A Measure of Competitive Imbalance for the PGA TOUR

Thomas A. Rhoads*
Department of Economics
Towson University
8000 York Road
Towson, MD 21252
Phone: 410.704.2187
Fax: 410.704.3424
Email: trhoads@towson.edu

June 30, 2005

Abstract

Competitive imbalance could be a key consideration in the decision-making process for planners of individual sports leagues like the PGA TOUR. The normalized Herfindahl-Hirschman Index and the four-player and eight-player concentration ratios of annual wins provide a measure of competitive imbalance for the PGA TOUR. Fewer winners and more concentration of wins indicate more competitive imbalance. The all-exempt tour enhanced balance while the implementation of the World Golf Championships lead to a higher level of imbalance. More competitive imbalance appears to lead to increased fan preference and suggests that individual and team sports leagues may need to be modeled differently. (JEL D71, D78, L83)

* I wish to thank Matt Chambers, Craig Depken, J.J. Lee, Kangoh Lee, Steve Shmanske, seminar participants at the University of Delaware and at the 2004 meetings of the Western Economic Association in Vancouver, BC for valuable comments and suggestions. All errors are mine alone.
1. Introduction

Traditionally, sports economists have held to the basic tenet that more competitive balance in sports leagues leads to greater fan demand. But this view has centered on team sports leagues and as Szymanski (2003) notes, individual sports leagues, like the PGA TOUR, are quite distinct from team sports leagues. So even as one of the stated goals of the PGA TOUR is to provide competitive opportunities for their member players (2004 PGA TOUR Media Guide), Cottle (1981) suggests that the PGA TOUR acts more like a cartel that agrees only to provide talent in golf tournaments. This may actually enhance competitive imbalance.

It is quite possible that more talent, and subsequently more imbalance, will actually enhance fan demand in individual sports leagues like the PGA TOUR. Since fans want to see top talent, and top talent only comes from consistently winning contests in individual sports leagues, imbalance is preferred. This hypothesis runs counter to the standard argument that too much imbalance may be detrimental to demand (see, for example, Lee and Fort, 2005) but is feasible given that fans seem to prefer more inequality in individual sports than in team sports generally (Sanderson and Siegfried 2003). Thus, competitive imbalance on the PGA TOUR could help draw attention to some fundamental differences between individual and team sports leagues that are still left largely unexplored by economists.

Achieving an optimal level of competitive imbalance must be a key consideration in the decision-making process for planners of individual sports leagues like the PGA TOUR. Because the unique nature of the PGA TOUR allows member golfers to have a large measure of discretion in the number of tournaments they enter in a given year (see
Rhoads, 2005), these decisions are expected to ultimately have an impact on the level of
talent present in any given tournament and on competitive imbalance on the PGA TOUR.
Thus, the goal of this paper is to measure competitive imbalance on the PGA TOUR
before estimating the impact of competitive imbalance on consumer demand for the PGA
TOUR.

Competitive balance for team sports leagues is often measured by comparing
teams’ actual winning percentages to an ideal distribution. For a variety of reasons—
individual competition against a field of players on a variety of different courses that
reward or punish different aspects of the game and thus alter a players’ chances of
winning—there is not an easy corollary for measuring competitive imbalance in
professional golf. Since almost all official PGA TOUR tournaments occur at non-
overlapping times, one player can theoretically win almost every PGA TOUR tournament
and thus capture a large “market share” of wins and money earnings. This feature is not
present in team sports leagues but can yield unique insights into the structure of
competitive imbalance on the PGA TOUR. Therefore, I develop a measure of the market
structure of wins on the PGA TOUR that captures the essence of competitive imbalance
on the PGA TOUR—the concentration of champions among PGA TOUR players.

