Relative measure of chance and skills In games

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Abstract

The purpose of this paper was to use statistical analysis to measure skills level and chance present in games. In this paper I presented statistical analysis of the results of all sports competitions, the data was taken from major competition results, as it can be seen from appendix A. The randomness present in each game was the main factor used as the measure of amount of skills and the chance element present in the games.

This paper discusses the relative skills and chance in games, in terms of the randomness in the distribution of points in the total scores of the games. An interesting aspect of games is the relative extent to which a player can positively influence his results by making appropriate strategic choices. This question is closely related to the issue of how to distinguish between games of skill and games of chance. The distinction in this paper we present a modification of an existing measure of the skill level of a game, which has served as a juridical tool for the classification of games.

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1. Introduction

A game is an (often, but not always recreational) activity involving one or more players. This can be defined by either a goal that the players try to reach, or some set of rules that determines what the players can or can not do. An interesting aspect of games is the relative extent to which a player can positively influence his results by making appropriate strategic choices. This question is closely related to the issue of how to distinguish between games of skill and games of chance. The distinction between game of skills and chance is definitely interesting from the judicial point of view, chance games are considered as lottery and in lottery the winners are exempted from tax, only the organising agents are taxed, while in games of skills the winners have to pay tax according to the specific earnings. A game of skills is a game in which the outcome is based on the merits of the performance of the competitors, the following are examples of games of skills; chess, Golf, Football, Tennis etc.
A game of chance is a game whose outcome is strongly influenced by some randomizing device, and upon which contestants frequently wager money. Common devices used include dice, spinning tops, playing cards, roulette wheels or numbered balls drawn from a container.
Some games of chance may also involve a certain degree of skill. This is especially true where the player or players have decisions to make based upon previous or incomplete knowledge, such as blackjack. The distinction between "chance" and "skill" is relevant as in some countries chance games are illegal or at least regulated (lottery), where skill games are not illegal but attract some percentage of taxes. By definition of skills game in which no external chance moves are present, is a pure game of skills. Examples of external chance moves are the dealing of cards and the spin of a roulette wheel.

An article by "Scott M Berry"[12] on lucky in sports, the question that he answered in his article was, "when two teams play multiple games, does the same team win all the time?" To answer this question, he investigated the amount of natural variability present in the four major North American sports; baseball (MLB), football (NFL), basketball (NBA) and hockey (NHL). He analyze season worth of games for the four major leagues, he estimated the teams abilities in each sports and the home advantage, and presented a model to find the probability that one team beats another, he used logistic model because the model fitted well for all four sports, he model the probability that team i beats team j when team i plays home as

[G]Column editor of statisticians reads sports page

P (home team i beats team j) = $\frac{\exp(\theta_i - \theta_j + \lambda)}{1+\exp(\theta_i - \theta_j + \lambda)}$

The parameters θ_i represented the ability of team i and θ_j represented ability of team j and the parameter λ represented the home field advantage. He compared the home field advantage in all the sports, baseball had estimated home field advantage 0.17 and that in baseball, if two teams of equal ability plays a match, the home team would have 0.54 probability of winning, the estimated home field advantage of hockey (NHL) was -0.058 thus a home-rink disadvantage, which was rarely common in the other sports. From his analysis basketball (NBA) has the largest home-court advantage 0.58 and in a basketball match between two teams of equal ability the home team had 0.64 probability of winning. He finally estimated the distribution of team abilities θ's and found the mean for each sport is 0, the standard deviation of the estimated θ's for baseball (MLB) was 0.25, for NHL was 0.53, for NBA was 0.76 and for the NFL was 0.73. He assumed that in each sport the distribution of the team abilities is a normal distribution with the given standard deviation.

He finally came to conclusion that baseball stands out of the three sports in the amount of luck involved in the outcome. Hockey is second to baseball and basketball was the sports of less luck involved in the outcome, NFL is very close to the NBA in that skill plays a larger role and games are more predictable.

The second article on games of skills report by E.Ben-Naim, F.Vazquez and S.Redner (Department of Physics, Boston University, Boston Massachusetts) with the topic "What is the most competitive team sport?"[13] they answered this question via statistical survey of game results, they studied the results of all regular season competitions in 5 major professional sports leagues in England and the United States; the premier soccer league of the English Football Association (FA), Major League Baseball (MLB), the National Hockey League (NHL), the National Basketball Association (NBA) and the National Football League (NFL).

The winning fraction, the ratio of wins to total games quantifies team strength. Thus the distribution of wining fraction measures the parity between teams in a league. They compute $F(x)$, the fraction of teams with a wining fraction of x as well as $\sigma = \sqrt{\langle x^2 \rangle - \langle x \rangle^2}$, the standard deviation in winning fraction. Where $\langle . \rangle$ denotes the average over all teams and all years using season-end standings. For example, in baseball where the wining fraction x

[13] http://arxiv.org/PS_cache/physics/pdf/0512/0512143.pdf

typically falls between 0.400 and 0.600, the variance is $\sigma = 0.084$. As show in the figure below, the wining fraction distribution clearly distinguishes the five leagues. It is found to be narrowest at baseball and widest for football.

League	Years	Games	‹games›	σ	q
FA	1888-2005	43350	39.7	0.102	0.452
MLB	1901-2005	163720	155.5	0.084	0.441
NHL	1917-2004	39563	70.8	0.120	0.414
NBA	1946-2005	43254	79.1	0.150	0.365
NFL	1922-2004	11770	14.0	0.210	0.364

The table above summaries the statistical data by the report, listed in the table are the time period, total number of games, average number of games played by a team in a season (‹games›),variance in the win-percentage distribution (σ), measured frequency of upsets (q). The above analysis did not apply that MLB games are the most competitive and NFL games the least, the length of the season is a significant factor in the variability in the wining fraction. Generally, the shorter the season, the larger σ, thus small number of games is partially responsible for the large variability observed in the NFL. To account for the varying season length and reveal the true nature of the sports, a mock sports league was set up, where teams paired at random, play a fixed number of games, in this simulation model, the team with better record is considered as the favorite and the team with the worse record is considered as the underdog. The outcome of a game depends on the relative team strengths, with the "upset probability" $q < ½$, the underdog wins, but otherwise, the favorite wins. From the analysis of the non-linear master equations that describe the evolution of the distribution of team win/loss records shows that σ decreases both as the season length increases and as games become more competitive, i.e. as q increases. The final conclusion was that soccer and baseball are the most competitive sports with $q = 0.452$ and $q = 0.441$, respectively, while basketball and football, with nearly identical $q = 0.365$ and $q = 0.364$, are the least.

Competitiveness: Is a comparative measure of the ability and performance of a team to cope with their opponent during tournaments or competition, competitiveness can be related to the predictability of the games, more competitive games becomes difficult to predict the out come and less competitive are easily predictable, we can link the predictability and competitiveness to the skills and chance involve in games, games of more skills becomes has

easy predictability in the out come ; for instance in competition involving better side and underdog, the out come can easily be predicted and that makes it less competitive, on the other hand games of more chance element are more competitive, and the out come is difficult to predict.

In this paper the skill measure is redefine; firstly I compared the variance and standard deviance of different sports to measure the chance element, from the properties of variance; the variance of skills games are expected to be larger than the variance of games of chance, in chance games the outcome is random and finally use the spearman rank correlation test to test the correlation between series of golf and tennis tournaments rankings, the greater the difference shows that the particular game has less randomness in the distribution of the total points, then we can classified it as being more skills than chance.

2. Methodology

The main statistical method for this study is based on the rules of variance of random variables; the first part of this study will use the analysis of variance to analyze the differing levels of random variability within four major sports; Major League Baseball(MLB),National Basketball(NBA), National Hockey League (NHL) and Association football(soccer) FA. The rules and regulations of these four major sports are discussed in the first place, Data on season worth of games from all the four sports are analyzed, the analysis is done independently for each sports.

