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# Analysis of the Evolution of Inequalities in Prize Money due to Ranking in Professional Tennis

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## Introduction

This paper analyzes the evolution of prize money inequalities in professional tennis over time. The analysis is split into three parts. The first accounts for the year 2017 in both men's and women's tennis. The second looks at the issue for men's tennis from the year 2009 until today. Finally, the last part focuses solely on Grand Slams.

In order to conduct a proper analysis of this issue, several databases have been constructed specifically for research purposes. The data used to create these new databases comes from the official websites of the Association of Tennis Professionals and the Women's Tennis Association. In order to assess inequality in earnings when rankings are different, some indicators of inequality are computed. Those indicators are the Lorenz Curve and the Gini coefficient.

The analysis excludes doubles' tennis, as well as tournament qualifications and the Challenger Tour. As sponsorship is based on private contracts, these earnings are not included in the analysis either. Therefore, the analysis is based on singles' tennis in the main draws of the ATP World Tour for men and WTA Tour for women, as well as Grand Slams.

The main results show that, in 2017, prize money earned by the top 100 ranked players was around 90% of total prize money at play on tour that year, for both men and women's tennis. Within the top 100, prize money distribution was highly unequal as well.

The analysis of men's tennis over the last 10 years shows that inequalities have remained stable at a very high level, with a Gini coefficient of around 0.91.

Since 2010, Grand Slam inequalities have started to decrease between players losing in the earlier stages of the Slam and those winning it, regardless of gender. This conclusion is drawn from the evolution of the shares of total prize money earned at different rounds of the tournament.

The question of earning inequalities in sport has already been discussed. In *"Income Inequality in American Professional Sports Leagues"*, Thurman (2016)<sup>1</sup> measured income inequality in the NBA, BFL and MLB using the Lorenz Curve and Gini index, as is done in this paper. B. Frick, J. Prinz and K. Winkelmann (2003) looked at the effect of earnings inequalities on team performance in *"Pay inequalities and team performance: Empirical evidence from the North American major leagues"*<sup>2</sup>.

A few papers discuss gender inequalities in tennis, such as *"Advantage men: The sex pay gap in professional tennis"* by Flake, Dufur and Moore (2012)<sup>3</sup>. As the matter of gender equality is a very heated and contemporary topic, a section of this paper will be dedicated to income inequalities related to gender in professional tennis.

There were no academic papers that I could find that were looking at inequalities due to ranking in professional tennis as this thesis was being written. However, the International Tennis Federation released a circuit review in December

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<sup>1</sup> <http://scholarworks.uark.edu/cgi/viewcontent.cgi?article=1015&context=econuht>

<sup>2</sup> <https://www.emeraldinsight.com/doi/abs/10.1108/01437720310485942?fullSc=1&journalCode=ijm>

<sup>3</sup> <http://journals.sagepub.com/doi/pdf/10.1177/1012690212442166>

2014<sup>4</sup>, analyzing player earnings and costs, among other topics. They found that, in 2013, men players had to be ranked within the top 336 to earn more than they spent. The breakeven ranking for women was 253.

One could also wonder whether income inequalities are a good or bad thing for tennis in general. Indeed, inequalities can be seen as an incentive to perform. However, this is only the case to some extent. At some point, the increased income perceived as a motivational tool becomes so high that it does not provide further incentives to perform but only digs the gap between top players and lower-ranked players who are struggling to make a living playing tennis, which drives them into corruption and match-fixing. Indeed, the Independent Review Panel, set up in 2016, uncovered “a *“very significant” corruption problem at “lower and middle levels of the sport”*”<sup>5</sup>, excluding the involvement of top-ranked players. This indicates that this issue might be a direct consequence of the difficulties that low-ranked players face to make ends meet.

Moreover, the high amount of prize money earned by top players allows them to afford a whole team that includes the coach, a personal physiotherapist, a manager, a nutritionist and sometimes even a “supercoach”, that is, a former player joining the team to personally advise the player. They can also afford to travel with their family members and other loved ones to provide them with support and make life on tour less lonely. All these advantages have a significant effect on the top players’ performance, which in turn leads to high results and prize money. Therefore, it points to the existence of a virtuous circle for top-ranked players, where money helps performance, which sequentially leads to prize money rewards. However, the opposite is also true for lower-ranked players, who are caught in a vicious circle where their lack of funds does not allow them to be surrounded with a full team to take care of them. This results in unequal conditions to grow and improve themselves, and also adds pressure to win matches in order to be able to make ends meet.

The paper is organized as follows.

Chapter one provides the history of the International Tennis Federation, the Association of Tennis Professionals and the Women’s Tennis Association. It also describes the different types of tournaments organized within each of these institutions and the way that prize money and points are distributed within each type of tournament.

Chapter two studies prize money in more details and discusses its sources as well as its evolution over time.

In Chapter three, the method is explained in details and some issues are raised.

Chapter four presents the results of the analysis per gender over time. A comparison between the cases of women’s and men’s tennis is made.

