

An insight to the ranking systems used in the Men's singles tennis and how this impacts the performance of a player in a major tournament

Olly Barnes

March 2020

Abstract

Tennis has a unique ranking system compared to other sports. This paper will provide an insight to how accurate this ranking system is. Additionally, it will broaden our understanding as to how players are seeded prior to a major tennis tournament and whether this impacts a player's progress through a knockout tournament, based on their seeded starting position. This paper will only be looking at the Men's singles world rankings and seeded positions for the 4 major grand slams from 2009-2019 due to the vast amounts of data.

Table of Contents

Abstract	1
1 Introduction	3
1.1 Ranking System	3
1.2 Protected Ranking	4
1.3 Grand Slams	4
1.4 Wimbledon	5
1.5 Tournament Bracket	6
2 Methodology	7
2.1 Data Collection	7
2.2 Hypothesis	7
3 Results.....	8
3.1 Linear Regression	8
4 Analysis	9
4.1 Seeded Players	9
4.2 Unseeded Players	9
5 Conclusion	11
Bibliography	12

1 Introduction

1.1 Ranking System

The ranking system used in tennis is called the men's Association of Tennis Professionals (ATP) and is updated weekly [1]. The period used for this ranking system is 52 weeks. Points that count towards your ranking can be gained at any ATP tournament. In 2009 the ATP tour tournament categories were changed to a four tier system. The four tiers of events are: Grand Slams, Masters 1000, ATP 500 and ATP 250. The following points can be earned by a player in each competition:

Figure 1.1

	Points obtained			
Position	Grand slams	Masters 1000	ATP 500	ATP 250
Winner (1 st)	2000	1000	500	250
Runner up (2 nd)	1200	600	300	150
Semi-finalist (3 rd -4 th)	720	360	180	90
Quarter-finalist (5 th -8 th)	360	180	90	45
Round of 16 (9 th -16 th)	180	90	45	20
Round of 32 (17 th -32 nd)	90	45	20	10
Round of 64 (33 rd -64 th)	45	20	N/A	N/A
Round of 128 (65 th -128 th)	10	10	N/A	N/A

[2]

As can be seen from Figure 1.1, points obtained from the Masters 1000 use half of the same totals from the Grand Slams. The ATP 500 is then half of this and ATP 250 is half of this again. Points are gained from the following 18 tournaments: Grand slam (x4), Masters 1000 (x8) and the best 6 results from the last 52 weeks from the ATP 500 and ATP 250.

As the ATP points available vary depending on which tier of tournament is played, less players enter the lower tiered tournaments (ATP 500 and ATP 250) as there are more of these tournaments to be played throughout the year. The range of ability of players in ATP 500 and ATP 250 can vary drastically, as few of the Top 30 players manage to enter the same ATP 500 and ATP 250 tournament whilst many players outside the Top 100 are also entering. However, when it comes to the top tier tournaments (Grand Slams and Masters 1000), almost all Top 30 players will enter with the exception of those who are injured. This is predominantly due to the fact that more ATP ranking points are on offer and also seen as more prestigious events.

At the end of every tournament, players drop points earned the previous year at that same tournament and replace them with the points won that current year. [3] For example, if a player has a total of 1000 points and they then win the French Open (a Grand Slam) in 2015 gaining an additional 2000 points, giving them a total of 3000 points. The next year, in 2016, they finish as the runner-up in the same competition, the French Open, which contributes 1200 points to their total. Their new total they would take away 2000 points earned in 2015

and then add 1200 earned in 2016 giving this player a new total of 2200 points. This means players have to defend the points that they achieved the previous year at each tournament.

Below is an example of what the world rankings for men's singles looks like for the Top 10 in the world as of 20th January 2020.

Figure 1.2

Rank	Player	Points
1	R. Nadal	10235
2	N. Djokovic	9720
3	R. Federer	6590
4	D. Medvedev	5960
5	D. Thiem	5890
6	S. Tsitsipas	5375
7	A. Zverev	3345
8	M. Berrettini	2870
9	R. Bautista Agut	2630
10	G. Monfils	2565

[1]

Current ATP world rankings as of 20/01/2020

1.2 Protected Ranking

When a player is injured and cannot compete in tournaments, they are unable to gain any points and cannot defend points they currently have, resulting in the player dropping down the rankings list. To help players recovering from injury and allow them to still qualify for major tournaments, they can request a protected ranking. However, this only available for players who have been injured for a minimum of six months. This ranking is calculated by taking an average of their ranking during the first three months of their injury.