The variance of the total points from the selected season of each sport is calculated and recorded as the observed variance; the league table is now re-constructed, this is done by reshuffling the selected regular season table from each sport, to re-construct the original league table, the following method was employed using the R programme[14];

Association football (soccer); there are 20 teams each team played 38 games, the total number of games won(W) is equal to the number of games loss(L),thus W = L = 270, the number of games that resulted in tie (draw),D = 220 and the total number of games played T = 760, I now put the number of wins (W), tie(D) and loss(L) together and sample (reshuffle), the sequence with number of observations N = 760 and difference of 38, starting from 1, is used to assign points to all the 20 teams, the first 38 samples are assign to the first team and the team's total points is calculated by summing the Win = 3, Tie (D) = 1 and Loss = 0 , the next 38 sample is assign to the second team and the same calculations is done for the points, the

[14]Can be obtained from the web link; http://cran.r-project.org/doc/manuals/R-lang.pdf

sequence continues until all the 20 teams are assign points' now put all the 20 team's points together and find the variance and recorded as $V(X_i)$, I resample and continue the same process for about 10,000 iterations. National Basketball Association; there 30 teams and each team played 82 games in regular season, I recorded only the number of wins (W) and the number of loss(L), because in NBA tie is not possible and that number of wins(W) = number of loss(L) = 1230, the total number of games T = W + L = 2460, i put all the points together W=1 , L= 0 and sample(reshuffle) them, the sequence with number of observations N = T = 2460 and difference of 82, starting from 1 is used to assign points to all the 30 teams, the first 82 samples are assign to team one and the team's total point is calculated by dividing the sum of wins(W) by number of games played 82 and multiply by 100, which measure the winning fraction of the team, continue the same process in the sequence until all the teams has been assign points. I resample and continue the same process for about 10,000 iterations. For Major League Baseball and National Hockey League, I used the method for reconstruction National Basketball and association football respectively, and make changes in the number of games, wins, loss and total points to suit the respective sports.

In all generated tables the expected variance of the random outcome is calculated, for instance when we consider a finite number of random generated tables, denoted by X_i the variance of the total points for each table is calculated as $V(X_i)$, we can also denoted the observed variance by $V(X_{\lg})$, we would expect the random points variances $V(X_i)$……..$V(X_n)$ $<V(X_{\lg})$, to verify the spread of this random variances I compute the 97.5^{th} percentile of the variance and compare to the observed variance, this can give us information on the proportion of the variance that fell below the observed variance and also measure the distance between them. Games of skills are expected to have variance lager then games of chance, but sometimes it is usual for games of chance to have large standard deviations because large variability makes gambling exciting.

The second part of this study will be based on the spearman correlation test, below is an illustration of the correlation test.

The correlation coefficient

Let X and Y be a pair of random variable, with means μ_x and μ_Y and variances σ_X^2 and σ_Y^2 A measure of the strength of their linear association is provided by the correlation coefficient, rho (ρ), define as

$$\rho = corr(X,Y) = \frac{Cov(X,Y)}{\sigma_X \sigma_Y} = \frac{E[(X-\mu_X)(Y-\mu_Y)]}{\sqrt{E[(X-\mu_X)^2]E[(Y-\mu_Y)^2]}}$$

it can be shown that the correlation must lie between -1 and 1, thus $-1 \le \rho \le 1$

with the following interpretations;

(i) A correlation of -1 implies perfect negative linear association

(ii) A correlation of 1 implies perfect positive linear association

(iii) A correlation of 0 implies no linear association

(iv) The larger in absolute value is the correlation, the stronger is the linear association between the random variables.

Spearman Rank correlation test

Suppose we have a random sample $(x_1, y_1)...(x_n, y_n)$ of n pairs of observations, if the x_i and y_i are each ranked in ascending order, and the sample correlation of these ranks is calculated, the resulting coefficient is called Spearman rank correlation coefficient ,

The formula for computing this coefficient is;

$r_s = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n(n^2-1)}$, where the d_i are the difference of the ranked pairs.

The following tests of null hypothesis Ho; of no association in the population, with α significant level;

(i) To test against the alternative of positive association, the decision rule is;

Reject Ho, if $r_s \succ r_{s,\alpha}$

(ii) To test against the alternative of negative association, the decision rule is;

Reject Ho if $r_s \prec -r_{s,\alpha}$

Here $r_{s,\alpha}$ is the cut off point of the distribution of the Spearman coefficient, give in distribution tables. In this article the Spearman Rank correlation test would be run by R programme, which is a statistical soft ware, the test will be based on statistical significance (p-value), if 0.01 < p-value < 0.05, the results is statistically almost significant and the hypothesis Ho; will be rejected.

Series of tennis tournaments ranking will be use here as the source of data, in tennis the ATP ranking for the beginning of the season year and the middle of the year for three consecutive years, starting from 2004 to 2006 would be considered. I recorded the rankings for about 50 players who have been participating in all the major tennis tournaments for the three consecutive years under study, they are also available in almost all the rankings by the ATP.
ATP stands for Association of Tennis Professionals and is the international circuit of men's tennis tournaments. ATP organised all the major tennis tournaments through the year. The spearman rank correlation test is used here to test the correlation between the consecutive rankings of individual players, to see if the same players always have the same positions and also the correlations between the rankings of the start of season to the end of seasons, the level of skills present in tennis is measured by the correlation coefficient, we will plot the graph ATP rankings from start of season year to the middle of the year, and also plot between one year ranking, to verify the correlation.
I find the correlation or the association between the rankings of players and also correlation between tournament rankings, test the null hypothesis of independence association between results of individual players in all the tournaments, the test output will be done by a computer programme. The skill measure in the tennis will be attributed to the correlation coefficient.

2. Football (soccer)

2.1 Description

Association football, soccer or simply football is a team sport played between two teams each consisting of 11 players; In the case of association football (soccer), matches are normally played on home and way bases, in one particular match a team may win the match or both teams may draw, Premiership league table as well as other football divisional league tables are compiled by awarding three points for a win, one point for tie and lose records zero points. We use the data from the English Premiership match results to analyse a football game, the end-of-season league outcomes are normally influenced by some factors such as involvement in European cup competition, relegation to lower division and promotion from lower division to the Premiership, the geographical distance between the two teams and playing at home advantage for the home team.

Table 1.0 shows the final end-of-season results from English Premiership for the 2004/2005 league season, it is observed from the table that some teams such as Chelsea, Arsenal and Manchester United obtained high points at the end of the league season, these teams might qualify to participate in European cup and other cup competitions, while on the

other hand, Cristal Palace, West Bromwich Albion, Portsmouth, Norwich City and Southampton recorded low points, these teams are in the relegation zone and may be relegated to the Lower Division, The distributions of points in the end-of-season table are attributed to the performance by the individual teams and these accounted for by the amount of skills in football game. Figure 1.0 shows the plot of the density of the points (Pts) of the end-of-season league table, and the graph is found to be positively skewed, which shows that the points were not randomly distributed, then football (soccer) can be classified as a game of skills rather than chance, The variance of the total points in the Premiership league is calculated, we will now compare this observed variance with the variance of a randomly generated league table,

In the game of skills the variation is expected to be larger than the random table whose outcome is from lottery. I now re-construct the league table; this is done by generating a random table, the variance of each is calculated. Consider a finite number of random points; we denote by X_i, the variance of the total points for each table is calculated as $V(X_i)$.

It would be observed that for each $V(X_i)$ … $V(X_n)$ $< V(X_{\lg})$, where $V(X_{\lg})$, denote the variance of the total points in Premiership league table.

Team	P	W	D	L	F	A	Pts
Chelsea	38	29	8	1	72	15	95
Arsenal	38	25	8	5	87	36	83
Manchester United	38	22	11	5	58	26	77
Everton	38	18	7	13	45	46	61
Liverpool	38	17	7	14	52	41	58
Bolton Wanderers	38	16	10	12	49	44	58
Middlesboro	38	14	13	11	53	46	55
Manchester City	38	13	13	12	47	39	52
Tottenham Hotspur	38	14	10	14	47	41	52
Aston Villa	38	12	11	15	45	52	47
Charlton Athletic	38	12	10	16	42	58	46
Birmingham	38	11	12	15	40	46	45
Fulham	38	12	8	18	52	60	44
Newcastle United	38	10	14	14	47	57	44
Blackburn Rovers	38	9	15	14	32	43	42
Portsmouth	38	10	9	19	43	59	39
West Bromwich Albion	38	6	16	16	36	61	34
Crystal Palace	38	7	12	19	41	62	33
Norwich City	38	7	12	19	42	77	33
Southampton	38	6	14	18	45	66	32

Table1.0 FA (soccer) Premiership 2004/2005

P	W	D	L	Pts
1	15	12	11	57
2	19	5	14	62
3	14	14	10	56
4	18	9	11	63
5	8	14	16	38
6	11	12	15	45
7	14	16	8	58
8	10	15	13	45
9	14	9	15	51
10	8	17	13	41
11	16	12	10	60
12	11	9	18	42
13	7	11	20	32
14	16	6	16	54
15	8	16	14	40
16	18	6	14	60
17	15	8	15	53
18	16	10	12	58
19	20	9	9	69
20	12	10	16	46

