if the winner receives the entire prize, while the loser receives nothing, then both have a greater incentive to exert effort, especially if both assume they have a chance to win. However, performances are determined not only by effort but also by luck. Because competitors are unable to predict or alter how lucky they will be, there is no level of effort that can absolutely assure either of them a victory. Therefore, the authors

show that both competitors will have an incentive to exert their maximum effort because it gives each of them the best chance to win.

Subsequent theoretical papers expanded upon Lazear and Rosen's theory. Nalebuff and Stiglitz (1983) argued that tournaments work the best when the competitors are of equal ability because compensation based upon relative performance ensures someone must always come in last. In a tournament with competitors of varying ability, the loser is often not just unlucky but has less ability. Thus, a loser may become demoralized, stop competing, and continue to lose. This presence of a sure loser might destroy others' incentives to work hard because their probabilities of winning have increased. As a result, all players put forth a smaller amount of effort.

Green and Stokey (1983) contended that competitors' output was also dependent on a "common shock" in addition to effort and luck. In the context of a golf tournament, the "common shock" can be thought of as a competition effect, due to the rules of the game, weather, and course conditions. These components have an equal effect on all competitors, and as a result, competitors' output levels will shift up or down with the competition effect, while rank order will remain the same. Green and Stokey argued that as the number of competitors in a tournament grows larger, every competitor becomes more aware of the value of the "common shock" (the same way that a professor gains a greater knowledge of a test's difficulty as more students take it). This knowledge makes each competitor more aware of the proportion of their output that is attributable to effort, thus giving each competitor a better understanding of how changes in effort level lead to changes in output level, and ultimately compensation.

While these works focus on compensation structure within a theoretical firm, economists quickly noticed that the framework fit the structure of many sporting events, eventually leading to an influential empirical study of tournament theory and professional golf by Ehrenberg and Bognanno (1990a). Assuming a player's ability level is fixed, Ehrenberg and Bognanno hypothesized a linear relationship between score and effort level, which has a positive and increasing marginal cost, and that a golfer's total score will depend on the total prize money in the tournament, tournament specific factors, player specific factors, and opponent specific factors. Using data from the 1984 PGA Tour season they found that a $100,000 increase in total prize money led to a decrease of 1.1 strokes, on average, from each player's total score.

Ehrenberg and Bognanno (1990*b*) repeated their empirical test of tournament incentives and professional golfers using data from the 1987 European PGA Tour. They found even stronger evidence that total prize money is negatively correlated with total score, concluding that a £60,000 increase in total prize money (approximately $100,000 in 1987) led to a decrease of approximately three strokes, on average, from each player's total score.

Jonathon Orszag (1994) re-examined Ehrenberg and Bognanno's work on golf tournaments using data from the 1992 PGA Tour season. Using essentially the same empirical model, Orszag found that the tournament prize coefficient was not statistically different from zero. The conclusion that greater total purses had a statistically insignificant effect on golfers' scores was a major finding that contradicted both the findings of Ehrenberg and Bognanno and the general theory of tournaments.

Orszag then attempted to explain differences in results. He noticed that in Ehrenberg and Bognanno's 1984 data set, the weather variable was correlated with the tournament purse. Because total tournament prize money is determined prior to the start of a tournament, "there is no rational reason the weather variable should be correlated with the total prize," (Orszag 83). He then estimated the total score equation without the weather variable, assuming the variable to be orthogonal to other variables, in order to obtain unbiased estimates of the other independent variables. After this was done, the significance of Ehrenberg and Bognanno's (1990*a*) tournament prize coefficient dropped dramatically. He suggested that the weather term may have biased Ehrenberg and Bognanno's (1990*a*) results and concluded that the construction of the weather variable needed to be improved.

Orszag then hypothesized why the incentive effects of total tournament prizes no longer existed. He said that, between 1984 and 1992, the increasing popularity of golf led to large increases in total prize money and television audiences thereby leading to increases in the amount of pressure players face. He suggested that this increased pressure might cause players to 'choke' when they play, resulting in worse scores. Assuming this hypothesis is correct, he predicted that 'choking' might become even more prominent in future competitions as total prize money and television audiences continue to rise. Orszag also questioned Ehrenberg and Bognanno's prime assumption that increased concentration/effort leads to lower scores. He posed that, in golf, extra effort does not necessarily translate into lower scores and, speaking from his own personal experience, might lead to higher scores.

Because the previous empirical studies all use data sets compiled from the PGA Tour, they are all subject to the same criticism. As noted, Nalebuff and Stiglitz (1983) concluded that a tournament structure works best when the competitor's are of a similar ability. If other competitors' abilities are well known (as they certainly are on the PGA Tour) then differences in ability will reduce the incentive to expend effort. Poor players will know their probability of success is below average, leading to reduced effort, while stronger players will also reduce effort because their probability of success is above average. This scenario may be commonplace on the PGA Tour because exceptionally gifted players continue competing on the PGA Tour rather than moving to a higher level of competition.