Chapter five briefly discusses the matter of gender inequality within professional tennis.

Finally, the conclusion of this paper provides a summary of the paper and suggests further possible interesting research.

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<sup>4</sup> <http://www.itftennis.com/media/194256/194256.pdf>

<sup>5</sup> <https://www.bbc.com/sport/tennis/43894806>

## I. History

Before 1968, only amateurs could participate in the four major tennis tournaments known as the Grand Slams, as well as in the traditional circuit. The Open Era, characterized by the fact that professional players and amateurs were allowed to compete together, began in 1968. Since then, as stated in *The Bud Collins History of Tennis*, tennis boomed:

*“By making tennis at the top level professional, honest, and unabashedly commercial, opens ushered in an era of dramatic growth and development. For an expanding group of pros, this was boom-time, a veritable bonanza of opportunities. They enjoyed and reaped the benefits of a brave new world of televised matches and two-fisted backhands, evolution of technique and technology, full-blown tours for women and over-45s, exposure and cash undreamed of even by Wimbledon champions in the pre-Open era.”*<sup>6</sup>

Nowadays, three institutions supervise professional tennis. The International Tennis Federation (ITF) was set up in 1913. The Association of Tennis Professionals (ATP) for the men’s game was created in the aftermath of the Open Era, in 1972. Finally, the Women’s Tennis Association (WTA) was founded in 1973 to represent and promote the women’s game.

The following sections briefly describe the history of these institutions.

### 1.1 International Tennis Federation (ITF)

The ITF, founded in 1913, is the governing body of world tennis in partnership with the Association of Tennis Professionals and the Women’s Tennis Association.

*“Prior to the Open Era, the ITF’s main role was to administer the rules of tennis and organize the Davis Cup”*<sup>7</sup>, the men’s world cup of tennis, taking place on an annual basis. Since 1968, the ITF is responsible for the *“administration and regulation of tennis, the organization of international competition, as well as the structure, development and promotion of the game.”*<sup>8</sup> This includes the protection of the sport’s integrity through anti-doping and anti-corruption programs.

The ITF governs the four Grand Slams, organizes the Davis Cup and Fed Cup, which are the annual world team competitions, as well as tennis at the Olympic Games. It also organizes the ITF’s men circuit and the ITF’s women circuit, which are the lowest-tier professional circuits in terms of importance of points and total prize money, below the mid-tier ATP Challenger Tour for men and WTA 125K series for women and the top-tier ATP World Tour for men and WTA Tour for women.

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<sup>6</sup> COLLINS, B. (2016), *The Bud Collins’ History of Tennis: An Authoritative Encyclopedia and Record Book*, p.143

<sup>7</sup> PARSON, J. & WANCKE, H. (2016), *The Tennis Book : The Encyclopedia of World Tennis*, p.180

<sup>8</sup> <https://www.itftennis.com/about/organisation/role.aspx>

## 1.2 Association of Tennis Professionals (ATP)

### 1.2.1 ATP History

The Association of Tennis Professionals was created in 1972. The professional players' ranking system began in 1973.

Before 1989, the professional men's tour was run by a council made up of representatives of the ITF, the ATP and tournament directors. Since 1990, the ATP organizes the men's tour, that is, ATP World Tour Masters 1000 tournaments, ATP World Tour 500 series and ATP World Tour 250 series. The ATP is also responsible for the Challenger Tour, which is a circuit of tournaments below the ATP World Tour, and the ATP Champions Tour for senior professional players.

### 1.2.2 Types of Tournaments

This paper analyses inequalities in professional tennis on the main circuits. These include the four Grand Slams – Australian Open, French Open, Wimbledon and US Open – as well as the ATP World Tour for men and the WTA Tour for women. Qualifications are excluded, which means that only tournaments' main draws are taken into account in the analysis.

There are several ways to enter a tournament's main draw. The first is through ranking, which is automatic if a player's ranking is high enough to earn them a spot in the main draw. The second is to participate in the qualification rounds of the tournaments and earn a main draw spot. The last way is to receive an invitation from the tournament's organizers – or Wild Card – into the main draw when the player's ranking is not high enough to earn them a direct entrance. The top players participating in a tournament receive a seeding number, which depends on their ranking. The top seed is the highest-ranked player participating in the tournament. The seeds are placed in the main draw of the tournament so that the top players cannot play one another at early stages of the event. Hence, seeds number one and two are placed on opposite sides of the draw so that they can only play each other in the final. The top four seeds can only play one another in the semifinals, the top eight in the quarters, and so on.

As the importance of tournaments increases, the number of top players participating grows significantly. Therefore, it becomes harder for lower-ranked players to earn a direct spot in a high-category tournament's main draw.

The following table displays the different types of tournaments that men professionals can play, by order of magnitude.