Table 2; randomly reconstructed FA (soccer) Premiership league table

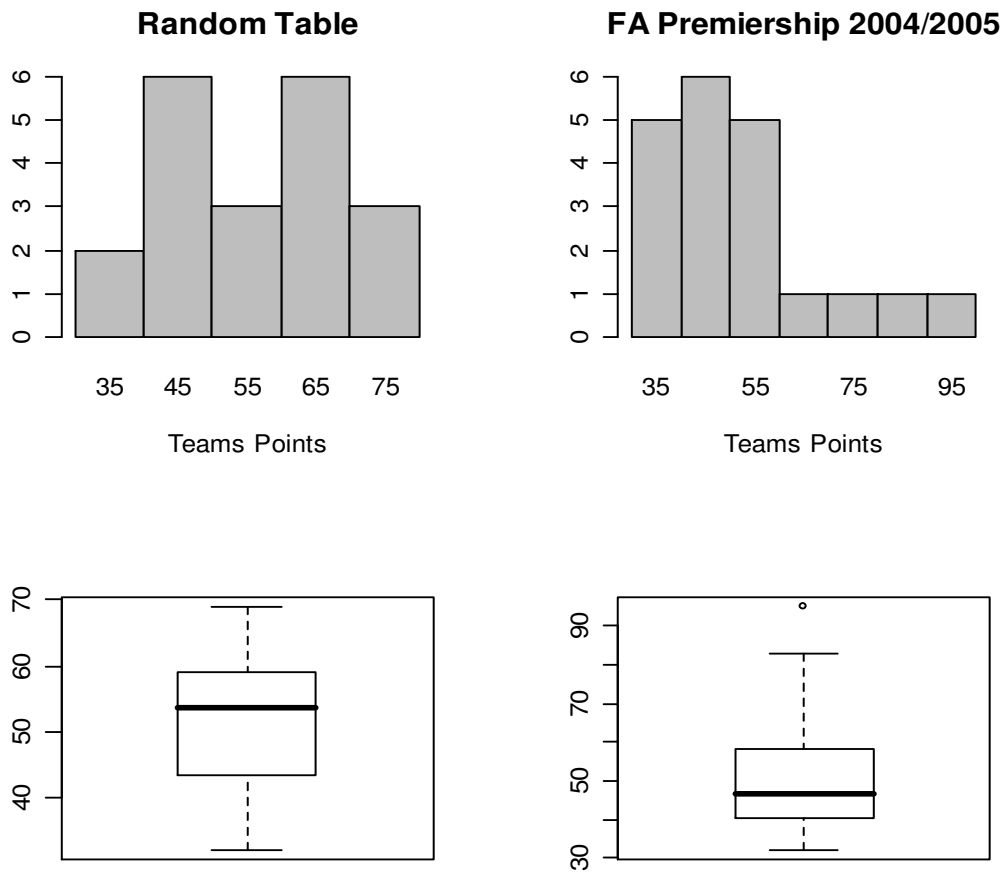

Figure 1.0 bar plot and box plot of the observed league table and random generated table

2.2 Expected variance

Consider the Premiership league table in Table 1.0, the variance of the total points $V(X_{\text{lg}}) =$ 291.8421 from the random table $X_1, \ldots X_n$ we generate n = 10000 tables and each variance of the total points, $V(X_i)$ is calculated. It was observed that 97.5% percentile of the random variance was found to be 108.7921, the 97.5% is very far from the observe variance, that means the results of the football (soccer) league is far from randomness (chance), we can conclude that the outcome of soccer games have less chance in it.

3.0 National Basketball Association (NBA), National Hockey League (NHL) and Major League Baseball (MLB)

The differing levels of random variability, within sports are always of prime interest to compare the skills level in different sports. In this chapter I investigate the amount of natural variability present in the three major sports, The National Basketball Association (NBA), National Hockey League (NHL) and the Major League Baseball (MLB). In this paper I analyse season worth of games for NBA, NHL and MLB, I discuss the rules in each game and analyse the results from past league in each game.

We follow the past league results of all games and then we calculate the variance of the observed league table, We then re-construct the league standings of any given season year, and generate about 10000 of the random table and record the expected variance of each random table. We calculate the expected 97.5 percentile variance of the 10000 random generated tables, the verify the randomness (chance) in a particular game, we compare the expected 97.5 percentile variance to the expected variance of the observed league table,
It will be noted that the expected 97.5 percentile variance will be very close to the observed variance of game with more chance element, and very far from the expected variance of game with little chance but more skills elements.

3.1 Basketball[15]

NBA games are played on courts that are 94 feet by 50 feet; points are scored whenever a ball is successfully thrown through the appropriate basket, which is suspended 10 feet above the floor with a backboard behind the rim, the team that scores the most points, either by field goals or free throws shots, wins the game; A field goal is a basket that is score during competitive action of the game; a free throw is tossed from the foul line, which is 25 feet from the backboard and is awarded because of a violation, when a free throw is taken, no defensive action occur until the shooter releases the ball from his hands, In the course of an NBA competition if a game is tied at the end of regulation play, “overtime” is played to break the tie. Teams play with tow forwards, two guards, and one center, the forecourt for a particular team is where the team’s basket is located. The backcourt is where the team’s

[15] Encyclopaedia of world sports from Ancient times to the present
(David Levison and Karen Christensen)

opponent's basket is found. The ball can be moved toward a basket by passing or dribbling, After a basket is scored , the opposing team passes the ball back into play from an out-of-bounds position. Professional games consist of four twelve-minute quarters.

3.2 Baseball

Is a team sport popular in North America, Latin America, the Caribbean and East Asia. The modern game was developed in the United States from early bat-and-ball games played in Britain, and it has become the national sport of the United States. It is a Bat-and-ball game in which a pitcher throws (pitches) a hard, fist-sized ball past the hitting area of a batter. Two teams alternate between playing offense (batting) and defense (fielding) for nine innings, with the home team batting last, if a batter reaches first base on a hit that is single; second base is a double, and third base is a triple, a run is scored whenever an offensive player successively and safely lands on first, second and third base. The team that scores the most runs, wins, a tie is resolved by playing extra time innings until one team secures the lead. Baseball is the only game in which the defense controls the ball, defensive positions are the pitchers; catchers; first, second and third basemen; shortstops and right, left and center fielders, their goal is to cause the offensive players to become "out" via the strikes, thus a strikeout or by a tag, clearly played ground ball, caught fly ball, or force out at the base, once three out are obtained, the two teams switch sides.

3.3 The National Hockey League (NHL)[16]

Ice hockey is a winter sport played on an ice rink. Two teams of players wearing skates and utilizing long sticks with a curved blade at the end attempt to put a hard rubber puck into the opponent's net. A rink in Canada and the United States is typically 200 feet long and 85 feet wide, in Europe a rink is slightly longer than 200 feet but significantly wider than North American rinks at 98.5 feet. The rink is generally rectangular in shape but the corners are rounded. The ice surface is surrounded by boards that have Plexiglas and netting on top to keep the puck from going into the stands and injuring spectators.

The game of ice hockey is played with six players on the ice at one time. The six players include three forwards, two defensive players, and a goalie. The three forwards consist of a right wing, a left wing, and the center. The center plays in between the two wingers and controls the flow of play, the two defensive plays side by side. An interesting aspect of the players in the ice hockey game is that, despite being labeled forwards and defense, all players

[16] Encyclopaedia of world sports from Ancient times to the present
(David Levison and Karen Christensen)

on the ice have both offensive and defensive responsibilities, with the exception of the goalie, the goalie's primary job is to keep the puck out of the net and sometimes communicate with the other players on the ice.

Ice hockey is started with all players on their side of the center line; the puck is dropped between two centers in a face off, and each player attempts to win possession of the puck. The game is normally divide into three equal periods of play, professional and international games are played in three twenty-minute period of stop time, each time the puck is out of play the clock stops. In ice hockey there are several tactics during play, tactics such as breakout; this is where defending team gains possession of the puck in the defensive zone, and work to move the puck into the neutral zone while maintaining possession of the puck. The goal of ice hockey is to score more goals than the opponent,. A goal is scored when the puck crosses completely over the opponent's goal line.