The normalized Herfindahl-Hirschman Index (dHHI) (Depken, 1999) and the
four-player (CR4) and eight-player (CR8) concentration ratio for annual wins are
calculated and serve as mechanisms to measure competitive imbalance. More winners
and less concentration of wins would indicate higher degrees of competitive balance

---

1 Multiple official PGA TOUR tournaments are played in the same week occasionally (i.e., the British
Open and the B.C. Open in mid-July), making it theoretically impossible for one player to win every
tournament in one year. Note, however, that the percentage of total available tournaments one player can
theoretically win on TOUR far exceeds the percentage of total games in a team sports league such as Major
League Baseball that one team can win.
while fewer winners and a greater concentration of wins will indicate imbalance. Because changes in the level of competitive imbalance should affect consumer demand, a measure of competitive imbalance for the PGA TOUR that is sensitive to policy changes should therefore allow an examination of the impact these policy changes ultimately have on total prize money since the total amount of prize money available is a function of consumer demand. The explanatory power of these competitive imbalance measures is found in the sensitivity of the total amount of prize money to competitive imbalance.

I calculate competitive imbalance for the PGA TOUR for each of the years from 1970 to 2004. Then I test the impact that two specific policy changes have exerted on the level of competitive imbalance to be sure that dHHI, CR4, and CR8 are indeed sensitive to these policy changes. The two policy changes to be assessed are the move to the all-exempt tour and the introduction of the World Golf Championships. A brief description of each policy change follows. In 1983 the PGA TOUR began an all-exempt tour, making the top 125 money winners from the previous year fully exempt to play in any PGA TOUR tournament the following year. This largely eliminated Monday qualifying and gave many more players in the already deep pool of talent on the PGA TOUR the chance to be competitive in tournament play.\(^2\) Then in 1999 the PGA TOUR teamed up with other professional golf tours throughout the world to start the World Golf Championships. The tournaments in this series now number four, with each tournament offering some of the largest purses in professional golf and some of the strongest fields to be found anywhere apart from major championships. While the World Golf

\(^2\) Prior to 1983, only the top 60 money winners from the previous year were exempt to play in any PGA TOUR event. In this setting, Monday qualifiers often were quite drained from attempting to qualify on the Monday before a PGA TOUR event and were not as rested and sharp with their game when the actual event started on the following Thursday.
Championships were formed to “enhance the competitive structure of professional golf worldwide,” it really gives a chance for the PGA TOUR and other world tours to showcase the top talent. The results of the analysis show that the impact these two policy changes have on competitive imbalance is significant.

Finally, consumer preference for competitive imbalance on the PGA TOUR is estimated by analyzing the relationship between competitive imbalance and the total annual prize money available. Total annual prize money is expected to be a proxy of consumer behavior—higher available prize money should result from increased consumer preference. The results show that fans seem to demand more imbalance on the PGA TOUR which may help explain some of the recent policy moves enacted by the PGA TOUR.

The rest of the paper is organized as follows. Section 2 points out the need for developing a measure of competitive imbalance for individual sports leagues such as the PGA TOUR. A rationale for measuring competitive imbalance with the normalized Herfindahl-Hirschman Index and the four-player and eight-player concentration ratio for annual wins is provided in Section 3 and sensitivity of this measure to PGA TOUR policy changes is examined. Section 4 includes an assessment of how competitive imbalance affects total prize money to determine competitive imbalance’s impact on fan preference. Section 5 concludes.

2. Competitive Imbalance and the PGA TOUR

Measuring competitive balance in sports leagues has become a popular activity among sports economists. Zimbalist (2002) notes no less than seven different frequently
used measures of competitive balance, ranging from computing the standard deviation of win percentages to the gini coefficient of win percentages. The focus has been exclusively on team sports leagues, with professional baseball attracting the most attention, likely due to the availability of data and the number of policy changes that have occurred over time. With all of these available measures, determining the best measure of competitive balance is thus reduced to an exercise in evaluating the sensitivity of consumer (fan) preference to these various measures (Zimbalist 2002). Humphreys (2002) does that by introducing a measure of competitive balance for professional baseball capable of explaining the variation in attendance due to changes in competitive balance.

But, competitive imbalance (or balance) is no less important an issue for individual sports leagues since generating an optimal level of competitive imbalance should be expected to lead to optimal fan interest, and therefore higher attendance and larger league revenues. Another way of expressing this is that individual sports leagues are mainly concerned with supplying that highest level of talent available. However, no empirical studies have examined this feature of individual sports leagues—until now, speculation and anecdotes are all that suggest that fans demand to see top talent, or more imbalance.