*Table 1 - Types of Tournaments in Men's Tennis<sup>9</sup>*

| Event category              | Number | Total prize money (USD) | Winner's ranking points | Governing body     |
|-----------------------------|--------|-------------------------|-------------------------|--------------------|
| Grand Slam                  | 4      | See individual articles | 2,000                   | ITF                |
| ATP World Tour Finals       | 1      | 4,450,000               | 1,100–1,500             | ATP (2009–present) |
| ATP World Tour Masters 1000 | 9      | 2,450,000 to 3,645,000  | 1000                    | ATP                |
| ATP World Tour 500 series   | 13     | 755,000 to 2,100,000    | 500                     | ATP                |
| ATP World Tour 250 series   | 39     | 416,000 to 1,024,000    | 250                     | ATP                |
| ATP Challenger Tour         | 178    | 40,000 to 220,000       | 80 to 125               | ATP                |
| ITF Men's Circuit           | 534    | 10,000 and 25,000       | 18 to 35                | ITF                |

The most important tournaments are the Grand Slams, which are governed by the ITF. 128 players are participating in the main draw of the Slam, including 32 seeds which are the 32 best-ranked players participating in the event, 16 qualifiers and 8 wild cards. The 72 remaining players are those ranked right after the 32 seeds.

The ATP World Tour Finals are a special tournament taking place at the end of the tennis season for the best 8 players of that season. In a way, it can be seen as a bonus tournament, providing significant amounts of prize money and points to the most successful players of the year and therefore, increasing the gap between top-ranked players and lower-ranked ones.

The ATP World Tour Masters 1000 are mandatory events for top players. There are nine of them, organized throughout the year. These tournaments provide the highest amounts of points and prize money outside of Grand Slams and the ATP World Tour Finals.

The ATP Challenger Tour is the last preparation for players before entering the ATP World Tour, where top players evolve.

Finally, the ITF's men circuit constitutes the lowest-tier tournament category.

The following sections explain how prize money and points are distributed in the categories of events that are studied in this paper: Grand Slams, ATP World Tour Masters 1000, ATP World Tour 500 series and ATP World Tour 250 series.

### 1.2.3 Prize Money Distribution

In 2017, prize money on the ATP World Tour and in Grand Slams was attributed as shown in table 2.

<sup>9</sup> [https://en.wikipedia.org/wiki/Association\\_of\\_Tennis\\_Professionals](https://en.wikipedia.org/wiki/Association_of_Tennis_Professionals)

*Table 2 - 2017 ATP Prize Money Distribution*

|                         | <b>Grand Slam</b> | <b>Masters 1000</b> | <b>ATP 500</b> | <b>ATP 250</b> |
|-------------------------|-------------------|---------------------|----------------|----------------|
| <b>Winner</b>           | \$2,353,260       | \$1,175,505         | \$336,900      | \$80,250       |
| <b>Finalist</b>         | \$1,187,836       | \$573,680           | \$165,170      | \$42,265       |
| <b>Semi-Finalist</b>    | \$593,918         | \$287,515           | \$83,110       | \$22,895       |
| <b>Quarter-Finalist</b> | \$381,004         | \$146,575           | \$42,265       | \$13,040       |
| <b>Round of 16</b>      | \$224,120         | \$77,265            | \$21,950       | \$7,685        |
| <b>Round of 32</b>      | \$132,231         | \$41,350            | \$11,575       | \$4,555        |
| <b>Round of 64</b>      | \$78,445          | \$22,325            | -              | -              |
| <b>Round of 128</b>     | \$39,221          | \$13,690            | -              | -              |

The tournaments chosen to provide this data are the French Open for the Grand Slam category and Indian Wells for Masters 1000. Tokyo and Auckland represent the ATP 500 and ATP 250 categories respectively. These tournaments have been selected because they are also played on the women's tour and carry the same relative importance, which allows for a general comparison between men and women's tennis.

#### 1.2.4 Point Distribution

Since 2000, the ATP ranks players based on the points they earned in 18 tournaments and during the ATP Finals if they qualified to the event. Those tournaments are the four Grand Slams, the eight mandatory Masters 1000 and their best results in six other tournaments played over the last 52 weeks. The original ranking system consisted of an average of each player's results. The current format was originally introduced in 1990 but only 14 tournaments were taken into account at the time.

In 2017, points were distributed as depicted in table 3.

*Table 3 - 2017 ATP Point Distribution*

|                         | <b>Grand Slam</b> | <b>Masters 1000</b> | <b>ATP 500</b> | <b>ATP 250</b> |
|-------------------------|-------------------|---------------------|----------------|----------------|
| <b>Winner</b>           | 2000              | 1000                | 500            | 250            |
| <b>Finalist</b>         | 1200              | 600                 | 300            | 150            |
| <b>Semi-Finalist</b>    | 720               | 360                 | 180            | 90             |
| <b>Quarter-Finalist</b> | 360               | 180                 | 90             | 45             |
| <b>Round of 16</b>      | 180               | 90                  | 45             | 20             |
| <b>Round of 32</b>      | 90                | 45                  | 0              | 0              |
| <b>Round of 64</b>      | 45                | 25                  | -              | -              |
| <b>Round of 128</b>     | 10                | 10                  | -              | -              |

## 1.3 Women's Tennis Association (WTA)

### 1.3.1 WTA History

At the beginning of the Open Era, the prize money difference between men and women was of 2.5 to 1. In 1970, inequalities in prize money between men and women increased to a ratio of 12 to 1 at a tournament taking place after the US Open.<sup>10</sup> Billie Jean King, along with eight other female tennis players, decided to boycott the event and create their own circuit. Alongside the female publisher of World Tennis Magazine, "*the original nine*" created the Virginia Slims Circuit, which became the Women's Tennis Association in 1973.