There are a number of rules in ice hockey that impact the game, two violations of this rules that do not results in penalties are icing and offside, Icing is called when the puck is played from the defensive side of the centerline across the end line. Offside is called when a player crosses into the offensive zone ahead of the puck; both of these rules attempt to eliminate the opportunity for teams to score easily goals by having a player stay in the offensive zone, behind the defensive team or ahead of the puck. There are a number of other rule violations that results in penalties to players.

The team that scores more goals at the end of regulation time is declared the winner.

For each sport I selected one regular season to study, for each team in each sport I recorded the number of winnings and the number of loses, also where there is tie. In the NBA data was taken from 2005-2006 season, there are 29 teams and each plays 82 regular season games, the home-court advantage is thought to be important in NBA, teams play non-sudden-death overtime periods until a team wins the game; thus ties are not possible.

There are 30 teams in NHL, with each team playing 82 games in the regular season; I recorded the results of the 2005 regular season. MLB data was recorded from 2006 overall season standings, MLB consist of 30 teams and each team played not less than 100 games, tie is not possible.

3.4 The expected variances

The winning fraction, the ratio of wins to total games quantifies the team strength, thus the distribution of the winning fractions measures the parity between teams in the league, and I characterize the parity among teams by the variance in the winning fraction from season-end standings data. The amount of chance (randomness) present in the game was measured by the expected variance of the total points and the variance from the random table,

When we compare 97.5% percentile of the random variance to the observe variance, it could be seen that the game with more chance element has the 97.5% percentile of the random variance very close to the variance of the observe variance. From table 5 below, it can be noted that all the three games have total observed variance very far from the 97.5% percentile of the random variance. We can conclude that the distributions of points in the three games were not random, and that they are games of more skills than chance.

League	Year	Games	Observed Variance	97.5 percentile Expected variance
NBA	2005-2006	2460	186.8479	47.3882
NHL	2005-2006	2741	272.8609	112.8609
MLB	2005-2006	3368	52.6741	34.2856
FA	2004-2005	760	291.8421	108.7921

The table 5 (a):summary of the sports statistical data; listed are ,season year, total number of game, variance of the observed league and the expected variances of the mock sports for the four sports.

League	Mean	Minimum	Maximum	Observed/Expected variance
NBA	30.5147	8.0002	78.1556	3.9
NHL	71.7348	20.3782	173.2057	2.4
MLB	21.8291	6.2334	53.2493	1.5
FA	63.1458	13.3158	184.0526	2.7

TABLE 5 (b):summary on the variance analysis on the four sports; listed are the distribution of the variance from the random league for the four major sports and the ratio of observed variance and the expected variance.

4 Tennis

4.1 Description

The term tennis can be applicable to lawn tennis or table tennis. Tennis most often refers to lawn tennis which a game is played by two players or two teams that alternate hitting a ball over a net upon an outdoor court. Table tennis, a scaled down indoor version of lawn tennis, is more commonly known as Ping Pong. While the rules vary greatly between table tennis and lawn tennis there are many similarities between the two games. We will now place all our emphasis on lawn tennis, Tennis is a game played by two persons (singles) or by two teams of two persons (double); for singles, the court measures 24 by 8.4 metres and in doubles the sides are extended to make it 24 by 11 metres. The court is divided in half by a net 0.91 metres high at the centre and 1.1 metres at the sides, the players goal is to hit the ball into the prescribed area of the court in such a way that it can not be returned. The ball is served diagonally from behind the baseline and must bounce in the opposite service court beyond the net. After the serve, the ball may be returned into any area of the opponent's court and may be hit by forehand or backhand ground stroke (after one bounce) or by volley or overhead (before it bounces). The point is lost by the first player who hits the ball into the net, beyond opponent's baseline (long), beyond the opponent's sideline (wide), or who allow the ball to bounce more than one in his own court, points may be won by either the server or receiver. A set is won by the first player to win six games while leading by at least two games; if neither

player gains a wining margin, today a tie-breaker is normally played at 6-6. The tie-breaker (and the set) is won by the first player to win 7 points while leading by at least 2. In championship play, women's matches are normally won by taking two of three sets, and men's either two or three of five sets. The analysis will be based on rankings of players at the end of seasons' tournaments; the data from ATP will be used for this analysis.

ATP stands for Association of Tennis Professionals and is the international circuit of men's tennis tournaments. The association was formed in 1972 to protect the interest of male professional tennis players; the association is the principal organizer of worldwide tennis tournaments, known as the ATP tours. The ATP tours at the present has five categories of tennis tournaments belonging to its tour, Grand Slam events, Masters Series, International Series Gold, International Series, Challenger Series, Delta Tour) and the World Team Cup; Players who earn the most tour points play season-ending events, players who earns the most single points can play in the Tennis masters cup.

4.2 RANKINGS

ATP is responsible for the ATP rankings; "the ATP defines the ATP Race as the annual race from season start to season end. The player who accumulates the most appoints by the season's ends is rank the world number one. And claims that the Race "is the mathematical method of ranking male professional tennis players on a calendar-year basis."

The ATP defines the ATP Entry Ranking as "the objective merit-based method used for determining qualification for entry and seeding in all Tournaments for singles and doubles, The Entry Ranking period is the immediate past 52 weeks"[17].

What is the variability in tennis? Does the same person rank number one each and every year season? Clearly not and sometimes it maybe possible for a particular player to be the world number one rank for some consecutive years,

4.3 Analysis of the rankings

I considered the ranking from the beginning of the season year for three consecutive years, starting from 2004 to 2006.I recorded the rankings for about 50 players who have been participating in all the major tennis tournaments for the three consecutive year under study, they are also available in almost all the rankings by the ATP. Figure 2 below shows the plots the association between the rankings in the season year 2004 and 2005.

[17] Source of information ; http://en.wikipedia.org/wiki/ATP_rankings

From the graph it could be noted that, the plot of rank in January 2004 vs. January 2005, shows sparsely association between each players' rank, which means that players can be consistent with their position on the ATP ranking from the beginning of the season's year to the following year. The spearman correlation test is used to compute the correlation between the rankings under the null hypothesis of independence association between the two rankings and calculate the exact value of the correlation coefficient rho (ρ). The figure (a) in the appendix is the R-programme output of the Spearman's rank correlation test, from the outputs the first test (i) has p-value 1.397e-05 and the correlation coefficient rho = 0.616. From the second test (ii) the p-value < 9.928e-05 and the correlation coefficient rho= 0.548. I reject the null hypothesis of independence association between the two rankings; and can conclude that rankings are correlated and that it was not randomly generated but rather depends on the performance of individual players, which means that tennis is not a game of chance but is a game of skills, The correlation coefficient in both outputs in figure (a) was found to be very high above 0.5 and the association is very strong, Players such as Federer Roger (SUI), Nedal Rafael (ESP), Gonzalez Fernando (CHI), etc maintained their position of 1st, 2nd and 11th respectively on the ranking table from the beginning of the year 2005 to 2006, players performance at the beginning of season year reflect at the end of the year and most players are likely to maintain their position at the end of year season.

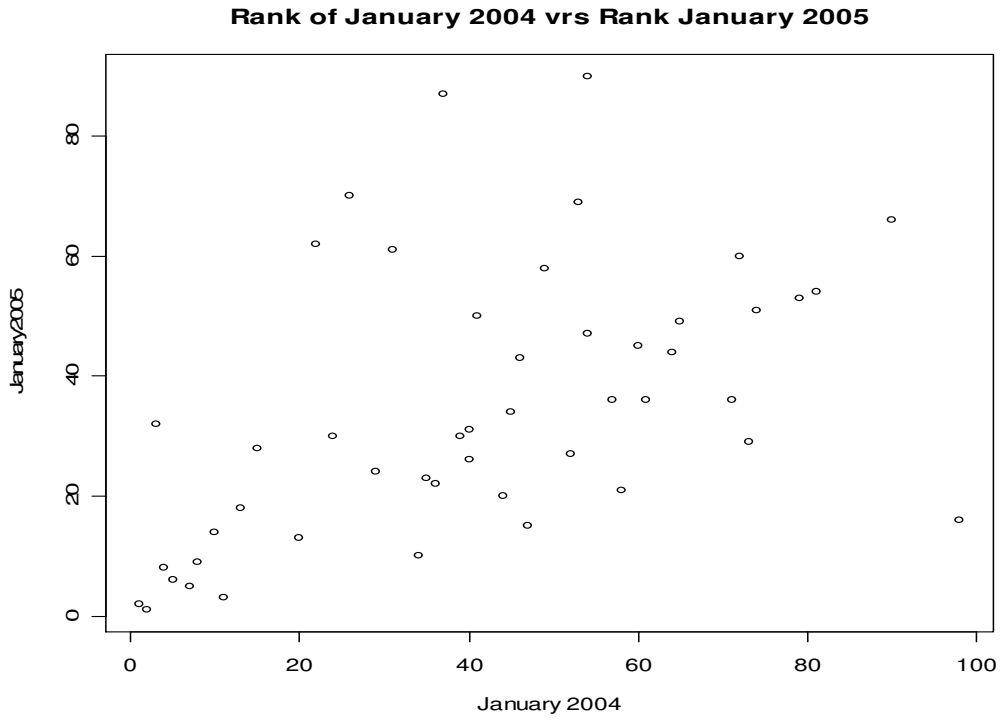

Figure 2.0 Plot of ATP rankings of various players; showing the association of their rankings between 2004 and 2005 season