Theoretically, the gap in ability between the best player to the worst player (be it the absolute worst player to play in a PGA Tour tournament or the player ranked number 125 on the money list, the last to retain his playing privileges) can be quite large. Because the PGA Tour has a rich history of truly dominant players (Jack Nicklaus, Greg Norman, Tiger Woods, etc.), it is a small logical extension to assume that not everyone is motivated to exert maximum effort because not everyone feels they have a reasonable chance to win.

This paper attempts to improve upon the aforementioned analyses by testing the basic prediction of tournament theory on 'minor league' golfers who are believed to be of more similar abilities.

Theory

Because of the rigorous sorting procedure involved in reaching the final stage of the PGA Tour Qualifying Tournament, we can be reasonably certain that all competitors

possess ability levels that are relatively equal and difficult to differentiate from one another. If a competitor had superior ability, he probably would not be forced into the Qualifying Tournament and would instead earn a position onto the PGA Tour through a different, relatively easier way (i.e. sponsor's exemptions, remaining in the top 125 money winners on the PGA Tour, etc.). Meanwhile, a competitor with inferior ability would have been sorted out during the first or second stage of competition by shooting a score too high to move into subsequent stages. The nature and purpose of the tournament ensures that all competitors at the final stage are there because their talent level is high and approximately equal.

Likewise, on the Nationwide Tour, players with superior ability should already be playing on the PGA Tour (the 'battlefield promotion' was instituted to identify these players). Meanwhile, players with inferior ability probably would not have qualified for status on the Nationwide Tour and would instead be playing on an even less prestigious professional tour (i.e. the Hooter's Tour, the Dakota Tour, etc.).

Within the final stage of the PGA Tour Qualifying Tournament or a Nationwide Tour tournament, there are a large number of competitors, each with a similar ability level, attempting to win. In doing so, a 'minor league' golfer faces the general problem of minimizing his score. On the Nationwide Tour, shooting the lowest possible score maximizes income, which is the pathway to the PGA Tour, while at the PGA Tour Qualifying Tournament, shooting a low score is the pathway.

However, because golfers' abilities are fixed for each particular tournament, minimizing scores must come from increasing their effort levels. In golf, this effort takes the form of increasing concentration. As a tournament proceeds over the course of four

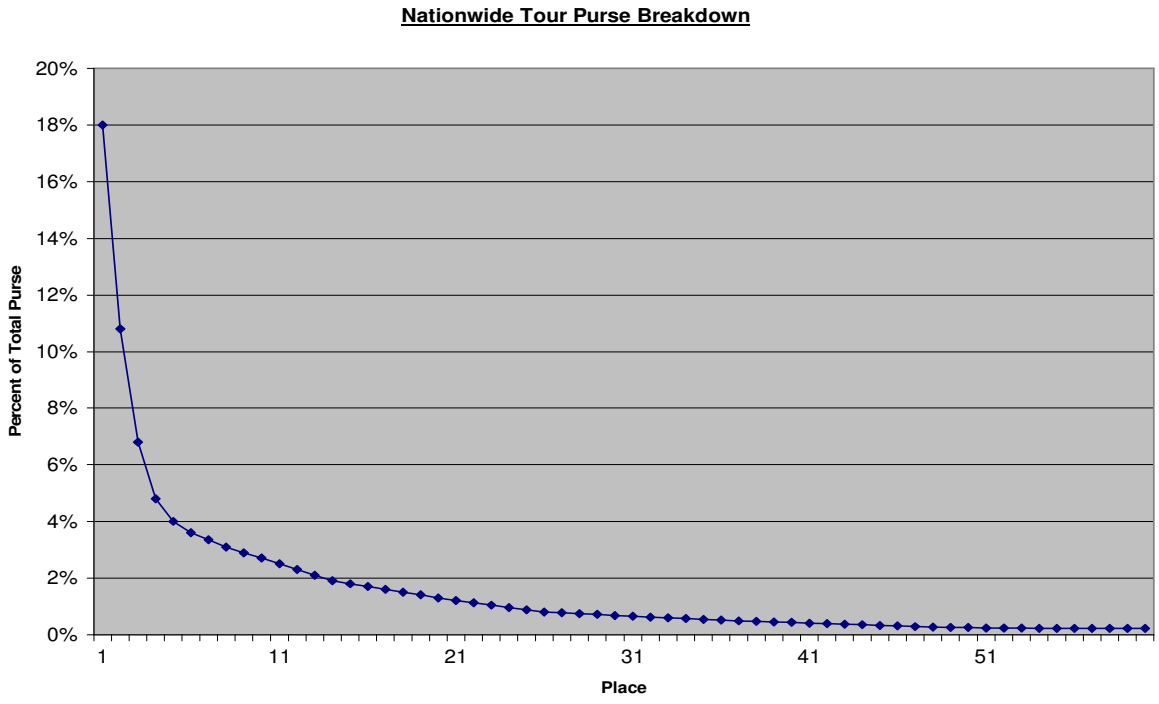
(or especially six) rounds, the physical and mental strain on a competitor makes it increasingly difficult to maintain a high level of concentration. Because of this challenge, golfers must feel that they are adequately compensated to increase their effort and take on this physical and mental strain. Simply put, a player will increase his effort when the marginal returns to effort outweigh the additional cost of increased concentration, and decrease his effort when the additional costs outweigh the marginal benefits of increased effort.