1973 was also the year that Billie Jean King defeated Bobby Riggs during "The Battle of the Sexes" in front of 30,472 spectators and around 50 million viewers.<sup>11</sup> Then, the United States Tennis Lawn Association (USTLA) realized the commercial potential of tennis and allowed the Virginia Slims Circuit to expand. The USTLA also introduced prize money parity at the US Open that year.

In 1975, the WTA signed its first television deal and its first sponsor joined the following year. By 1980, 250 women were professional tennis players and 47 tournaments made up the WTA circuit, for a total prize money of around \$7 million.<sup>12</sup>

The US Open provided prize money parity since 1973 and the Australian Open followed in 1984 but then retracted it in the mid-1990s only to reinstall it in 2001. The French Open offered equality in the final match in 2005. In 2007, all four Grand Slams ensured prize money parity between male and female players at all rounds of the tournaments, 39 years after the beginning of the Open Era.<sup>13</sup>

Female tennis is revolutionary, in the sense that it has played a major role in setting up standards of remuneration for women in sports. For instance, Serena Williams' career prize money is twice as high as any other female athlete's total earnings, sponsorship money not included. Out of Forbes' top 10 of world's highest-paid female athletes, eight were tennis players in 2016.<sup>14</sup>

### 1.3.2 Types of Tournaments

Tournament structure changed in 2009, when the WTA replaced Tier I and Tier II events with Premier tournaments, whereas Tier III and Tier IV events became International tournaments.

The Premier category is made up of three different types of tournaments.

Premier Mandatory events consist of four tournaments also organized on the men's tour and providing equal prize money to male and female players. They are equivalent to Master 1000 events in men's tennis.

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<sup>10</sup> [https://en.wikipedia.org/wiki/Women%27s\\_Tennis\\_Association](https://en.wikipedia.org/wiki/Women%27s_Tennis_Association)

<sup>11</sup> COLLINS, B. (2016), *The Bud Collins' History of Tennis: An Authoritative Encyclopedia and Record Book*, p.167

<sup>12</sup> [https://en.wikipedia.org/wiki/Women%27s\\_Tennis\\_Association](https://en.wikipedia.org/wiki/Women%27s_Tennis_Association)

<sup>13</sup> PARSON, J. & WANCKE, H. (2016), *The Tennis Book: The Encyclopedia of World Tennis*, p.59

<sup>14</sup> <https://www.forbes.com/pictures/mli45ffmff/the-worlds-highest-paid/#6fb10284610e>

Premier Five events are five tournaments of slightly lesser importance than Premier Mandatory tournaments.

Finally, there are twelve Premier tournaments with variable prize money, of less importance than the first two subcategories. These Premier events are similar to ATP World Tour 500 series tournaments.

International tournaments are more or less equivalent to ATP World Tour 250 series events, although their importance in terms of points is slightly higher than their male counterparts.

In 2012, a new category was added, denoted as WTA \$125K series. These tournaments have a total prize money of \$125,000 each, making them an intermediate type of tournament, located between International events and the ITF's women circuit. In order to be able to compare the men's tour with the women's tour, this new category of tournaments, specific to the women's tour, will not be included in the analysis.

The following sections focus on prize money and point distribution in these categories for the year 2017.

### 1.3.3 Prize Money Distribution

2017 prize money distribution on the WTA Tour and Grand Slams is shown in table 4.

*Table 4 - 2017 WTA Prize Money Distribution*

|                         | <b>Grand Slam</b> | <b>Premier Mandatory</b> | <b>Premier Five</b> | <b>Premier</b> | <b>International</b> |
|-------------------------|-------------------|--------------------------|---------------------|----------------|----------------------|
| <b>Winner</b>           | \$2,353,260       | \$1,175,505              | \$487,245           | \$194,860      | \$43,000             |
| <b>Finalist</b>         | \$1,187,836       | \$573,680                | \$243,621           | \$104,040      | \$21,400             |
| <b>Semi-Finalist</b>    | \$593,918         | \$287,515                | \$121,690           | \$55,575       | \$11,300             |
| <b>Quarter-Finalist</b> | \$381,004         | \$146,575                | \$56,115            | \$22,635       | \$5,900              |
| <b>Round of 16</b>      | \$224,120         | \$77,265                 | \$27,790            | \$12,140       | \$3,310              |
| <b>Round of 32</b>      | \$132,231         | \$41,350                 | \$14,265            | \$7,702        | \$1,925              |
| <b>Round of 64</b>      | \$78,442          | \$22,325                 | \$7,335             | -              | -                    |
| <b>Round of 128</b>     | \$39,221          | \$13,690                 | -                   | -              | -                    |

The French Open has been chosen to represent the Grand Slams, Indian Wells for the Premier Mandatory tournaments, Dubai for the Premier Five category and finally Tokyo and Auckland for the Premier and International tournaments respectively.