Although the use of 'Protected Ranking' allows players to still qualify for major tournaments, the player will still fall down the world rankings list temporarily and will not be able to use this ranking to be seeded in a tournament. The player will then have the chance to regain ranking points by competing in tournaments, once recovered from injury. [4]

1.3 Grand Slams

The Grand Slams are the most prestigious tennis tournaments of the year and therefore have the most ATP ranking points available to be won. There are four Grand Slams in a calendar year: Australia Open, French Open, Wimbledon and the US Open.

Both the Australia and US Open play on hard courts and the French open is played on clay which are similar surfaces. However, Wimbledon is the exception and is played on a grass court which is a much faster surface in terms of how quickly the ball bounces off the court

[5]. The men's singles are played as a best of 5 sets, compared to that of all other tournaments throughout the year which are just a best of 3 sets.

All Grand Slams consist of 128 players in a straight knockout tournament. So in total there are 7 rounds with the numbers of players in each round being half number of the round before that. Since June 2001 the decision was made to have a total of 32 players that are seeded in these Grand Slams, with the remaining 96 players left unseeded. This was increased from the original 16 seeds, to in theory avoid early upsets in the early rounds of the bigger tournaments. The idea of the seeds is that if the No.1 seed and No.2 seed (the best two players in the tournament) win all their matches, they will meet in the final.

The Australia, French and US Open all seed their players based directly on their current ATP world ranking prior to the start of the tournament. For example, the player with an ATP world ranking of No.4 prior to one of these tournaments will be the No.4 seed in that tournament.

1.4 Wimbledon

Wimbledon uses a different method to seed its players. Players are seeded via the following formula:

$$\text{Ranking Points} = ATP \times G_{all} + (75\% \times G_{best})$$

Equation 1

"where:

- ATP is the total ATP points accumulated by the player until the Monday before the tournament starts
- G_{all} is the total number of points earned for all grass court tournaments in the past 12 months.
- G_{best} is the number of points awarded for the player's best performance at a grass court tournament in the 12 months before that." [2]

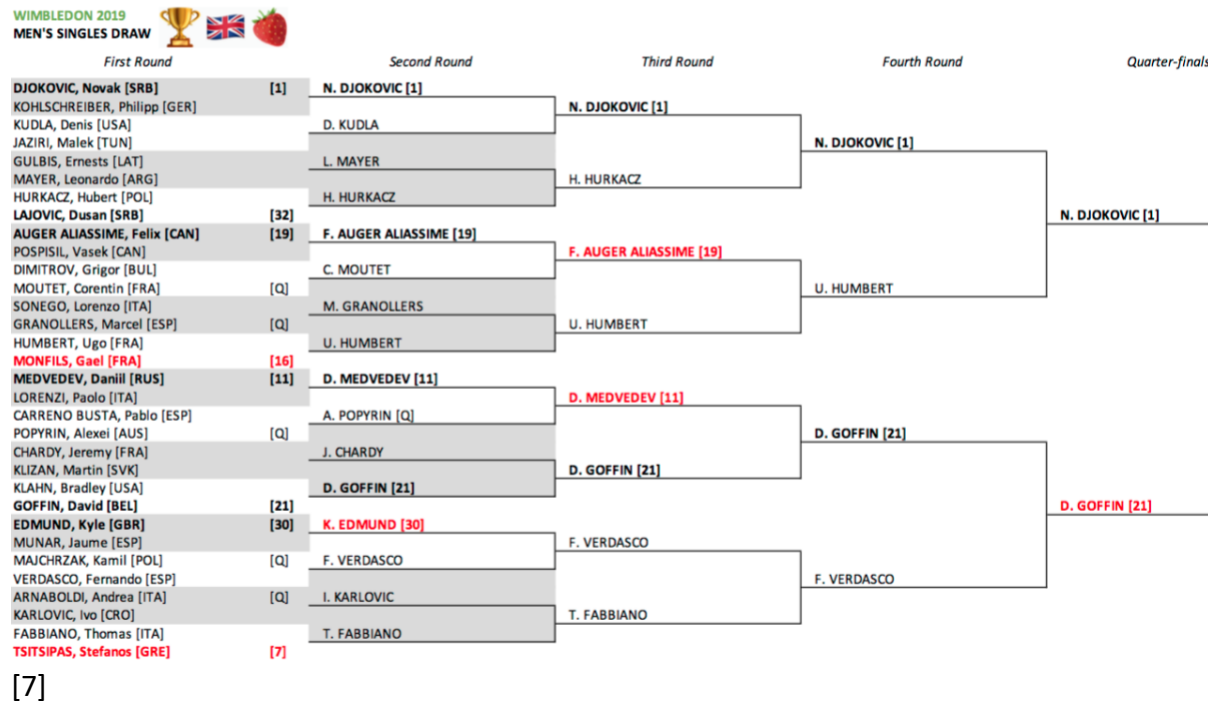
This formula accounts for the fact that some players may be better than other players on a grass court surface even if their ATP World ranking is lower. As an example, this means the player ranked No.4 in the world in the ATP rankings list could be seeded as the No.3. As there are very few grass court tournaments throughout the year (compared to that of hard and clay court tournaments), the above formula is only applied at Wimbledon.