In deciding the level of effort to expend, a golfer, regardless of rank in a tournament, should take into account the marginal gain or loss from altering his score. As the PGA Tour Qualifying Tournament rewards those finishing in the top 30 of the tournament, there is a very large marginal gain from improving from 31st place to 30th place and a very large marginal loss from moving from 30th place to 31st place. In addition, competitors also face marginal gains and losses between every other rank. However, the expected gains from improving one rank (or losses from falling one rank) decrease the further a competitor is away from 30th place. For example, the marginal gain from improving from 32nd to 31st is greater than the marginal gain from improving from 33rd to 32nd, and so on. Likewise, the marginal gain from improving from 30th to 29th is greater than the marginal gain from improving from 29th to 28th, and so on. As a result, a competitor's marginal return to effort takes on the look of a positively skewed frequency distribution, centered on 30th place. Thus, any change in the level of total PGA Tour prize money leads to a proportional increase in expected return between every rank.

Similarly, every Nationwide Tour tournament employs a prize structure where each rank corresponds with a percentage of the total purse, as shown in **Figure 1**. This means that increases in total prize money leads to proportionate increases in prize differentials between every rank. Therefore, one is able to look at the final tournament results to see if higher total prizes lead to lower scores on the Nationwide Tour.

Applying the theory of tournaments to 'minor league' golfers, it is expected that as a tournament prize level goes up, each player's potential earnings go up, leading to increased efforts among participants, which is realized in lower total scores. In the case of the Nationwide Tour, these prizes are represented by current prizes, and in the case of the PGA Tour Qualifying Tournament, these prizes are represented as the expectation of future prizes upon winning a tour card.

Figure 1



Data

Two data sets were gathered in order to test the hypothesis that higher prize levels lead to lower scores at the PGA Tour Qualifying Tournament and on the Nationwide Tour. The PGA Tour Qualifying Tournament data include the top 30 finishers from each final stage tournament from 1982 to 2006, except the 1996 final stage which has been excluded from the sample because it was significantly shortened by weather. The pooled data set for the PGA Tour Qualifying Tournament then consists of 720 player-tournament scores. The Nationwide Tour data includes the top 60 money earners from each tournament during the 2006 Nationwide Tour season. The pooled data set for the Nationwide Tour then consists of 1680 player-tournament scores. All of the data is available in the public domain, and it is assumed that all players are properly accounted for and all statistics are correct.

The PGA Tour Qualifying Tournament data from 1982 to 2000 was collected from the appendix of Q School Confidential (Gould, 2002). For the years 2001 to 2006 the data comes from golfweek.com. For each of these years, the data set includes the name of each finisher and their six-round total score, as well as the name of the course(s) used in the tournament.

The PGA Tour's monetary data was collected from www.pgatour.com. It includes the cumulative dollar amount of PGA Tour prize money for each year from 1982 to 2006, and the total amount of money won by the leading PGA Tour money leader each year from 1982 to 2006. These amounts were then converted to 2006 dollars using the Bureau of Labor Statistics yearly CPI indexes in the formula:

$$Converted\ CPI_x = Original\ CPI_x / Original\ CPI_{2006}$$

Notably, this data set is not without limitations. The shortcomings are summarized by Gould (ix), "Unlike professional golf's regular schedule of tournaments, the qualifying events have been sparsely documented. The records that do exist are not so easily accessible, even to experienced staff people at the PGA of America and the PGA Tour." Only recently, corresponding to the growing popularity of golf, have better statistics begun to be more readily available. Therefore, there are a few variables excluded from the data set. While the name of the tournament course has been identified, its par, yardage, and course rating (the PGA's measure for the difficulty of the course) at the time of competition have not. Due to the high probability that these parameters have changed over the years, each course's present day values will not be used. Further, the prize money available to high finishers in the PGA Tour Qualifying Tournament is also sparsely documented. Again, any years where this is available has been disregarded for the sake of consistency.