5. Golf game

3.1 Description

In match play, opponents compete hole by hole, with a point score for the winner of each hole. Every game of golf is based on playing a number of holes in a given order. A round typically consists of 18 holes that are played in the order determined by the course layout. On a nine-hole course, a standard round consists of two successive nine-hole rounds. A hole of golf consists of hitting a ball from a tee on the teeing ground (a marked area designated for the first shot of a hole), and, once the ball comes to rest, striking it again, and repeating this process until the ball at last comes to rest in the cup. Once the ball is on the green (an area of finely cut grass) the ball is usually putted (hit along the ground) into the hole. The borders of a course are marked as such, and beyond them is *out of bounds*, that is, ground from which a ball must not be played. Some areas on the course may be designated as *ground under repair*, meaning that a ball coming to rest in them may be lifted and then played from outside such ground without penalty. Certain man-made objects on the course are defined as *obstructions*, and specific rules determine how a golfer may proceed when the play is impeded by these.

The aim of holing the ball in as few strokes as possible may be impeded by various hazards, such as bunkers and water hazards**.**

5.2 Professional golf tours

The major championships are the four most prestigious men's tournaments of the year. In current chronological order they are:

- The Masters
- U.S. Open
- The Open Championship (referred to in North America as the British Open)
- PGA Championship

There are at least twenty professional golf tours, each run by a PGA or an independent tour organization, which is responsible for arranging events, finding sponsors, and regulating the tour. The most widely known tour is the PGA (Professional Golf Association) TOUR (officially rendered in all caps), which attracts the best golfers from all the other men's tours. This is due mostly to the fact that most PGA TOUR events have a first prize of at least USD 800,000. The European Tour, which attracts a substantial number of top golfers from outside North America, ranks second to the PGA TOUR in worldwide prestige. Some top professionals from outside North America play enough tournaments to maintain

membership on both the PGA TOUR and European Tour. The golf game is a one person game, in which the outcome is mainly influence by the individual players, The data in table 1.2 below is taken from the full leader board from golf competition in an open championship and the second table 1.3 is taken from the PGA Tour from 2003 to 2005, both tables consist of the same players participating in the three consecutive years of the Open-championship competition,

From the original results some of the players were not able to qualify to the third round because they could not obtain scores more or equal to the cut-off points, to analysed this data, we summed the total scores obtained from the first two rounds by each player as the total score.

5.3 Analysis of golf game results

The plot in figure 3.0 shows the correlation of the results of players in the various tournaments, the graph does not show very good correlation between the scores obtained by players in all competitions; to verify the correlation, the spearman correlation test is use to check the association and calculate the exact correlation coefficient for the strength of the association, and test the null hypothesis of independence association between results of individual players in all the tournaments. The R-programme output of the test is presented in figure 3.0 in the appendix, from the result output we fail to reject the null hypothesis of no association because the test has a *p-value = 0.4038,* greater than 0.05, it could be noted that the correlation is not very strong, from the output the correlation coefficient was calculated to be $rho(\rho)$ = 0.03458722. Test on all the tournaments shows similar results, which means that the various players participating in the tournaments can perform well in some competition and be failure in the subsequent competitions. We can conclude from the above results that scores obtain in golf competition are not consistent for the players. Golf game therefore seems to be a game that involves more chance than skills; The chance element in golf is very significant in games involving players ranking say the first 20 ranks ,but is less chance and the skills is very much significant in competition involving low ranking players and high ranking players. Therefore to classified golf as a game of skills or chance depends on the hierarchy of the participating players in the particular tournaments.

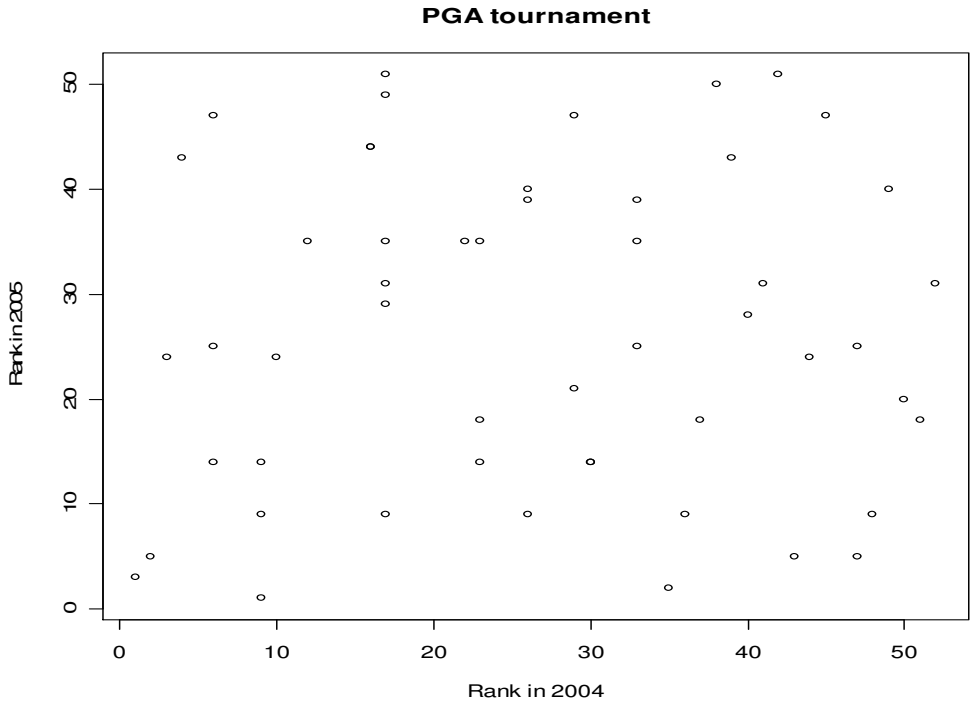

Figure 3: the plot of rankings of players in PGA tournament of 2004 and 2005, showing very weak correlation in the rankings of players in the two tournaments

5.4 Comparing Golf and Tennis tournaments

The analysis on the two sports shows different pattern of correlation, to verify the difference in correlation of the rankings, I compare the rankings of players that have been participating in any two recent tournaments in one particular year, and two separate tournaments of tennis and golf in 2006 were selected, in a game of skills players that have participated in tournament are able to maintain their form or improve their performance due to constant training in the subsequence competition in the same year, The U.S.Open Championship 2006 and The Masters tournament 2006 are the golf tournaments considered, for tennis tournament ATP tour 2006 and the US Open Tennis championship was also taken into consideration. The spearman rank correlation test on the two golf tournament with the p-value = 0.1090, shows weaker correlation between the ranks of players in the two tournaments, on the other hand the tennis tournaments proved to have strong correlation with p-value = 3.538e-06, tennis games can be classified as being more skills than golf games, for

instance top players in golf tournament such as Tiger Woods fell from 3rd rank in the Masters and ranking 82nd in the US Open tournament all the same year, whiles in tennis top players maintain their positions in all the tournaments. The figure.4 below illustrates the pattern of the correlation of the rankings of players in tennis and golf tournament in 2006.