It was decided in 2001 when the seeding's were changed from 16 to 32 that the other Grand Slams would not use a formula similar to this. Mark Miles the ATP Chief Executive Officer stated *"We have viewed it as both unnecessary and a potentially confusing addition to the game, by its very nature a surface-specific system will be highly technical and likely to be understood by very few fans."* [6] With this said, Wimbledon remains the only Grand Slam tournament to use its own ranking formula. Currently, there is insufficient evidence to be able to say whether this is the best approach or not.

1.5 Tournament Bracket

Once the seeds for a tournament has been decided, the main draw can take place. The No.1 seed is placed in the top half of the draw and the No.2 seed is placed in the bottom half of the draw (so if to meet it can only be in the final). The No. 3 seed is then placed in the bottom half of the draw too but opposite to the No.2 seed (so if to play it would be in the semi-final). An example of this can be seen in Figure 1.3 which shows the top ¼ section of the 2019 Wimbledon draw and results.

Figure 1.3



This method continues, meaning the top seeds meet in the final; top four seeds meet in the semi-final; top eight seeds meet in the quarter-final; top sixteen meet in the 4th round and the top 32 meet in the round of 32. This means the earliest a seeded player can play another seeded player is in the 3rd round. Moreover, this 3rd round seeded player clash will be a Top 16 player against a 17-32 seeded player. Unseeded players are then randomly assigned to the remaining spaces available.

From Figure 1.3, it can be seen that Djokovic (the No.1 seed) only had to face a seeded player for the first time in the quarter finals due to Monfils (No.16 seed) and Augier Aliassime (No.19 seed) being knocked out by unseeded players. This provided Djokovic with, in theory an easier run the later stages of the tournament.

2 Methodology

2.1 Data Collection

As a result of the changes to the ATP category system in 2009, as well as the aforementioned seeding changes in 2001, this paper uses data from major tournaments from January 1st 2009 (start of the calendar year) until December 31st 2019 (end of the calendar year). This timeframe has been chosen to allow consistency, as no changes to the seeding or category system were made during this time. The results of each player in a seeded position have been gathered and scored. If a player is knocked out in the first round they score a 1, knocked out in the 2nd round they score a 2 and so on with the runner up receiving a score of 7 and the winner an 8. This is then done for every year between 2009 and 2019.

A mean average finish of these scores were then calculated for each seeded player. The data for this can be seen the attached **excel file**. The results from all four major tournaments were then combined and once again created a mean average finish for each player. Figure 2.1 below shows the data collected for Wimbledon between 2009 and 2019. For example, in 2009, the No.1 seed won the tournament so scored an 8 and the No.2 seed only reached the semi-final so scored a 6.