Because the total purse available and the non-linear structure of the prizes in PGA TOUR events influence performance (Ehrenberg and Bognanno 1990a, 1990b) and cause substantial inequalities in earnings among PGA TOUR members (Scully, 2002) some players, like Tiger Woods, earn millions on and off the course and because of this are
widely recognized outside PGA TOUR venues.\textsuperscript{3} Events in which the “Big Five” compete (and win) generally attract the most media attention and the largest crowds.\textsuperscript{4} Thus, it is not clear that generally higher levels of competitive balance on the PGA TOUR will translate into higher levels of fan interest as is often the case in team sports leagues (see Lee and Fort 2005, Humphreys 2002, etc).

Unique PGA TOUR rules additionally suggest that top talent, and subsequently imbalance, is what attracts the largest crowds, and thus generates the largest revenues. The PGA TOUR mandates that all players, including top talent, enter at least 15 events each year. By further providing more lucrative purses in top World Golf Championship events, top talent will play more often and will be expected to win more often. This structure is expected to lead to an increase in competitive imbalance. Thus, mechanisms impacting players’ annual entry decisions are expected to additionally impact competitive imbalance on the PGA TOUR (Rhoads 2005).

3. Measuring Competitive Imbalance on the PGA TOUR

The normalized Herfindahl-Hirschman Index and the four-player and eight-player concentration ratios are popular measures of market concentration that can easily be applied to the PGA TOUR. Any TOUR win is highly valued among PGA TOUR players, carrying with it a substantial money prize and at least a two-year exemption. There can be only one winner of each PGA TOUR tournament so one player can theoretically win almost all of the tournaments during the season—there are a few cases of two tournaments running simultaneously making it impossible for one player to win

\textsuperscript{3} Tiger Woods earned a number 2 ranking on the Forbes Top 100 Celebrities list in 2005.

\textsuperscript{4} The “Big Five” is the name given to the unique group of golfers atop the World Golf Rankings in 2005. This group includes Tiger Woods, Vijay Singh, Ernie Els, Phil Mickelson, and Retief Goosen.
every PGA TOUR event in one season. Even so, a measure of market structure based on the concentration of wins among PGA TOUR players should provide a good indication of competitive imbalance on the PGA TOUR. Note that some wins on the PGA TOUR are clearly worth more than others—winning the Masters includes a five-year PGA TOUR exemption, a lifetime exemption to the Masters tournament, over $1 million, and a green jacket. But using another possible metric—annual prize money earned—provides no clear advantages over using wins since many tournaments have different purses. For example, first place in a tournament with a $3 million purse and second place in a tournament with a $5 million purse both are worth $540,000. However, a multi-year PGA TOUR exemption is also included with winning the tournament with the $3 million purse and not with earning second place in the tournament with the $5 million purse.

Within this framework, more winners and less concentration of wins indicates a higher level of competitive balance while less winners and a greater concentration of wins will suggest a higher level of competitive imbalance. Weighting each tournament win equally, the dHHI and CR4 and CR8 measures can be calculated for the PGA TOUR for each of the years from 1970 to 2004. The HHI is defined as \( HHI = \sum_{i=1}^{N} (WS_i)^2 \) where \( WS_i \) is the win share of all PGA TOUR events of the \( i^{th} \) player on a scale of 0 to 1. But because HHI is decreasing in the number of potential winners, \( N \), dHHI is defined as \( dHHI = HHI - \frac{1}{N} \) and becomes a more useful measure of competitive imbalance since it always provides a comparison to the ideal distribution of winners (see Depken 1999). This measure is useful since all possible wins are accounted for, changes in the share of wins among players are tracked, and the measure is bounded below by 0 (different
winner each tournament) and above by approximately 1 (same winner each week, except for few cases of simultaneous tournaments). CR4 and CR8 measure the share of wins collected by the top four and top eight winners respectively on the PGA TOUR for each year. Thus, $CR4 = \sum_{i=1}^{4} WS_i$ and $CR8 = \sum_{i=1}^{8} WS_i$. A higher value for any of these three measures indicates more competitive imbalance due to a higher concentration of winners.