The analysis of tennis rankings was based on the whole year, this players participated regularly in all major tournaments throughout the season year, players accumulates points from the start of the season to the end of season year; the correlation test reflect the actual association of the players performance in that particular year, the statistical analysis was easy to perform. On the other hand if the analysis was based on a single tournament ranking, there will not be sufficient data for the analysis and also the players participating in single tournament might not be consistent in their rankings, this would affect the correlation test, and the correlation test will not provide enough evidence on the association of the rankings players in tennis tournaments. the analysis of golf rankings was based on different tournaments throughout the year; the selected players participated regularly in all the considered tournaments, there was sufficient and available information on the rankings of the individual players, the statistical analysis via the correlation test was easy to present, it was possible to test the correlation between different tournaments in the same year, which gives the exact representation of players rankings, a player can perform poorly in one tournament , but can be excellent in different tournament in the same year, if the analysis was based on single tournament; correlation test would not give enough information on the chance element in golf , and also the results would have been different ,with different correlation coefficient , that data will not also give sufficient information on player rankings, each correlation test on each single tournament would produce different correlation coefficient, which would make it difficult to make conclusion on the chance element in golf.

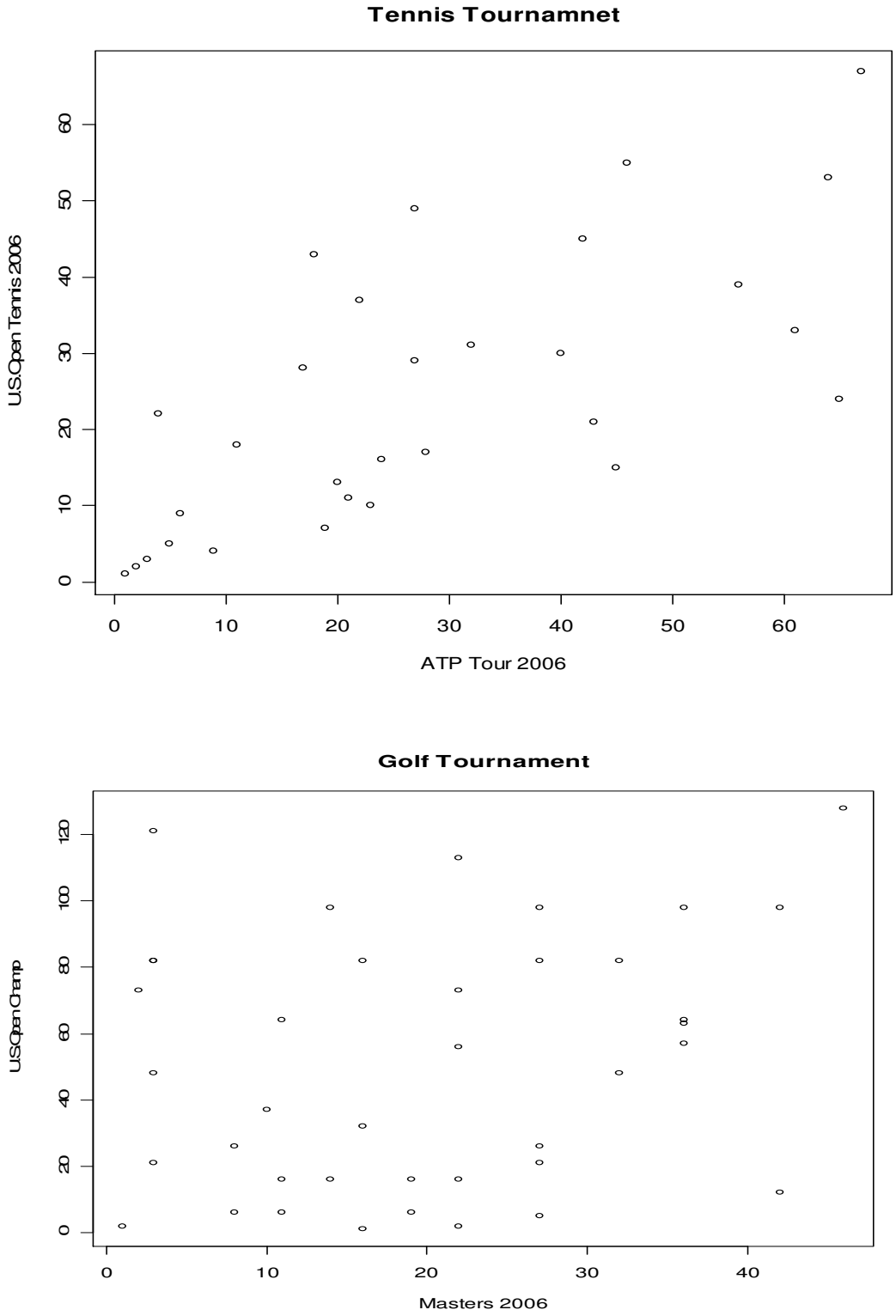

Figure.4; plot of the rankings of players in tennis and golf tournament

6 Conclusions

The purpose of this paper was to use statistical analysis to measure skills level and chance present in games. In this paper I presented statistical analysis of the results of sports competitions, the data was taken from major competition results, as it can be seen from appendix A. The randomness present in each game was the main factor used as the measure of amount of skills and the chance element present in the games.

The analysis for association football (soccer) was based on English premiership league season 2004-2005; the data can be seen in table 1 Appendix. The distribution of points in Football (soccer) game have been proved to be far from randomness (chance), the outcome of football (soccer) game is by skills, when a stronger team plays a weaker team in several games in football(soccer) tournament, the stronger team is expected to win more times than the weaker one. Table 1.0 present soccer table of the English premier League, from the table Chelsea top the league with 98 points followed by Arsenal with 83 points, the bottom teams were Norwich City with 33 points and Southampton with 32 points, the reconstructed table 1, shows that 19^{th} position team top the league with 69 points followed by the 4^{th} position team with 63 points and the 13^{th} position team being the last with 32 points, when comparing the two tables, it implies that if Football(soccer) were a game of chance then the Norwich City would have top the league in table 1.0 and the 13^{th} position team Fulham would be relegated from the premiership to lower division league.

To compare the level of skills and chance in the four leagues, the ratio of the observed variance to the expected variance shows that, Basketball (NBA), Baseball(MLB), Hockey(NHL) and Football (soccer) FA had different level of chance element present the outcomes, baseball stands out from the four sports with the least ratio of 1.5 and that from the analysis the variance of the randomly generated outcome was very closed to the observed variance from the MLB tournaments, this make baseball game of more chance related than skills, even the best MLB teams can lose to the worse MLB teams, which can be true at different levels of baseball tournaments, Basketball is the league with the highest ratio of 3.9, which implies that in basketball the difference in observed variance and the expected variance is wide, that makes the outcome of the results in basketball tournaments far from randomness, in a basketball competition if every player in one team is better than every player on the opposition side, the better team will win virtually every game. Football (soccer) is

second to basketball in the skills level of the three sports, the skills level shows up more in the NBA than in the NHL and MLB.

The chance element involved in Golf and Tennis was found to be different, golf stands out to be different from tennis in the amount of chance involved in the outcome. I used the spearman correlation test to test the correlation between the outcome points of several tournaments of golf and the ATP rankings of tennis, the correlation was strong in the tennis rankings and it was not strong in golf, the outcome of golf tournaments was found to be very close to randomness (chance), in golf tournaments such as the open championship players who fall at the button of the final leader board in previews tournament may have equal probability of wining the subsequent tournaments. The correlation in tennis ranking was very strong; players who rank in the top position have high probability of maintaining their positions in the subsequent years, Federer Roder (Switzerland) was the best player on the ATP in January 2005 and June 2005, when there is several tournament matches involving Federer and player like Martin Alberto (Spain) who also rank 61st and 52nd in January 2005 and June 2005 respectively, Federer Roger stand the chance of winning more times than Martin Alberto .