Prize money distribution is identical between men and women during Grand Slams and some Masters 1000 and Premier Mandatory events, such as the tournament of Indian Wells. However, when it comes to smaller events, which represent the majority of tournaments organized within a year, prize money allocated in women's and men's tournaments is unequal. For instance, International

tournaments allocate more points to women players than ATP 250 to their male counterparts. Yet, for every round of the International tournament, women earn about half of men's prize money in ATP 250 tournaments.

### 1.3.4 Point Distribution

The ranking method used by the WTA tour is quite similar to the one of the ATP World Tour. It is based on a cumulative system as well but only includes 16 tournaments' results at most in singles. They are calculated over a "rolling 52-week period" as well, meaning that points for each tournament remain in the system during 52 weeks. Over these rolling 52 weeks, the tournaments included are those offering the most points, that is, Grand Slams and Premier Mandatory events in priority. Results in WTA Finals must also be included if the player qualified to the event.

There is an additional constraint for players in the top 20, for whom the two best results in the Premier Five category must also be included.

In 2017, points were distributed as depicted in table 5.

*Table 5 – 2017 WTA Point Distribution*

|                         | <b>Grand Slam</b> | <b>Premier Mandatory</b> | <b>Premier Five</b> | <b>Premier</b> | <b>International</b> |
|-------------------------|-------------------|--------------------------|---------------------|----------------|----------------------|
| <b>Winner</b>           | 2000              | 1000                     | 900                 | 470            | 280                  |
| <b>Finalist</b>         | 1300              | 650                      | 585                 | 305            | 180                  |
| <b>Semi-Finalist</b>    | 780               | 390                      | 350                 | 185            | 110                  |
| <b>Quarter-Finalist</b> | 430               | 215                      | 190                 | 100            | 60                   |
| <b>Round of 16</b>      | 240               | 120                      | 105                 | 55             | 30                   |
| <b>Round of 32</b>      | 130               | 65                       | 60                  | 30 or 1        | 1                    |
| <b>Round of 64</b>      | 70                | 35                       | 1                   | 1 or -         | -                    |
| <b>Round of 128</b>     | 10                | 10                       | -                   | -              | -                    |

The point distribution is slightly different in the case of women's professional tennis than it is for men. Indeed, women get more points for each round of every tournament than men, except for the winners of Grand Slams and Masters 1000, which are the equivalent of Premier Mandatory, who get the same amount of points as men's champions, and for women's Premier tournament winners, who get less points than their men's ATP 500 equivalents.

The following chapter discusses the sources of prize money as well as its evolution over time.

## II. Prize Money

Each category of tournaments is subject to some rules regarding prize money.

On the WTA Tour, minimum total prize money is set by WTA rules for every type of tournament. For instance, International tournaments must provide a total prize money of at least \$250,000. Even though there are no maximum levels of total prize money, there are rules regarding how this excess prize money must be distributed. Furthermore, prize money breakdowns in the tournament's rounds are also decided by WTA rules. This means that tournaments cannot decide by themselves of which shares of total prize money to allocate at each round of their tournament.<sup>15</sup>

The ATP World Tour enforces similar rules on their tournaments. There are rules on minimum prize money and breakdown across rounds as well.<sup>16</sup>

The following section describes the sources of tournaments' income, which allows them to distribute prize money during the event.

### 2.1 Sources

Tournaments' total prize money comes from several income sources.

The first is direct sponsorship, which is usually the most significant source of tournaments' income. The amount depends on the importance and attractiveness of the tournament in question and *"ranges between \$250,000 up to \$2 million."*<sup>17</sup> Some tournaments also bear the name of a particular brand, such as the Porsche Tennis Grand Prix in Stuttgart. Many giant companies have invested in tennis, such as Mercedes Benz, Peugeot and Porsche in the motor industry or IBM and BNP Paribas in the computer and banking industries respectively.

Note that players are also directly sponsored by clothing and equipment brands and various other industries such as the motor industry or the watch industry, which significantly enhances their revenue. For instance, *"usually reliable sources indicate that Nike paid Roger Federer more than \$10 million a year over a ten-year period for him to use their equipment."*<sup>18</sup> Hence, inequalities in players' total earnings are magnified by the direct sponsorship of star tennis players. However, as those sponsorship contracts are private, they are not included in this analysis.