Figure 1. Plots of $dHHI$, $CR4$ and $CR8$ for PGA TOUR wins concentration, 1970-2004 ($dHHI$ measured on right axis)

Computing the normalized Herfindahl-Hirschman Index and the four-player and eight-player concentration ratios requires annual wins data which were collected for the years 1970 to 2004 from the PGATOUR.com website and from Golf Magazine’s Encyclopedia of Golf (1993). Since reliable record keeping began in 1970, it is generally considered to mark the start of the modern era of PGA TOUR records. The intent here is to develop a measure of competitive imbalance that captures the concentration of wins by players in a given year. Thus, when Tiger Woods won nine events and Phil Mickelson
won four events on the PGA TOUR in 2000, the measure of competitive imbalance should indicate more imbalance than in 2002, when there were 18 first-time winners on the PGA TOUR (a record), and only Tiger Woods won more than two events all year. Figure 1 above shows plots of the dHHI, CR4 and CR8 measures for the concentration of wins on the PGA TOUR from 1970 to 2004. Each of these measures track along approximately the same path, although with different scales. Indeed, each measure of competitive imbalance indicates more competitive imbalance in 2000 than in 2002, just as expected.

While there is some variation in the level of each of these measures of competitive imbalance from year to year, there appear to be distinct breaks at 1983, when the all-exempt tour was established, and in 1999, when the World Golf Championships were instituted. Some explanation is warranted. A measure of competitive imbalance for the PGA TOUR must be sensitive to the uniqueness of the manner by which PGA TOUR players select the tournaments they desire to enter. Since 1983, each exempt PGA TOUR player has been assigned a position on the all-exempt tour priority ranking system. Players earn a particular position in this system through a fairly complex system that accounts for recent tournament wins and tournament earnings from the previous year. Because this means that for the most part they may play in any tournament they desire, it follows that their annual entry decision—the number of PGA TOUR events entered in any given year—would not be exogenously imposed on them in the same manner that it would be for a football player in the NFL or a basketball player in the NBA who is
contractually obligated to play in a certain number of games throughout the season. As a result, these players would be more likely to enter those tournaments where they expect the value of their marginal product of labor to be highest, taking into consideration certain factors such as tournament purse, location of tournament, length of course, and time of year on the schedule. Thus, it is expected that the all-exempt tour will increase the number of players that will be capable of winning any given PGA TOUR tournament, and subsequently decrease the level of competitive imbalance. Measures of dHII, CR4, and CR8 are expected to be lower after the introduction of the all-exempt tour.

The only significant stipulation required of PGA TOUR member players regarding the all-exempt tour is that they play a minimum of 15 tournaments during the season. This minimum number of tournaments requirement of the PGA TOUR must be assumed to enhance revenue generation since it is likely only a constraint for elite players. That is, those players that are top talent—the players that consistently win and are in the top 30 on the money list (i.e., Tiger Woods and Phil Mickelson)—may possibly play less than 15 tournaments in a year without this requirement. The requirement demonstrates the link between enhancing revenue generation and competitive imbalance together through mandating more appearances by elite players (see Hausman and Leonard 1997 and Berri et al. 2004). Given this requirement, elite players will be more likely to play in elite tournaments—tournaments with major or otherwise exclusive stature—that are generally accompanied by higher purses. It is expected that because the World Golf Championships are deemed to be elite tournaments by PGA TOUR players, offering more of these tournaments in the season will make it more likely for the elite

---

5 Of course, professional golfers on the PGA TOUR do have contracts with equipment companies that could influence decisions to play. Scully (2002) estimates that these sponsorships and contracts roughly cover the costs of competition for most of these players.
players to play in more events in the year. Providing more elite players the opportunity to win will make it more likely to increase the concentration of wins and thus increase the level of competitive imbalance. Measures of dHHI, CR4, and CR8 are expected to increase in the presence of the World Golf Championships.