Figure 2.1

	Wimbledon													
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019			
seed	round reach	round reach	round reach	round reach	round reach	round reach	round reach	round reach	round reach	round reach	round reached	total points	mean points	
1	8	5	7	6	7	8	8	3	5	5	8	70	6.363636364	
2	6	8	8	2	8	4	7	8	5	6	7	69	6.272727273	
3	5	6	5	8	2	5	6	6	8	2	6	59	5.363636364	
4	2	6	6	7	5	7	5	2	4	3	3	50	4.545454545	
5	7	4	3	6	1	5	2	4	1	5	1	39	3.545454545	
6	4	5	4	1	2	3	4	7	5	1	1	37	3.363636364	
7	4	2	4	5	5	2	3	4	7	1	1	38	3.454545455	
8	3	1	3	3	6	6	5	2	4	7	5	45	4.090909091	
9	3	4	3	4	3	3	2	5	3	6	2	38	3.454545455	
10	3	5	5	4	2	4	3	6	4	1	3	40	3.636363636	
11	3	1	3	1	1	6	5	4	6	3	3	36	3.272727273	
12	4	7	6	3	3	2	3	5	3	8	3	47	4.272727273	
13	1	2	2	2	4	2	4	2	4	5	2	30	2.727272727	
14	3	1	2	1	1	4	2	3	2	2	4	25	2.272727273	
15	3	4	3	3	3	3	4	4	3	3	1	34	3.090909091	
16	1	4	3	4	1	3	3	2	5	1	4	31	2.818181818	
17	2	1	4	3	2	2	3	1	2	2	2	24	2.181818182	
18	4	4	4	4	2	1	1	3	4	1	3	31	2.818181818	
19	4	1	4	3	1	4	4	4	1	3	2	31	2.818181818	
20	1	1	2	1	3	4	6	1	1	1	5	26	2.363636364	
21	5	3	2	2	1	3	4	1	1	3	2	27	2.454545455	
22	4	3	1	2	3	2	4	3	1	4	6	33		

2.2 Hypothesis

This data will be used to test the following hypothesis:

Null hypothesis H_0 : There is no relationship between a player being seeded and how far they will progress in a major tournament.

Alternative Hypothesis H_1 : There is a relationship between a player being seeded and how far they will progress in a major tournament.

3 Results

3.1 Linear Regression

By using a linear regression analysis with the mean average finish being the dependent variable and the expected finish as the independent variable the following results were produced:

Figure 3.1

Regression Statistics	
Multiple R	0.961687482
R Square	0.924842814
Standard Error	0.3642793
P-value	2.0663×10^{-18}
Lower 99.0%	0.957034118
Upper 99.0%	1.27674971

From Figure 3.1, it can be seen that the multiple R of 0.961687482 means there is a strong positive correlation between the data. The R squared value shows that 92.48% (rounded to 2 d.p) of the values fit the regression analysis model.

The P-value is close to zero which means that the ranking system used in tennis has a statistically significant effect on how far a seeded player goes in a tournament. Furthermore, the P-value is significantly lower than the 99.0% value (which does not include the value zero). This means there is a 99.0% confidence interval. We can therefore reject the Null hypothesis (H_0) 'There is no relationship between a player being seeded and how far they will progress in a major tournament' and accept the alternative hypothesis (H_1) 'There is a relationship between a player being seeded and how far they will progress in a major tournament'.