The second source of tournaments' income is broadcasting rights. Signing a television deal attracts sponsors and also provides considerable employment. The first broadcasting package in history included 19 men's tournaments. In order to guarantee exposure to the main sponsors of a tournament, television is key, with one exception only as Wimbledon is the only professional event that does not have advertising boards around its courts.

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<sup>15</sup> <http://wtafiles.wtatennis.com/pdf/publications/2018WTARulebook.pdf>, p.165-194

<sup>16</sup> <http://www.atpworldtour.com/en/corporate/rulebook>, p.33-42

<sup>17</sup> PARSON, J & WANCKE, H. (2016), *The Tennis Book: The Encyclopedia of World Tennis*, p.182

<sup>18</sup> PARSON, J & WANCKE, H. (2016), *The Tennis Book: The Encyclopedia of World Tennis*, p.193

Ticket sales also account for a portion of a tournament's income and some tournaments also sell merchandise to spectators. This provides a small base of direct income and also promotes the tournament's image.

Ion Tiriac, former professional player, coach, entrepreneur and manager, estimates *"the actual turnover of a Grand Slam around \$400 million and the average cost of a Master 1000 event at around \$10 to \$15 with income 20 to 30% more than that."*<sup>19</sup>

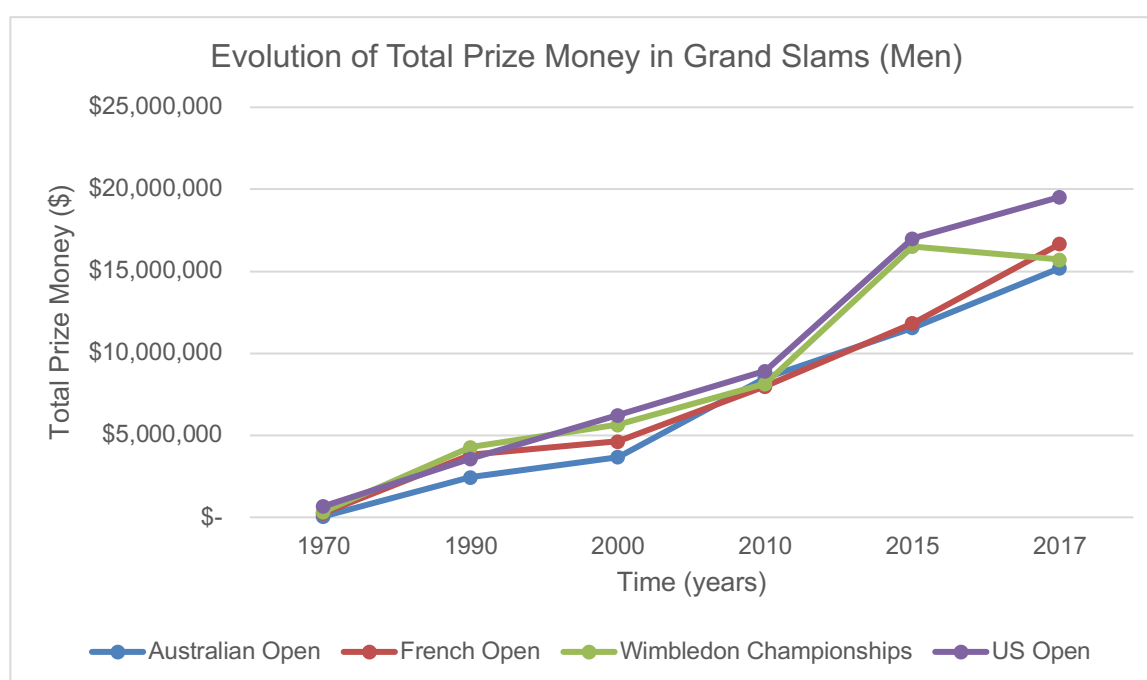
## 2.2 Evolution

This section is dedicated to the evolution of prize money over time.

*"One only has to consider the growth in prize money to begin appreciating just how much a business tennis has become. In 1968, the first year of the Open Era, the total prize money of Wimbledon was about \$78,000. By 2015, it has grown to \$41.5 million. Add to that the other three Grand Slam tournaments, the ATP World Tour and the WTA Tour and you are already nearing the \$200m mark."*<sup>20</sup> Federer and Djokovic have already earned over \$100,000,000 in career prize money, whereas *The Tennis Book* estimates that *"around 500 men and women have become dollar millionaires from prize money alone."*

First is a figure representing how total prize money earned by male tennis players has evolved in Grand Slams. All numbers have been adjusted for inflation.

*Figure 1 - Total Men's Prize Money Evolution in Grand Slams*



<sup>19</sup> PARSON, J & WANCKE, H. (2016), *The Tennis Book: The Encyclopedia of World Tennis*, p.182

<sup>20</sup> PARSON, J & WANCKE, H. (2016), *The Tennis Book: The Encyclopedia of World Tennis*, p.180

All four Grand Slams have substantially increased prize money over time. In particular, the last decade has seen a massive raise in total prize money. In 1970, the total prize money allocated to men at the US Open was \$673,908. Twenty years later, the Grand Slams provided men's total prize money that ranged between \$2,500,000 and \$4,300,000. At the beginning of the 21<sup>st</sup> century, total men's prize money continued to increase steadily. This jump has not slowed to this day, with the US Open reaching a record total prize money of \$19,530,000 in 2017. Note that this last number is relevant for both men and women's tennis, as there is parity in all Grand Slams since 2007.