Any model of competitive imbalance on the PGA TOUR must, therefore, account for the depth of the pool of talented players that are exempt to play in tournaments and for the number of exclusive tournaments available for elite players to enter. I present a simple model of the measure of competitive imbalance for the PGA TOUR for year $t$ as $CIB_t = CIB_t(POOL_t, ELITE_t, \gamma_t)$. $CIB_t$ is the current time period competitive imbalance measure, which can be dHHI, CR4, or CR8. $POOL_t$ represents the depth of talent of the pool of exempt PGA TOUR tournament field in year $t$, $ELITE_t$ represents the number of tournaments elite players enter in year $t$ and $\gamma_t$ represents all else that can influence competitive imbalance, such as the level of technology permitted in the equipment and the length of golf courses. It is expected that $\frac{\partial CIB_t}{\partial POOL_t} < 0$ since a deeper pool of talent on the PGA TOUR should decrease competitive imbalance, and thus decrease the value of the metric, $CIB_t$. Additionally, it is expected that $\frac{\partial CIB_t}{\partial ELITE_t} > 0$ since elite players are expected to win more tournaments in the year as the number of tournaments they enter increases.

Relationships are estimated by applying an ordinary least squares (OLS) model to the data. The model to be estimated is

$$ \begin{align*}
CIB_t &= \beta_0 + \beta_1 TOP125_t + \beta_2 WGC_t + \epsilon_t
\end{align*} $$(1)
where TOP125 is a dummy variable taking a value of 1 from 1983 on when the all-exempt tour was in effect and 0 otherwise. WGC is a dummy variable with the value of 1 from 1999 on when the World Golf Championship events were on the PGA TOUR schedule. The $\beta$’s are coefficients to be estimated and $\varepsilon_t$ is an error term. The dependent variable, CIB, is the current time period measure of dHHI, CR4, or CR8. The relationship in equation (1) is primarily meant to evaluate the sensitivity of the three proposed measures of competitive imbalance to the major policy changes implemented by the PGA TOUR in recent years.

Table 1: Estimated Coefficients of the Competitive Imbalance OLS Model

<table>
<thead>
<tr>
<th></th>
<th>dHHI</th>
<th>CR4</th>
<th>CR8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant</strong></td>
<td>0.0263**</td>
<td>0.316**</td>
<td>0.486**</td>
</tr>
<tr>
<td></td>
<td>(12.54)</td>
<td>(26.61)</td>
<td>(35.51)</td>
</tr>
<tr>
<td><strong>TOP125</strong></td>
<td>-0.0119**</td>
<td>-0.0789**</td>
<td>-0.0800**</td>
</tr>
<tr>
<td></td>
<td>(-4.23)</td>
<td>(-4.94)</td>
<td>(-4.35)</td>
</tr>
<tr>
<td><strong>WGC</strong></td>
<td>0.0146**</td>
<td>0.0699**</td>
<td>0.0611*</td>
</tr>
<tr>
<td></td>
<td>(4.02)</td>
<td>(3.41)</td>
<td>(2.36)</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td><strong>Adjusted R²</strong></td>
<td>0.41</td>
<td>0.43</td>
<td>0.35</td>
</tr>
<tr>
<td><strong>F-Statistic</strong></td>
<td>12.64</td>
<td>13.81</td>
<td>10.09</td>
</tr>
</tbody>
</table>

Notes: * and ** indicate statistically significant at the 5% and 1% level. T-statistics are in parentheses.

Results of OLS applied to equation (1) are presented in Table 1 and suggest that recent PGA TOUR policy changes have had the expected impact on competitive imbalance on the PGA TOUR. In each of the specifications of competitive imbalance used, the coefficients of TOP125 and WGC are significant and have the expected sign. Specifically, the negative sign on TOP125 indicates that moving to the all-exempt tour in 1983 and giving exempt status to the top 125 money winners from the previous year has lead to less competitive imbalance on the PGA TOUR. In addition, the positive sign on WGC suggests that offering World Golf Championship events has lead to more
competitive imbalance by providing a mechanism for elite players to play more often, and thus win more often. The magnitude of the coefficients on TOP125 and WGC are roughly similar, suggesting they offset one another given their opposing signs. In the CR4 and CR8 models, introducing the all-exempt tour lead to about four wins accumulating to players outside the top winners on the PGA TOUR while adding the World Golf Championships events has lead to almost four additional wins for the top winners on the PGA TOUR. Durbin-Watson statistics for dHHI, CR4, and CR8 are 1.66, 1.90, and 2.02 respectively, so there appears to be no autocorrelation in any of the specifications.