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Appendix

Figure 3.0 spearman correlation test, output from R-programme

Figure (a)

i. Spearman's rank correlation rho

data: d$JANUARY2004 and d$JANUARY2005

S = 4736.767, p-value = 1.397e-05

alternative hypothesis: true rho is not equal to 0

sample estimates:

rho

0.6161764

Warning message:

Cannot compute exact p-values with ties in: cor.test.default(d$JANUARY2004, d$JANUARY2005, method = "spearman")

ii. Spearman's rank correlation rho

data: d$JANUARY2005 and d$JANUARY2006

S = 6868.905, p-value = 9.928e-05

alternative hypothesis: true rho is not equal to 0

sample estimates:

rho

0.547503

Warning message:

Cannot compute exact p-values with ties in: cor.test.default(d$JANUARY2005, d$JANUARY2006, method = "spearman")

PLAYER	Rank Masters 2006	Rank USOpen 2006
P. Mickelson	1	2
T. Clark	2	73
J. Olazabal	3	21
R. Goosen	3	121
T. Woods	3	82
C. Campbell	3	82
F. Couples	3	48
A. Cabrera	8	26
V. Singh	8	6
S. Cink	10	37
M. Weir	11	6
M. Jimenez	11	16
S. Ames	11	64
A. Oberholser	14	16
B. Mayfair	14	98
G. Ogilvy	16	1
S. Verplank	16	82
R. Pampling	16	32
N. O'Hern	19	6
D. Howell	19	16
R. Allenby	22	16
D. Love III	22	113
M. Hensby	22	73
J. Furyk	22	2
D. Clarke	22	56
A. Scott	27	21
C. Pettersson	27	98
P. Harrington	27	5
S. Katayama	27	82
E. Els	27	26
B. Jobe	32	82
T. Bjorn	32	48
R. Sabbatini	36	64
T. Herron	36	63
R. Mediate	36	98
B. Curtis	36	57
L. Donald	42	12
R. Beem	42	98
S. Garcia	46	128

http://www.usopen.com/2006/scores/alllb.html

http://www.masters.org/en_US/news/index.html

Table 1 - ATP Ranking from Jan 2004 - June 2006

Player	JAN 04	JUNE04	JAN 05	JUNE 05	JAN06	JUNE 06
Federer, Roger,(SUI)	2	1	1	1	1	1
Nadal, Rafael,(ESP)	41	46	50	3	2	2
Nalbandian, David,(ARG)	8	4	9	19	6	3
Ljubicic, Ivan,(CRO)	36	29	22	16	9	4
Roddick,,Andy,(USA)	1	2	2	4	3	5
Davydenko,,Nikolay,(RUS)	52	59	27	7	5	6
Blake,,James,(USA)	39	38	30	32	23	7
Robredo,,Tommy,(ESP)	20	19	13	14	19	8
Hewitt,,Lleyton,(AUS)	11	10	3	2	4	9
Ancic,,Mario,(CRO)	73	63	29	17	21	10
Gonzalez,,Fernando,(CHI)	35	26	23	24	11	11
Gaudio,,Gaston,(ARG)	34	11	10	12	15	12
Stepanek,,Radek,(CZE)	45	67	34	13	20	13
Berdych,,Tomas,(CZE)	64	65	44	49	24	14
Kiefer,,Nicolas,(GER)	58	33	21	26	22	15
Nieminen,,Jarkko,(FIN)	37	60	87	42	28	18
Ferrer,,David,(ESP)	74	65	51	15	14	19
Agassi,,Andre,(USA)	4	9	8	6	7	20
Johansson,Thomas(SWE)	40	38	31	22	13	21
Hrbaty,,Dominik,(SVK)	44	25	20	25	18	22
Haas,,Tommy,(GER)	98	100	16	23	45	24
Coria,,Guillermo,(ARG)	5	3	6	18	8	25
Grosjean,Sebastien(FRA)	10	13	14	27	25	26
Andreev,,Igor,(RUS)	79	64	53	42	26	27
Ferrero,,Juan,Carlos,(ESP)	3	5	32	31	17	28
Rochus,,Olivier,(BEL)	49	74	58	35	27	29
Verdasco,Fernando(ESP)	71	40	36	34	32	30
Acasuso,,Jose,(ARG)	90	97	66	46	40	32
Massu,,Nicolas,(CHI)	13	12	18	29	61	33
Mathieu,,Paul-Henri,(FRA)	81	80	54	58	46	35
Serra,,Florent,(FRA)	54	52	90	94	49	36
Soderling,,Robin,(SWE)	57	37	36	37	74	37
Srichaphan,Paradorn(THA)	15	14	28	45	42	38
Rusedski,,Greg,(GBR)	60	48	45	40	37	40
Youzhny,,Mikhail,(RUS)	47	35	15	34	43	41
Moya,,Carlos,(ESP)	7	7	5	21	31	42
Malisse,,Xavier,(BEL)	54	51	47	51	47	43
Santoro,,Fabrice,(FRA)	65	53	49	53	65	45
Chela,,Juan,Ignacio,(ARG)	40	18	26	44	39	48
Lopez,,Feliciano,(ESP)	29	22	24	33	33	49
Martin,,Alberto,(ESP)	53	61	69	52	53	51
Horna,,Luis,(PER)	61	58	36	55	81	52
Mirnyi,,Max,(BLR)	24	28	30	36	60	53
Volandri,,Filippo,(ITA)	46	52	43	32	56	56
Clement,,Arnaud,(FRA)	31	47	61	62	64	57
Calleri,,Agustin,(ARG)	22	41	62	50	52	58
Bjorkman,,Jonas,(SWE)	26	27	70	97	66	59
Karlovic,Ivo,(CRO)	72	62	60	56	67	60

[http://www.atptennis.com/en/players/entrysystem/Default.asp?range=1-50&country=&RankDate=1/19/2004]

R- code for re-construction the random tables

FA re-construction programe

```
vp<-numeric(100)
for (n in 1:100){
z<-c(rep(3,270),rep(1,220),rep(0,270))
z<-sample(z)
result<-matrix(numeric(60),nrow=20,byrow=T)
pts<-rep(0,20)
j<-1

for(i in seq(1,760,38)){
x<-z[i:(i+37)]
result[j,1:3]<-c(length(x[x==3]),length(x[x==1]),length(x[x==0]))
res<-data.frame(result)
names(res)<-c("W","D","L")
pts<-3*res$W+0*res$L+1*res$D
t<-cbind(res,pts)
vp[n]<-var(t$pts)
j<-j+1
}
}
 quantile(vp,0.975,)  ## calculating the 97.5 percentile
##END##


##NBA--re-construction programme
rm()
vp<-numeric(1000)
for (n in 1:1000){

z<-c(rep(1,1230),rep(0,1230))
z<-sample(z)
result<-matrix(numeric(60),nrow=30,byrow=T)
pts<-rep(0,30)
j<-1

for(i in seq(1,2460,82)){
x<-z[i:(i+81)]
result[j,1:2]<-c(length(x[x==1]),length(x[x==0]))
res<-data.frame(result)
names(res)<-c("W","L")
  pts<-(1*res$W/(1*res$W+1*res$L))*100
  t<-cbind(res,pts)
j<-j+1

}
vp[n]<-var(t$pts)
}
##END##
```

```
##NHL--re-construction programme

rm()
vp<-numeric(10000)
for (n in 1:10000){
z<-c(rep(2,1230),rep(0,949),rep(1,281))
z<-sample(z)
result<-matrix(numeric(90),nrow=30,byrow=T)
pts<-rep(0,30)
j<-1

for(i in seq(1,2460,82)){
x<-z[i:(i+81)]
result[j,1:3]<-c(length(x[x==2]),length(x[x==0]),length(x[x==1]))
res<-data.frame(result)
names(res)<-c("W","L","OTL")
pts<-2*res$W+0*res$L+1*res$OTL
t<-cbind(res,pts)
vp[n]<-var(t$pts)
j<-j+1
}
}
```

##END##

```
##MLB--re-construction programme

rm()
vp<-numeric(1000)
for (n in 1:1000){

z<-c(rep(1,1684),rep(0,1684))
z<-sample(z)
result<-matrix(numeric(60),nrow=30,byrow=T)
pts<-rep(0,30)
j<-1

for(i in seq(1,3368,113)){
x<-z[i:(i+112)]
result[j,1:2]<-c(length(x[x==1]),length(x[x==0]))
res<-data.frame(result)
names(res)<-c("W","L")
  pts<-(1*res$W/(1*res$W+1*res$L))*100
  t<-cbind(res,pts)
j<-j+1

}
vp[n]<-var(t$pts)
}
```