The Nationwide Tour tournament data was collected from www.pgatour.com and from www.golfweek.com. For each tournament the data set includes the name and four-round score of the top 60 players to earn money in the tournament, the total prize money offered in the tournament, the par of each tournament course, and the yardage of each tournament course. Again the tournament course's rating was widely unavailable. Therefore, par and yardage will serve as the only proxies for the tournament course's difficulty.

Three 2006 Nationwide Tour events have been omitted from the data set. The Nationwide Tour Championship was omitted because it is an invitation only tournament and not every competitor who wanted to compete was allowed to, while the Jacob's

Creek Open and ING New Zealand PGA Championship were omitted because they are tournaments co-sponsored by the Australasian Tour and thus contained competitors from both that tour and the Nationwide Tour. The remaining 28 tournaments from the 2006 Nationwide Tour have been included in this data set.

From these collected data sets, two regression models will be estimated to determine the incentive effects of tournaments on 'minor league' golfers.

The Models:

The analysis of 'minor league' golfers' effort levels will be based on the two-contestant tournament models previously employed in the empirical work of Ehrennberg and Bognanno (1990*a* & *b*) and Orszag (1994). The models are contingent on scores reflecting a golfer's selection of his effort level while facing the increasing physical and mental strain over the course of a multi-day tournament. Because abilities are assumed equal, a golfer's score is therefore dependent on the prize differential for winning and tournament specific factors.

The PGA Tour Qualifying Tournament model will take the form:

$$(1) \quad S_{ki} = \beta_o + \beta_1 TOTAL_i + \sum_t \lambda_t D_t + \sum_j \theta_j D_j + \nu_{ki}$$

where $\mathbf{S}_{ki}$ is the score of player k at the final stage of the PGA Tour's Qualifying Tournament in year i, TOTAL is the total prize money of all PGA Tour tournaments in year i and $\mathbf{v}_{ki}$ is a standard error term.

Over the years, golf, as well as other sports, have made use of improved technology, improved nutrition, and improved coaching, leading to expected changes in performances (Chatterjee, et al. 2002). Therefore, the dummy variable $\mathbf{D}_t$ breaks the 25 year time period into five year increments, serving as a control against the changing state

of the game. The time periods for the construction of this dummy variable are as follows: 1982-1986, 1987-1991, 1992-1995 (due to the omission of 1996 data), 1997-2001, and 2002-2006.

Because course difficulty data is widely unavailable, this paper employs a dummy variable $\mathbf{D}_j$ controlling for the repeat use of certain tournament courses. While the PGA Tour Qualifying Tournament rotates the site of the final stage competition, very often courses have been re-used over the time period. As shown in Table 1, three tournament courses have been used four or more times, while no other course has been used more than twice. The dummy variables were thus constructed using PGA West and La Quinta GC, Grenelefe G&TR, PGA West Nicklaus, and All Others as the categories. To avoid the dummy variable trap of perfect multicollinearity in the use of both dummy variables, the time period 1982 – 1986 and the category All Others were omitted from the regression equation.

Table 1. PGA Tour Qualifying Tournament Courses

Course Name(s)	*Year(s)*
TPC at Sawgrass and Sawgrass CC	1982
TPC at Sawgrass	1983
Mission Hills CC and La Quinta GC	1984
Grenelefe G&TR (West & South)	1985, 1991, 1994, 1997
PGA West and La Quinta GC	1986, 1988, 1990, 1993, 1998
Matanzas Woods GC and Pine Lakes GC	1987
TPC at the Woodlands and Woodlands CC	1989, 1992
Bear Lakes CC	1995, 2001
Doral Resort and Spa	1999
PGA West Nicklaus	2000, 2002, 2004, 2006
Orange County National and Crooked Cat	2003, 2005

In the analysis of the 2006 Nationwide Tour season, the data will be restricted to those players who passed the cut (top 60) for each tournament because in many cases that is all the information that is available. The final-score equation is estimated in the form:

(2) $$\mathbf{S}_{ki} = \beta_0 + \beta_1 \text{TOTAL}_i + \beta_2 \text{PAR}_i + \beta_3 \text{YARDS}_i + \beta_4 D_{\text{Middle}} + \beta_5 D_{\text{End}} + \nu_{ki}$$

where $\mathbf{S}_{ji}$ is the final four-round score of player k in tournament i, TOTAL_i is the total prize money available in Nationwide Tour tournament i, PAR_i is the tournament course's par, YARDS_i is the length of the tournament course, and ν_{ij} is a standard error term.

Because the Nationwide Tour rewards the top 20 finishers on the year-end money list with a spot on the PGA Tour, it can be reasonably assumed that as the end of the season draws closer, the tournaments become increasingly important for players attempting to finish there. Therefore, these tournaments may elicit high effort levels regardless of prize money. The dummy variables D_{Middle} and D_{End} are constructed to control for this logical occurrence. A variable for the beginning of the season was omitted to avoid perfect multicollinearity in this case.