Of the three similar measures of competitive imbalance, it is not clear that either one is better than the other. Each measure explains about the same amount of variation in the concentration of wins from year to year. The results from the OLS specification provides some evidence that the policy changes on the PGA TOUR may be driven in part by a pursuit of some optimal level of competitive imbalance. It must still be determined what impact competitive imbalance has on fan preference. This topic is taken up in the next section.

4. Competitive Imbalance and Fan Preference

Our attention now turns to estimating the impact of competitive imbalance on consumer preference. It is quite important to our understanding of how competitive imbalance impacts fan preference for the PGA TOUR just as Humphreys (2002) finds for the case of competitive balance and professional baseball. While there is value to be found in the above analysis by estimating the precise impact of certain policy changes on
competitive imbalance on the PGA TOUR, the true strength of this examination is in determining whether or not competitive imbalance impacts consumer preference. To do this, a measure of consumer behavior must be found. Attendance has been used to analyze the impact of competitive balance on behavior in baseball (Humphreys 2002), but this data is not easily available nor is it reliable for PGA TOUR events. Instead, total annual prize money will serve as a measure of consumer behavior.

Figure 2: Growth of Total Purse on PGA TOUR, 1970-2004, in millions of 2004$. 

Total prize money data is collected from the 2005 PGA TOUR Official Fan Guide for the years 1970 to 2004. The figures are expressed as real 2004 dollars and are presented in Figure 2. After relatively no growth in total purse from 1970 to the mid 1980s, a slight increase in purse size emerged to be followed by an explosive amount of

---

6 For example, the FBR Open in Phoenix attracts the largest crowds of any PGA TOUR event. The crowds are estimated by counting cars and then assuming each car has 3.1 people—hardly a precise measure of attendance.

7 This measure of fan preference has the additional benefit of capturing television audience since a large portion of prize money is generated from television rights fees.
growth in purse size in the late 1990s. Increased revenues coming into the PGA TOUR from enhanced television and corporate sponsorship revenues have driven much of the growth in total purse size in recent years.

To analyze the impact of competitive balance on the total prize money available on the PGA TOUR, I follow Humphreys (2002) and offer the following model:

\[
PURSE_t = \delta_0 + \delta_1 RNDPER_t + \delta_2 EVENTS_t + \sum_{i=1}^{4} \delta_i CIBLAGi_t + \epsilon_t
\]

where \( PURSE_t \) is the total annual real prize money in year \( t \) and is detrended to account for the time trend present in Figure 2.\(^8\) The variables included in equation (2) are expected to affect demand for and supply of PGA TOUR events and \( \epsilon_t \) is a random error term. Definitions and descriptive statistics of each of the variables are provided in Table 2.

\begin{footnotesize}
\begin{table}[h]
\centering
\begin{tabular}{|l|l|c|c|c|}
\hline
\textbf{Variable} & \textbf{Definition} & \textbf{Mean} & \textbf{Median} & \textbf{Standard Deviation} \\
\hline
PURSE & Prize money, millions of 2004$ in year \( t \) & 75.99 & 53.39 & 62.39 \\
RNDPER & Rounds played per capita in US in year \( t \) & 1.61 & 1.68 & 0.14 \\
EVENTS & PGA TOUR events played in year \( t \) & 45.26 & 45.00 & 2.06 \\
dHHLAGi & Previous \( i \) year’s dHHI value, \( i = 1 \) to 4 & 0.021 & 0.018 & 0.0093 \\
CR4LAGi & Previous \( i \) year’s CR4 value, \( i = 1 \) to 4 & 0.27 & 0.25 & 0.06 \\
CR8LAGi & Previous \( i \) year’s CR8 value, \( i = 1 \) to 4 & 0.44 & 0.43 & 0.06 \\
\hline
\end{tabular}
\caption{Descriptive Statistics of Variables Used in Equation (2)}
\end{table}
\end{footnotesize}