Figure 3.2

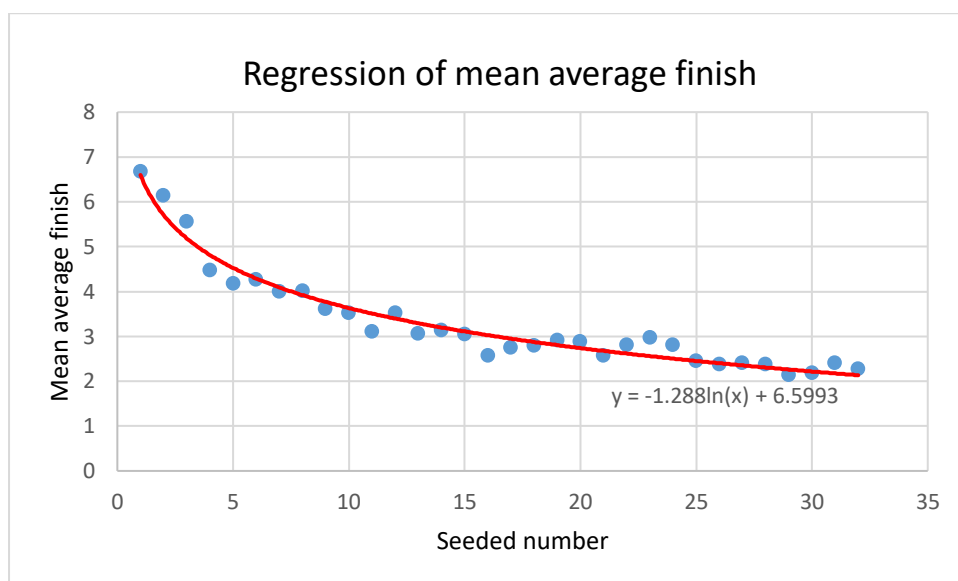


Figure 3.2 shows the regression line of the mean average finish depending on what seed a player starts a grand slam tournament at. The trend line shows that the closer a player is seeded to No.1, the better they will do in the tournament. Using the graphs formula

$$y = -1.288\ln(x) + 6.5993$$

Equation 2

with x , $x \in \mathbb{R}$ and $1 \leq x \leq 32$. Then y is an estimate for the minimum finish for a player in a tournament. For example, by letting $x = 3$, by equation (2) we get $y = 5.184287372$ meaning the No.3 seed is estimated to reach at least the quarter final of a major tournament.

4 Analysis

4.1 Seeded Players

The above data clearly shows that the top seeded players tend to progress to the later stages of a major tournaments. This shows players at the top of the ATP rankings have a significantly better chance of winning a tournament.

To break into the current Top 10 as of 20th January 2020, a player would only need just over 2,500 points [1]. Once in the Top 10, if a player can stay fit enough to play 18 tournaments a year, they would only need to average reaching the 4th round of all required tournaments to stay within the Top 10. From Figure 4 we can see that if $x = 10$ then $y = 3.6335704$ meaning, a Top 10 player is estimated to reach around the 4th round of a major tournament. Applying this to all tournaments a Top 10 seed player will achieve enough points to remain in the Top 10 at all times. For example, if a player averages a 4th round finish (wins first 3 matches of a tournament) for each tournament for: four Grand Slams, eight Masters 1000 and six ATP 500 tournaments, they will receive the following estimated points:

$$(180 \times 4) + (90 \times 8) + (180 \times 6) = 2520$$

Now, if a seeded player in a Grand Slam reaches the 4th round and progresses no further, they would register three wins and one loss. As previously discussed, the 1st and 2nd round will be played against non-seeded players and then the 3rd round would be played against either a seeded or non-seeded player, depending who won in the previous rounds. So at most, to reach the 4th round of a major tournament a seeded player will only have to play one other seeded player. Furthermore, a Top 16 player will only be able to face someone seeded 17-32 meaning they still play someone ranked lower than them. This means a Top 10 player has a much easier route to the 4th round.

4.2 Unseeded Players

As seen before from Figure 1.3, an unseeded player could play up to two seeded players within the first 3 rounds of a tournament (either in the 1st and 3rd round or the 2nd and 3rd round). These seeded players will be one player seeded 1-16 and then one player seeded 17-

32. Making it a much harder route to the 4th round. Obviously this is the idea of the seeds to give that 'protection' to top players in the early rounds. However, the ranking points given to a seeded player and non-seeded player for each round is the exact same. This means there is no bonus system for a lower ranked player beating a significantly higher ranked player. Below is a formula that would give bonus points to an unseeded player for beating a seeded player in a major tournament.

$$R_{best} + F_{points} = T_{points}$$

Equation 3

$$R_{best} = \left(\frac{R_{difference}}{100} \times R_{points} \right) \Rightarrow$$