It might be reasonably assumed that weather would play an important part in the final score of a golfer. Because golf is played outdoors, tournament organizers are unable to control the various temperatures, wind speeds, and precipitation levels facing the players. However, a myriad of problems arise in understanding weather's effect upon player's scores and assigning an objective rank to it. First, with up to 156 players teeing off on the first two days of competition, the Nationwide Tour breaks the total field into two equal 'waves'. On the first day of competition, the first half of the field tees off in the morning, while the second half tees off in the afternoon. On the second day of competition, the two groups switch. Further, on the final two days of competition, after

the field is cut to the low 70 and ties, players tee off in sequential order starting with the players with the highest (worst) scores. Therefore, simply looking up the weather on a particular day provides useless information unless coupled with each player's tee time on each day. This tee time information is unavailable and may not even be recorded by tournament officials. This concern was raised by Orszag (1994) in his critique of Ehrenberg and Bognanno's (1990*a*) weather variable.

Second, difficulties arise in deciding how 'adverse' weather really is. A simple example best describes this problem. Assume that the first day of a tournament is played in a steady rainfall, which causes players to shoot worse scores than normal. It is possible that this rainfall affects the course for the remainder of the tournament, causing players to shoot scores higher than normal on the following days, even in the absence of 'adverse' weather. Because Ehrenberg and Bognanno (1990*a* & *b*) determined the effects of the weather on a round to round basis, there is no proxy for how the previous day's weather affected subsequent days. In fact, it is possible that 'adverse' weather occurred in the days prior to the tournament, leading Ehrenberg and Bognanno to conclude weather did not affect play at any time during the tournament.

Based upon these reasons, a variable controlling for weather has been omitted from both regression equations. It is assumed that, despite the possibility that weather affects a player's score, its effect is sufficiently small as to not disrupt the regression results.

Results

For both models, the significance of the regression coefficients will be determined at the 1% level. The regression results are presented in **Table 2.**

Table 2. Results from Two Regression Methods

PGA Tour Qualifying Tournament			**Nationwide Tour**		
Variable	***Coefficient***	***|T|-Stat***	***Variable***	***Coefficient***	***|T|-Stat***
Constant	438.439	746.4	Constant	72.981	4.5
TOTAL (Millions)	-0.154	15.0	TOTAL (Thousands)	0.024	11.1
D87-91	-0.603	1.0	PAR	2.480	9.8
D92-95	-3.831	5.5	YARDS	0.003	3.1
D97-01	-1.728	1.4	D(Middle)	-5.046	13.1
D02-06	17.503	8.6	D(End)	-1.851	5.2
D(Grenelefe)	-3.535	6.8			
D(PGAW/LQ)	-3.735	7.9			
D(PGAWEST)	1.210	2.0			
R-Square	0.705		R-Square	0.168	
F-Stat	212.108		F-Stat	67.731	
# of Observations	720		# of Observations	1680	

For the PGA Tour Qualifying Tournament results, the coefficient on TOTAL is significant, supporting the predictions of tournament theory. The variable is measured in millions of 2006 dollars, therefore it is concluded that increasing the total prize money available on the PGA Tour by $1,000,000 in 2006 dollars leads to players' scores decreasing (or improving), on average, by 0.154 shots.

The coefficients on the dummy variable splitting the time period into five year segments are only significant for the years 1992 to 1995, and 2002 to 2006 and show that players' scores, on average, decrease by 3.83 shots and increase by 17.5 shots, respectively, when the tournament was played in those years.

The coefficients for the frequently used courses dummy variable are only significant with respect to Grenelefe Golf and Tennis Club and PGA West / La Quinta

Country Club and players' scores, on average, decrease by 3.5 and 3.7 shots, respectively, when the tournament was played on those courses.

Interpreting these dummy variables results requires understanding how they fit together. During the four-year period 1992 to 1995, the tournament was played once at Grenelefe G&TC and once at PGA West / La Quinta CC. It seems reasonable, based on the coefficients obtained, to argue that these courses are of a lower difficulty than other courses. Consequently, we can conclude that the use of these courses in half of the tournaments between 1992 and 1995 is at least partially responsible for the periods lower scoring.

The result of the five year period between 2002 and 2006 increasing scores by 17.5 shots is more difficult to understand. Using the logic of the previous paragraph it may be argued that the courses used during this period were more difficult. The dummy variable for PGA West Nicklaus (a course that was used three times during the period (2002, 2004, 2006)) yields a result that appears to support this argument. However, the coefficient on PGA West Nicklaus is not statistically significant, meaning it cannot be concluded that the course's effect on scores is not zero. One logical conclusion is that the courses used in 2003 and 2005 are also of a high difficulty, leading to the period's high scoring. Another possibility is that institutional rules changes that increase the number of sponsor's exemptions that can be extended to each non-PGA Tour member has allowed many of the more talented players to avoid the Qualifying Tournament. This increase gives players more opportunities to earn enough money to finish within the top 125 on the money list thereby securing a tour card for the following season.