##END##

2006 Major League Standings

MLB	W	L	PCT	GB	HOME	ROAD	RS	RA	STRK	L10
Detroit	76	37	.673	-	37-18	39-19	591	443	Lost 1	04-jun
NY Yankees	66	43	.606	8	36-19	30-24	606	510	Lost 1	03-jul
NY Mets	67	44	.604	8	33-22	34-22	596	501	Won 3	03-jul
Chicago Sox	66	45	.595	9	35-20	31-25	631	542	Won 1	04-jun
Minnesota	66	46	.589	9.5	39-15	27-31	581	509	Won 1	03-jul
Boston	65	46	.586	10	35-17	30-29	610	553	Lost 3	06-apr
Oakland	62	51	.549	14	30-25	32-26	511	501	Won 6	01-sep
St. Louis	61	51	.545	14.5	33-23	28-28	554	542	Lost 1	07-mar
LA Angels	59	54	.522	17	27-28	32-26	557	523	Won 4	04-jun
Toronto	59	54	.522	17	37-24	22-30	593	557	Lost 1	08-feb
San Diego	58	54	.518	17.5	28-31	30-23	506	501	Lost 1	06-apr
Cincinnati	58	55	.513	18	30-30	28-25	556	584	Won 1	07-mar
LA Dodgers	58	55	.513	18	33-24	25-31	576	524	Won 11	10-0
Arizona	57	56	.504	19	28-29	29-27	567	571	Won 1	05-maj
Texas	56	58	.491	20.5	26-30	30-28	577	570	Lost 4	05-maj
Seattle	55	57	.491	20.5	30-29	25-28	526	519	Won 2	04-jun
Houston	54	58	.482	21.5	31-26	23-32	509	525	Won 1	04-jun
Philadelphia	54	58	.482	21.5	27-31	27-27	574	586	Lost 1	04-jun
Colorado	54	58	.482	21.5	28-26	26-32	508	496	Lost 3	05-maj
San Francisco	54	59	.478	22	31-28	23-31	522	528	Lost 1	07-mar
Milwaukee	52	60	.464	23.5	32-24	20-36	506	593	Lost 3	06-apr
Atlanta	52	60	.464	23.5	23-29	29-31	583	574	Won 1	06-apr
Florida	52	60	.464	23.5	27-28	25-32	518	540	Won 1	06-apr
Baltimore	51	63	.447	25.5	30-31	21-32	548	636	Won 1	06-apr
Washington	49	63	.438	26.5	26-25	23-38	515	578	Lost 3	07-mar
Chicago Cubs	48	64	.429	27.5	25-31	23-33	471	571	Won 3	03-jul
Cleveland	47	64	.423	28	26-30	21-34	598	570	Lost 4	08-feb
Tampa Bay	47	67	.412	29.5	29-26	18-41	504	615	Lost 2	06-apr
Pittsburgh	42	71	.372	34	28-28	14-43	503	571	Lost 3	05-maj
Kansas City	39	73	.348	36.5	24-33	15-40	512	676	Won 1	07-mar

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NBA Overall Standings 2005-2006

NBA	W	L	PCT	GB	HM	RD	CONF	DIV	PF	PA	DIFF
z-Detroit	64	18	.780	-	apr-37	27-14	39-13	13-mar	96.8	90.2	+6.7
z-San Antonio	63	19	.768	1	jul-34	29-dec	okt-42	13-mar	95.6	88.8	+6.8
y-Phoenix	54	28	.659	10	31-okt	23-18	32-20	06-okt	108.4	102.8	+5.6
y-Miami	52	30	.634	12	31-okt	21-20	35-17	13-mar	99.9	96.0	+3.9
y-New Jersey	49	33	.598	15	29-dec	20-21	33-19	06-okt	93.8	92.4	+1.4
y-Denver	44	38	.537	20	26-15	18-23	25-27	06-okt	100.3	100.1	+0.2
x-Dallas	60	22	.732	4	jul-34	26-15	37-15	13-mar	99.1	93.1	+6.1
x-Cleveland	50	32	.610	14	31-okt	19-22	34-18	05-nov	97.6	95.4	+2.2
x-Memphis	49	33	.598	15	30-nov	19-22	31-21	10-jun	92.2	88.5	+3.7
x-Washington	42	40	.512	22	27-14	15-26	29-23	08-aug	101.7	99.8	+1.9
x-LA Clippers	47	35	.573	17	27-14	20-21	27-25	09-jul	97.2	95.6	+1.6
x-Indiana	41	41	.500	23	27-14	14-27	24-28	10-jun	93.9	92.0	+1.9
x-LA Lakers	45	37	.549	19	27-14	18-23	27-25	07-sep	99.4	96.9	+2.5
x-Chicago	41	41	.500	23	21-20	20-21	30-22	12-apr	97.8	97.2	+0.6
x-Sacramento	44	38	.537	20	27-14	17-24	30-22	06-okt	98.9	97.3	+1.5
x-Milwaukee	40	42	.488	24	25-16	15-26	29-23	10-jun	97.8	98.8	-1.0
Utah	41	41	.500	23	22-19	19-22	26-26	05-nov	92.4	95.0	-2.6
Philadelphia	38	44	.463	26	23-18	15-26	22-30	06-okt	99.4	101.3	-2.0
NO/Oklahoma City	38	44	.463	26	24-17	14-27	25-27	09-jul	92.8	95.6	-2.8
Orlando	36	46	.439	28	26-15	31-okt	24-28	07-sep	94.9	96.0	-1.1
Seattle	35	47	.427	29	22-19	13-28	20-32	06-okt	102.6	105.6	-3.0
Boston	33	49	.402	31	21-20	29-dec	19-33	06-okt	98.0	99.5	-1.5
Houston	34	48	.415	30	15-26	19-22	19-33	15-jan	90.1	91.7	-1.6
Toronto	27	55	.329	37	15-26	29-dec	20-32	10-jun	101.1	104.0	-3.0
Golden State	34	48	.415	30	21-20	13-28	19-33	12-apr	98.5	99.8	-1.4
Charlotte	26	56	.317	38	17-24	9-32	18-34	11-maj	96.9	100.9	-4.0
Minnesota	33	49	.402	31	24-17	9-32	20-32	10-jun	91.7	93.6	-1.9
Atlanta	26	56	.317	38	18-23	8-33	19-33	11-maj	97.2	102.0	-4.8
New York	23	59	.280	41	15-26	8-33	15-37	12-apr	95.6	102.0	-6.4
Portland	21	61	.256	43	15-26	6-35	10-42	13-mar	88.8	98.3	-9.5

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NHL Standings 2005-2006

	GP	W	L	OTL	PTS	GF	GA	PP%	PK%
*-z-Detroit	82	58	16	8	124	305	209	22.1	85.5
y-Ottawa	82	52	21	9	113	314	211	20.8	84.7
y-Dallas	82	53	23	6	112	265	218	17.7	83.7
y-Carolina	82	52	22	8	112	294	260	17.9	81.8
x-Buffalo	82	52	24	6	110	281	239	21.2	86.6
x-Nashville	82	49	25	8	106	259	227	18.4	84.6
y-Calgary	82	46	25	11	103	218	200	18.2	84.3
x-New Jersey	82	46	27	9	101	242	229	17.7	81.9
x-Philadelphia	82	45	26	11	101	267	259	18.0	79.1
x-NY Rangers	82	44	26	12	100	257	215	18.8	83.7
x-San Jose	82	44	27	11	99	266	242	18.2	80.7
x-Anaheim	82	43	27	12	98	254	229	18.1	83.5
x-Colorado	82	43	30	9	95	283	257	18.8	84.6
x-Edmonton	82	41	28	13	95	256	251	18.1	84.1
x-Montreal	82	42	31	9	93	243	247	19.2	81.1
x-Tampa Bay	82	43	33	6	92	252	260	16.7	81.6
e-Vancouver	82	42	32	8	92	256	255	18.3	81.8
e-Toronto	82	41	33	8	90	257	270	21.4	80.0
e-Atlanta	82	41	33	8	90	281	275	19.0	79.3
e-Los Angeles	82	42	35	5	89	249	270	14.2	78.7
e-Florida	82	37	34	11	85	240	257	15.3	82.3
e-Minnesota	82	38	36	8	84	231	215	17.0	87.4
e-Phoenix	82	38	39	5	81	246	271	17.7	80.9
e-NY Islanders	82	36	40	6	78	230	278	16.9	79.2
e-Columbus	82	35	43	4	74	223	279	14.2	81.8
e-Boston	82	29	37	16	74	230	266	14.8	83.7
e-Washington	82	29	41	12	70	237	306	14.7	78.9
e-Chicago	82	26	43	13	65	211	285	12.2	83.9
e-Pittsburgh	82	22	46	14	58	244	316	19.0	78.8
e-St. Louis	82	21	46	15	57	197	292	14.6	82.2

http://sports.espn.go.com/nhl/standings?season=2006&group=league&column=points&order=false&seasontype=2