The total real prize money is measured in millions of 2004 dollars for the years 1970 to 2004. The National Golf Foundation (NGF) provides data on annual rounds of

\(^8\) \( PURSE_t \) is the residual for each year \( t \) that remains from regressing TIME and TIME\(^2\) on the total annual real prize money in year \( t \).
golf played in the US.\(^9\) Rounds of golf played per capita in the US serves as a proxy of tastes and preference for watching PGA TOUR events and should affect demand for PGA TOUR events. It is expected that more rounds played per capita would be an indication of greater demand for watching PGA TOUR events, so the coefficient on RNDPER is expected to be positive. The number of events played is a supply-side element and directly impacts the size of the total annual prize money. But since the PGA TOUR controls the number of events staged during the year, it is expected that this number would not be significantly different from zero. Otherwise, the PGA TOUR would be able to increase total prize money at the margin by increasing or decreasing total annual events, depending on the magnitude of the coefficient on EVENTS.

Finally, three different lagged measures of competitive imbalance developed in section 3—dHHILAG, CR4LAG and CR8LAG—are introduced in the specification of equation (2). Again, it is expected that golf fans desire higher levels of competitive imbalance with enough anecdotal evidence suggesting that the domination on the PGA TOUR by Tiger Woods in recent years has fueled much of the growth in the interest of golf fans. Because total prize money is determined at the start of the year, competitive imbalance in year \(t\)-1 is expected to impact total prize money in year \(t\). But more than just one year of lagged competitive imbalance may actually impact total prize money. More specifically, up to four years of these lagged competitive imbalance measures are included since television contracts can last for up to that long.\(^{10}\) Thus, if higher levels of

---

\(^9\) Interpolation was required due to nonexistent observations in the early part of the data set. The NGF only tracked rounds of golf played in the US every five years in the 1970s and 1980s. This is the best historical data set on rounds of golf played in the US that exists.

\(^{10}\) Recent television contracts were renegotiated between the PGA TOUR and the networks in 1997 and 2001. Notably, these negotiations occurred just after Tiger Woods won his first Masters tournament in 1997 and after he completed the “Tiger Slam” in 2001. In each case, the PGA TOUR was able to convert these successes by Tiger Woods into very large television contracts.
competitive imbalance on the PGA TOUR are to translate into higher fan interest and thus increased prize money, the sign on the coefficients of $dHHILAG_i$, $CR4LAG_i$ and $CR8LAG_i$ should be positive. I estimate equation (2) using OLS. The Newey-West (1987) correction for autocorrelation and heteroskedasticity is used. The results are found in Table 3.

Table 3. Estimated Coefficients of the Total Prize Money Model

<table>
<thead>
<tr>
<th></th>
<th>dHHILAG Model</th>
<th>CR4LAG Model</th>
<th>CR8LAG Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-149.91***</td>
<td>-223.01***</td>
<td>-270.36***</td>
</tr>
<tr>
<td></td>
<td>(-3.21)</td>
<td>(-4.14)</td>
<td>(-3.66)</td>
</tr>
<tr>
<td>RNDPER</td>
<td>50.31***</td>
<td>47.22***</td>
<td>55.45***</td>
</tr>
<tr>
<td></td>
<td>(4.22)</td>
<td>(4.74)</td>
<td>(4.61)</td>
</tr>
<tr>
<td>EVENTS</td>
<td>0.97</td>
<td>2.06*</td>
<td>1.77*</td>
</tr>
<tr>
<td></td>
<td>(1.10)</td>
<td>(2.03)</td>
<td>(1.92)</td>
</tr>
<tr>
<td>CIBLAG1</td>
<td>295.49*</td>
<td>34.64</td>
<td>53.16**</td>
</tr>
<tr>
<td></td>
<td>(1.74)</td>
<td>(1.65)</td>
<td>(2.25)</td>
</tr>
<tr>
<td>CIBLAG2</td>
<td>149.88</td>
<td>30.18</td>
<td>46.32**</td>
</tr>
<tr>
<td></td>
<td>(1.16)</td>
<td>(1.29)</td>
<td>(2.11)</td>
</tr>
<tr>
<td>CIBLAG3</td>
<td>306.13*</td>
<td>60.99**</td>
<td>59.66*</td>
</tr>
<tr>
<td></td>
<td>(1.86)</td>
<td>(2.35)</td>
<td>(1.71)</td>
</tr>
<tr>
<td>CIBLAG4</td>
<td>433.00*</td>
<td>69.02***</td>
<td>67.68**</td>
</tr>
<tr>
<td></td>
<td>(2.01)</td>
<td>(3.09)</td>
<td>(2.30)</td>
</tr>
<tr>
<td>N</td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>F-statistic</td>
<td>7.48</td>
<td>17.94</td>
<td>6.51</td>
</tr>
</tbody>
</table>