Turning to the Nationwide Tour results, it is shown that the coefficients on PAR and YARDS are both positive and statistically significant. Increasing par by one shot leads to an increase of 2.48 shots, on average, for each players score. This may seem a very considerable increase but it must be remembered that the increase is seen over four rounds. Increasing par by one shot equates to increasing four-round par by four shots, but players only shoot, on average, 2.48 shots higher. Therefore, increasing par by one leads to a 0.62 shot increase *per round*. Increasing the length of the tournament course by 100 yards leads to an increase of 0.3 shots, on average, for each player's score. These two measures show that, as expected, more difficult courses lead to higher scores.

The coefficients of the dummy variables are both negative and significant. Tournaments played in the middle of the season lead to a decrease in players' scores by 5.05 shots, on average while tournaments played at the end of the season lead to a decrease in players' score by 1.85 shots, on average. These results would seem to follow the predictions of tournament theory and the assumptions of the Nationwide Tour. Table 3 shows the average purse size and average player's score for the beginning, middle, and end of the season.

Table 3. Differences in Purse Sizes in Different Seasons on the Nationwide Tour

	Average Purse	Average Scores
Beginning of Season	$513,889	282.037
Middle of Season	$565,667	278.487
End of Season	$512,500	280.758

It can be seen that the tournaments in the middle of the season are disproportionately weighted with large-prize tournaments and thus yield the lowest scores. The beginning and end of the season feature purses of approximately equal average sizes, yet the end of the season yields lower scores, supporting the prediction that

tournaments at the end of the season will elicit disproportional effort. This result is likely because of the increased importance of end-of-year tournaments on a player maintaining his Nationwide Tour membership or obtaining his PGA Tour membership.

However, the coefficient of TOTAL is both positive and significant. The variable is measured in thousands of dollars; therefore increasing the prize money by $100,000 is linked with each player, on average, scoring 2.4 shots *higher* during a tournament. This finding suggests a direct contradiction to the theory of tournament pay structures.

Interpreting the Difference

As shown above, the results from the PGA Tour Qualifying Tournament analysis support the predictions of tournament theory, while the Nationwide Tour analysis seems to indicate otherwise. There are three possible reasons for this result.

First, because the Nationwide Tour is owned and operated by the PGA Tour, movement between the two tours has become fairly commonplace. Because PGA Tour tournaments are the most recognized in the world, they draw the strongest players and are thus the most difficult for potential competitors to enter. PGA Tour tournaments are subsequently subject to a sorting bias. The strongest players enter the most prestigious (i.e. richest) tournaments while avoiding the least prestigious tournaments. In addition, professional golfers from the European PGA Tour are routinely allowed to enter the most prestigious of PGA Tour tournaments based upon a complicated system of world rankings. This institutional complication often leaves many low-level PGA Tour members without a spot in these tournaments. As a result, the low-level PGA Tour members' only option is to enter the Nationwide Tour event contested during that week.

Consequently, the ability levels of competitors during some Nationwide Tour tournaments may be less homogenous than the ability levels of competitors at the PGA Tour Qualifying Tournament. As noted above, heterogeneity of abilities leads to lower effort amongst every competitor because the tournament outcome is less in doubt. It is possible that this heterogeneity of abilities in certain Nationwide Tour tournaments biases the incentive effects of the tournament prizes. If the prestigious tournaments on the PGA Tour correspond with the richest tournaments on the Nationwide Tour, then this bias may produce the conflicting result reached in this study. A quick check of this reveals a very weak negative relationship between PGA Tour prize level and Nationwide Tour prize level. That is, the richer PGA Tour tournaments correspond with slightly smaller prizes in concurrent Nationwide Tour tournaments. As such, the heterogeneity explanation is not supported by the data in this case and therefore remains theoretical in nature. A thorough examination of the effects on scoring resulting from players moving between the two tours is beyond the scope of this paper.