Equation 4

$$\left[\left(\frac{R_2 - R_1}{100} \times R_{points} \right) + F_{points} \right] = T_{points}$$

Equation 5

where:

- R_{best} is the highest value achieved in the participated tournament
- F_{points} is the Final round reached and the ranking points achieved for reaching this round
- T_{points} is the total ranking points gained for that tournament
- R_2 is the ATP ranking of a non-seeded player with $33 \leq R_2 \leq 100_{max}$ if the ATP ranking of the player is 101 or higher they will be assigned the maximum R_2 value of 100
- R_1 is the ATP ranking of a seeded player with $1 \leq R_1 \leq 32$
- R_{points} is the points achieved for reaching that round

By using equation 3 in ATP tournaments, unseeded players who are able to defy the odds and beat a seeded player will be rewarded with a point bonus to their ATP ranking. This will allow for lower ranked players rise through the ATP rankings quicker.

During Wimbledon 2019, Ugo Humbert made it to the fourth round of the competition before being knocked out by the No.1 seed Djokovic. For reaching the fourth round Ugo accumulated 180 points. Before the tournament Ugo was ranked 66th in the ATP rankings list with a total of 822 points [1]. He only reached the 1st round of Wimbledon in 2018 so he was only defending 10 points. This means he had a net total of 170 points which saw him rise to 992 points and No.48 in the ATP rankings.

However, applying equation 5 to his performance in the tournament would give:

$$\left[\left(\frac{66 - 19}{100} \times 180 \right) + 180 \right] = 264.6$$

By applying this formula, Ugo would have achieved 265 (rounded to nearest whole number) points and he would have a net total of 255 points. This would have taken his total points at

that stage to 1007 points which would place him as the No.42 in the world, only 15 points shy of the Top 40. This can make all the difference when being seeded for the Masters 1000 and ATP 500 and ATP 250. This example shows that the formula can work in helping lower ranked players move up the rankings list without causing major disruption at the same time.

5 Conclusion

As this paper has shown, the regression model along with the 99% confidence intervals proves the ranking system used in tennis to seed players in tournaments has been effective, with higher ranked players receiving protection in the early rounds by avoiding other high ranked players. The top seeded players tend to then reach the later stages of a tournament and therefore attain more ranking points which allows them to maintain their top ranking. This also means tournaments have better contested matches as the tournament goes on, with the higher ranked players only meeting in the later stages. Something the ranking system does not take in to account is the opponents ability, with players receiving the same points for reaching the next round in a tournament, regardless of the ability of their opponent. This paper provides an example formula that could be adopted to take this in to account and provide more reward for lower ranked players beating top ranked players, which in turn will allow them to advance through the ranking lists.

Bibliography

- [1] ATP TOUR, "ATP tour rankings," [Online]. Available: <https://www.atptour.com/en/rankings/singles>. [Accessed 20 January 2020].
- [2] C. Praeger, "Maths point- the mathematics of tennis," [Online]. Available: <https://www.science.org.au/curious/everything-else/tennis-maths>. [Accessed 24 February 2020].
- [3] C. chase, 06 August 2018. [Online]. Available: <https://ftw.usatoday.com/2018/08/atp-wta-tennis-rankings-how-do-they-work-faq-federer-serena-nadal>. [Accessed 24 February 2020].
- [4] A. Bhattacharya, 11 July 2016. [Online]. Available: <https://www.quora.com/What-is-protected-ranking-in-tennis-How-is-it-useful-for-players-outside-of-tennis-tournaments>. [Accessed 25 January 2020].
- [5] A. SG. [Online]. Available: <https://www.myactivesg.com/Sports/Tennis/How-To-Play/Tennis-Facts/Differences-between-tennis-courts>. [Accessed 17 March 2020].
- [6] S. Wine, "independent sport," independent, 11 June 2001. [Online]. Available: <https://www.independent.co.uk/sport/tennis/wimbledon-change-seeding-system-9249997.html>. [Accessed 16 march 2020].
- [7] "tiffstuff," [Online]. Available: <https://tiffstuff.com/grand-slam-draw-brackets.html> . [Accessed 16 March 2020].