Note also that the only reason why Wimbledon's total prize money has decreased between 2015 and 2017 is that the pound has lost value following Brexit, leading to currency depreciation. This decrease is therefore only caused by an important variation in exchange rates.

Novak Djokovic, former world number one and winner of twelve Grand Slams, is also the President of the ATP Player Council since 2016 and the first player to reach \$100,000,000 in total prize money earnings over his career. Earlier this year, he announced that he would like to create a players' union and would demand "a substantial prize money increase, favoring mainly the least fortunate players. According to *The Telegraph*, he pointed out that Grand Slams transfer only 7% of their revenue to players, as opposed to 50% in the NBA."<sup>21</sup>

The following table shows the evolution of prize money per round of the main draw in the 2018 French Open.

*Table 6 - French Open Prize Money Evolution<sup>22</sup>*

## **DOTATION SIMPLES MESSIEURS ET DAMES**

| <b>SIMPLES<br/>MESSIEURS ET DAMES</b> | <b>DOTATION 2018 en euros</b> |                                           |
|---------------------------------------|-------------------------------|-------------------------------------------|
|                                       | <b>Par joueur/joueuse</b>     | <b>Augmentation en %<br/>2018 vs 2017</b> |
| <b>Vainqueur</b>                      | 2 200 000 €                   | + 4,76 %                                  |
| <b>Finaliste</b>                      | 1 120 000 €                   | + 5,66 %                                  |
| <b>Demi-finaliste</b>                 | 560 000 €                     | + 5,66 %                                  |
| <b>Quart de finaliste</b>             | 380 000 €                     | + 11,76 %                                 |
| <b>Huitième de finaliste</b>          | 222 000 €                     | + 11 %                                    |
| <b>Troisième tour</b>                 | 130 000 €                     | + 10,17 %                                 |
| <b>Deuxième tour</b>                  | 79 000 €                      | + 12,86 %                                 |
| <b>Premier tour</b>                   | 40 000 €                      | + 14,29 %                                 |

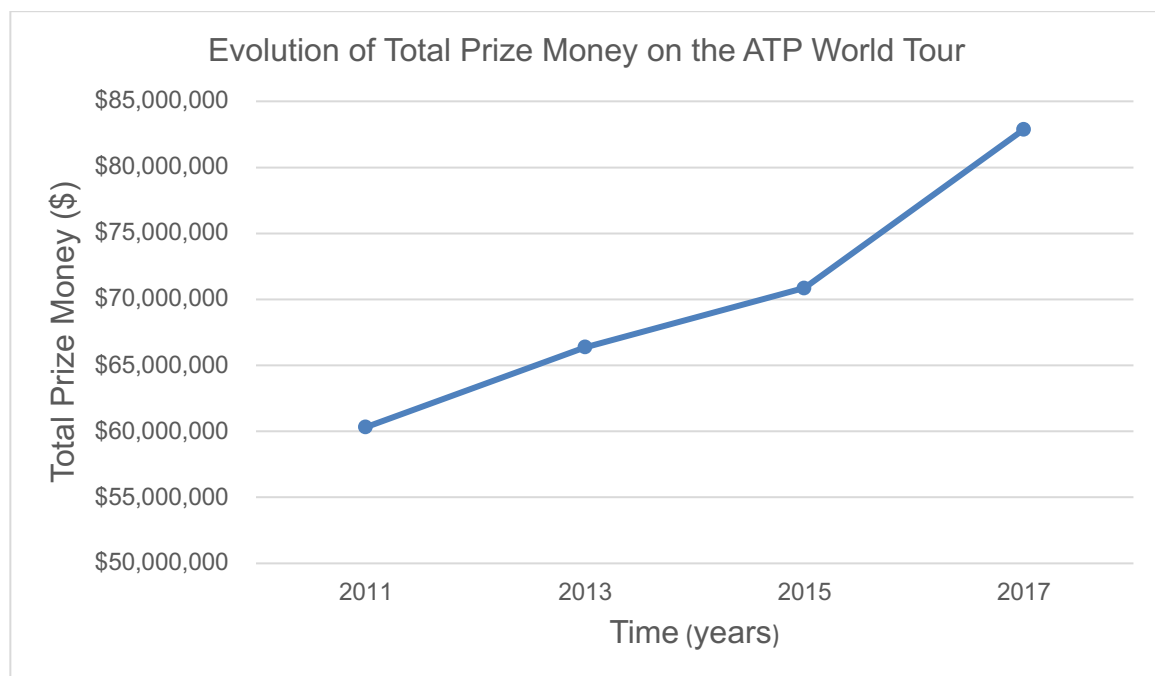
<sup>21</sup> Tennis Magazine (03/2018), 494, p.11