Second, the relatively small size of the Nationwide Tour tournament prize compared with the PGA Tour Qualifying Tournament prize may account for the differing results. Because the Nationwide Tour is a 'minor league' tour to the PGA Tour, it follows that Nationwide Tour prizes are significantly smaller than PGA Tour prizes. Indeed, Nationwide Tour purses are approximately one tenth the size of PGA Tour purses. As PGA Tour Qualifying Tournament competitors are competing for the opportunity to play for and win PGA Tour money, it follows that they are competing for much larger prizes than the competitors on the Nationwide Tour. Under this condition, the contradictory result may be attributed to a threshold value that must be crossed before

'minor league' golfers respond to changes in tournament prizes. Possibly, the variation in purse size between Nationwide Tour tournaments, or the value of the Nationwide Tour purses themselves, are simply too small to elicit changes in effort among competitors. Thus, competitors' effort remains constant from one tournament to the next because they fail to recognize a financial incentive to alter their effort level. This study of the incentive effects of Nationwide Tour tournaments may simply have exposed a year where competitors happened to score higher during richer tournaments.

Third, and most importantly, this paper essentially tested the incentive effects of current tournament prizes and future earnings separately. The analysis of the PGA Tour Qualifying Tournament tested how 'minor league' golfers responded to changes in possible future income (without a control for current tournament prize), while the analysis of the Nationwide Tour tested how 'minor league' golfers responded to changing current tournament prize levels (without a control for future earnings). The results show that competitors in the PGA Tour Qualifying School responded to increasing perceived future earnings by shooting lower scores, while Nationwide Tour competitors did not respond to increasing current tournament prizes by shooting lower scores.

Taking these results together, it follows that 'minor league' golfers are less responsive to the current tournament purses because players are concerned with being promoted to the PGA Tour and not necessarily earning an 'instant' income. Therefore, it is probable that Nationwide Tour golfers are indeed responding to tournament incentives in a manner consistent with tournament theory. However, they are responding to an unseen change in their perceived future earnings rather than a change in the current tournament prize. It could therefore be argued that 'minor league' golfers place a great

deal of importance the value of perceived future earnings, while widely ignoring current tournament prizes.

Conclusion

This paper has used two original data sets that add to the ever growing number of tests on theory of tournaments. It has provided evidence that 'minor league' golfers respond strongly to an increase in perceived future earnings. The analysis of the PGA Tour Qualifying Tournament from 1982 to 2006 suggests that increasing prize money on the PGA Tour leads to lower (better) golf scores, while the analysis of the 2006 Nationwide Tour season suggests increasing current prize money does not lead to lower scores. This study of aspiring golf professionals and the incentive effect of tournaments is only a beginning empirical analysis. It is a logical extension from the current literature on golf into a data set that better fits the theory.

While the study of golf tournament incentives is by itself interesting, the real value of this paper lies in its implications for other labor markets. Employers typically use tournaments in an attempt to elicit higher effort among employees, meaning employees are competing for bonuses, and more importantly, raises and promotions. Previous sports analyses have almost exclusively used sports at the highest professional level, thereby eliminating the possibility of, or need for, promotion. Because of this, it is somewhat unclear how much performance is due to tournament incentive effects and how much is due to an athlete selecting to compete in the tournaments with the greatest probability for success. As shown by James G. Lynch and Jefferey S. Zax (2000), professional road racers with a high level of ability usually only enter races with a high purse, while low ability racers are more likely to skip those races. It is highly unlikely

that employees in the 'real world' have the opportunity to pick and choose the tournaments in which they compete, while, as was argued above, 'minor league' golfers should not want to. It follows that, in tournament systems, 'minor league' golfers more closely mirror the situation of most 'real world' employees.

This finding could be useful for employers looking to improve the effort level of their employees. These findings suggest that employees' respond more when a reward structure increases perceived future earnings. This may imply that offering raises or promotions to higher paying positions results in more efficient effort among employees than bonuses or other one-time rewards.

Naturally, there are limitations of this paper that deserve consideration. First, in both the Nationwide Tour data and the PGA Tour Qualifying Tournament data, the tournament prize structure was identical across every tournament. That is, the percentage of the total prize that is allocated to each individual rank was the same for each tournament. Therefore, an increase in the total tournament prize always increased the size of the prize differential between each rank. It is therefore unknown whether the results of this study were the result of higher prize levels or greater prize differentials between ranks.

This paper uses a sports tournament to analyze a compensation structure that can be used outside of sports. Critics argue that a sporting event is not an "important business situation," (Charles R. Knoeber and Walter N. Thurman 1994) and is thus less applicable to studying the 'real' world. Indeed, the use of sports data presents a paradox in interpreting the incentive effects of tournaments (Brian E. Becker and Mark A. Huselid 1992). Tournament theory suggests that tournament structures will be used when output

is difficult to observe or measure and should therefore elicit effort in competitors that have no knowledge of how their opponents are doing. However, testing incentive effects with sports data uses an observable, objective measure of output that allows all competitors to constantly monitor the performance of their opponents. Therefore, performances in sporting events due to prize incentives may be confused with player responses to their opponents' performances.