Notes: * and ** and *** indicate statistically significant at the 10%, 5% and 1% level. T-statistics are in parentheses.

In all three of the specifications, the estimated coefficients emerge pretty much as expected. The positive and significant sign on RNDPER suggests that increased fan demand translates to increased purse size. The coefficient on the variable RNDPER in each of the specifications together indicate that there will be an increase of between $880,000 and $1.03 million in total purse size on the PGA TOUR with one additional round of golf played per day on each golf course in the US. The coefficient on the variable EVENTS in the dHHILAG model is not significantly different from zero, as
expected. However, the coefficient is positive and weakly significant at the 10% level in the CR4LAG and CR8LAG models. This provides weak evidence that the PGA TOUR could increase the number of events in order to increase the total annual prize money. But the value of the coefficient on EVENTS for the CR4LAG and CR8LAG models indicates that the increase in total annual purse size for the PGA TOUR of about $2 million is considerably less than the approximately $5 million average tournament purse size in 2004 and does not necessarily justify an increase in the annual number of PGA TOUR events.

Finally, the coefficients on all the variables measuring competitive imbalance have the expected positive sign. This result is consistent with the earlier proposition that higher levels of competitive imbalance lead to higher levels of fan demand and subsequently more prize money. The CIBLAG variables in the CR8LAG model are all significant at least at the 10% level while the CIBLAG variables in the dHHILAG and CR4LAG models show mixed results. To interpret the coefficients on the CIBLAG variables for the CR8LAG model, increase competitive imbalance in a prior year by allowing one of the multiple winners on the PGA TOUR to have one additional win. In this case, total annual prize money in 2004 would increase by $1.11 million due to this hypothetical increase in competitive imbalance in 2003, $965,000 from increased imbalance in 2002, $1.24 million from increased imbalance in 2001, and by $1.41 million due to the same amount of increase in imbalance in 2000.

Overall, the results provide fairly strong evidence that competitive imbalance has a positive impact on total prize money suggesting that fans prefer higher levels of competitive imbalance on the PGA TOUR. This result agrees with the intuition in
Sanderson and Siegfried (2003) that fans seem to prefer more inequality in golf and other individual sports than in team sports generally. It is notable, then, that this result suggests that fans of individual sports leagues may have a different preference level for competitive imbalance than for team sports leagues and suggests that the current thinking on this topic needs to be expanded.

5. Conclusions

Competitive balance is perhaps the most studied topic in sports economics today. But the focus is largely on team sports and especially professional baseball. While a measure of competitive balance has been developed that indicates fans of professional baseball value more balance, it has been unclear whether fans of the PGA TOUR and other individual sports leagues had a similar preference for balance.

The measures of competitive imbalance for the PGA TOUR that I developed here were sensitive to policy changes. Further, competitive imbalance seems to positively affect fan preference. There is evidence that higher levels of competitive imbalance for the PGA TOUR leads to more prize money, suggesting that a higher level of imbalance seems to be more highly valued by fans of individual sports leagues like the PGA TOUR than is generally the case in team sports leagues. Thus, decision makers in charge of policy for the PGA TOUR and for other individual sports leagues are seemingly left with the task of trying to achieve the right level of competitive imbalance in order to maximize fan interest and league revenues. Some of the more interesting lines of research opened up by these results include trying to explain more precisely the differences between
individual and team sports leagues and generating measures of competitive imbalance in other individual sports leagues to see if fans prefer imbalance in those leagues as well.
References