Finally, concepts of strategies (risky or conservative play) have not been included here. This paper's data set was limited to round totals therefore problems arise in assigning an objective measure to risky behavior because players choose and alter strategies from shot to shot, based upon continually updated information. Consequently, the data set was partially chosen to minimize the existence of risk. Players at the PGA Tour Qualifying Tournament and on Nationwide Tour should have similar abilities thereby eliminating the employment of different strategies based upon the possibility that a more talented player could 'pull it off'. The rewards of finishing high at the PGA Tour Qualifying Tournament or on the Nationwide Tour should force all players to shoot the best scores they possibly can, which necessitates playing risky at times and conservative at times. Because of similar abilities, the predicaments that lead to risky or conservative choices should manifest themselves equally among all players throughout a tournament. That is, in every situation, every player should make approximately the same choice. However, competitors might have differing perceptions as to their ability levels. If this is the case, some players would make risky decisions based on their perceived higher ability level, while others would make conservative decisions based on their perceived lower

ability level. Therefore, an analysis that includes a proxy for strategy would certainly add to the empirical literature.

Economists have already made great strides in identifying and empirically testing different tournament structures, and a continuation of this research will only enrich the understanding of tournament compensation incentive effects. However, much of this research has centered on the incentive effects of current tournament prizes while largely ignoring the incentive effects of perceived future earnings. This study has provided evidence that 'minor league' golfers respond to an increase in their perceived future earnings and act seemingly indifferent to changes in current tournament prizes. If golf tournaments continue to be the sport of choice in the study of tournament theory, then the primary goal of researchers should be to separate the current and future prize incentives within the same group of players. Only by studying the difference between current and future prizes can academics and practitioners truly understanding what motivates tournament competitors.

REFERENCES

Becker, Brian E. and Huselid, Mark A. "The Incentive Effects of Tournament Compensation Systems." *Administrative Science Quarterly,* Special Issue June 1992, *37*(2), pp. 336-350.

Bognanno, Michael L. "Corporate Tournaments." *Journal of Labor Economics,* April 2001, *19*(2), pp. 290-315.

Chatterjee, Sangit, Wiseman, Frederick, and Perez, Robert. "Studying Improved Performance in Golf." *Journal of Applied Statistics*, November 2002, *29*(8), pp. 1219-27.

Ehrenberg, Ronald G. and Bognanno, Michael L. "Do Tournaments Have Incentive Effects?" *Journal of Political Economy*, December 1990, *98*(6), pp. 1307-24.

Ehrenberg, Ronald G. and Bognanno, Michael L. "The Incentive Effects of Tournaments Revisited: Evidence from the European PGA Tour." *Industrial and Labor Relations Review,* Special Issue February 1990, *43*(3), pp. S74-88.

Erikkson, Tor. "Executive Compensation and Tournament Theory: Empirical Tests on Danish Data." *Journal of Labor Economics,* April 1999, *17*(2), pp. 262-280.

Fernie, Sue and Metcalf, David. "It's Not What You Pay It's the Way You Pay It and That's What Gets Results: Jockeys' Pay and Performance." *Labour,* June 1999, *13*(2), pp. 385-411.

Gould, David. *Q school confidential*. New York: St. Martin's Press, 2002.

Green, Jerry R. and Stokey, Nancy L. "A Comparison of Tournaments and Contracts." *Journal of Political Economy,* June 1983, *91*(3), pp. 349-364.

Knoeber, Charles R. and Thurman, Walter N. "Testing the Theory of Tournaments: An Empirical Analysis of Broiler Production." *Journal of Labor Economics,* 1994, *12*(2), pp. 155-179.

Lazear, Edward P. and Rosen, Sherwin. "Rank-Order Tournaments as Optimum Labor Contracts." *Journal of Political Economy,* October 1981, *89*(5), pp. 841-864.

Lazear, Edward P. *Personnel Economics for Managers*. New York: John Wiley & Sons, Inc., 1998.

Lynch, James G. "The Effort Effects of Prizes in the Second Half of Tournaments." *Journal of Economic Behavior & Organization,* 2005, *57*(1), pp. 115-129.

Lynch, James G. and Zax, Jeffery S. "The Rewards to Running: Prize Structure and Performance in Professional Road Racing." *Journal of Sports Economics,* November 2000, *1*(4), pp. 323-340.

Maloney, Michael T. and McCormick, Robert E. "The Response of Workers to Wages in Tournaments: Evidence from Foot Races." *Journal of Sports Economics,* May 2000, *1*(2), pp. 99-123.

Nalebuff, Barry J. and Stiglitz, Joseph E. "Prizes and Incentives: Towards a General Theory of Compensation and Competition." *Bell Journal of Economics,* Spring 1983, *14*(1), pp. 21-43.

Orszag, Jonathan M. "A New Look at Incentive Effects and Golf Tournaments." *Economics Letters*, September 1994, *46*(1), pp. 77-88.