<sup>22</sup> [https://fft-rg-commun-news.cdn.prismic.io/fft-rg-commun-news%2F29c0916d-e2ec-4b30-85c4-ce133bb294a9\\_communiq%20u%20e%20de%20presse%20dotations%20roland-garros%202018.pdf](https://fft-rg-commun-news.cdn.prismic.io/fft-rg-commun-news%2F29c0916d-e2ec-4b30-85c4-ce133bb294a9_communiq%20u%20e%20de%20presse%20dotations%20roland-garros%202018.pdf)

This table allows for a more detailed view of which rounds benefit the most from the on-going increases in prize money. In this particular case, lower rounds' prize money has grown the most, which shows encouraging progress in the reduction of disparities in professional tennis, although the 2018 French Open singles' winners will still earn 55 times the prize money of first-round losers.

The next figure shows how total prize money has evolved on the ATP World Tour over the past 6 years. All numbers are adjusted for inflation. Grand Slams are excluded, as they are not a part of the ATP World Tour but are governed by the International Tennis Federation.

*Figure 2 - Total Prize Money Evolution on the ATP World Tour*



Although the time span is short due to missing data on the official ATP website, this figure shows a drastic increase in total prize money on the ATP World Tour, especially in very recent years.

The following chapter explains the different methods applied in order to analyze inequalities due to ranking in professional tennis. It also points out the limitations of such methods.

### III. Methodology

#### 3.1 Methodology

Databases have been constructed specifically to answer the objectives of this paper. The data compiled in these databases comes from the official websites of the ATP World Tour for the ATP and from the official ATP/WTa application for WTA data.

*Table 7 - Database Example*

|    | A       | B             | C            | D      | E            | F      | G             | H      | I            | J      |
|----|---------|---------------|--------------|--------|--------------|--------|---------------|--------|--------------|--------|
| 1  | Ranking | Player name   | Brisbane     |        | Chennai      |        | Doha          |        | Sydney       |        |
| 2  |         |               | PM           | Points | PM           | Points | PM            | Points | PM           | Points |
| 3  | 1       | Nadal         | \$ 12.675,00 | 45     |              |        |               |        |              |        |
| 4  | 2       | Federer       |              |        |              |        |               |        |              |        |
| 5  | 3       | Dimitrov      | \$ 77.980,00 | 250    |              |        |               |        |              |        |
| 6  | 4       | A. Zverev     |              |        |              |        |               |        |              |        |
| 7  | 5       | Thiem         | \$ 12.675,00 | 45     |              |        |               |        | \$ 12.675,00 | 45     |
| 8  | 6       | Cilic         |              |        |              |        |               |        |              |        |
| 9  | 7       | Goffin        |              |        |              |        | \$ 20.080,00  | 20     |              |        |
| 10 | 8       | Sock          |              |        |              |        |               |        |              |        |
| 11 | 9       | Wawrinka      | \$ 22.245,00 | 90     |              |        |               |        |              |        |
| 12 | 10      | Carreño Busta |              |        |              |        |               |        | \$ 12.675,00 | 45     |
| 13 | 11      | del Potro     |              |        |              |        |               |        |              |        |
| 14 | 12      | Djokovic      |              |        |              |        | \$ 209.665,00 | 250    |              |        |
| 15 | 13      | Querrey       | \$ 4.425,00  | 0      |              |        |               |        |              |        |
| 16 | 14      | Anderson      |              |        |              |        |               |        |              |        |
| 17 | 15      | Tsonga        |              |        |              |        | \$ 34.080,00  | 45     |              |        |
| 18 | 16      | Murray        |              |        |              |        | \$ 110.420,00 | 150    |              |        |
| 19 | 17      | Isner         |              |        |              |        |               |        |              |        |
| 20 | 18      | Pouille       | \$ 7.470,00  | 20     |              |        |               |        |              |        |
| 21 | 19      | Berdych       |              |        |              |        | \$ 59.810,00  | 90     |              |        |
| 22 | 20      | Bautista Agut |              |        | \$ 79.780,00 | 250    |               |        |              |        |

Each database comprises the list of all top 100 players based on end-of-the-year rankings. Prize money and points have been collected from each tournament's main draw for each player of the top 100. They have been attributed to all players on the list for the year studied in the database.

For instance, as shown on this table, Grigor Dimitrov (ATP 3) won the tournament of Brisbane and thus earned \$77,980 and 250 points. He did not play in Chennai, Doha or Sydney. Dominic Thiem (ATP 5) reached the quarterfinals in Brisbane and Sydney and received the corresponding prize money and points.

Prize money in Australian dollars, Euros and Pounds has been translated into US dollars. This allows to sum all prize money for each player in the top 100 at the end of the year, giving the total amount of prize money earned by each member of the top 100 during a particular year, or tennis season.

The database also allows to compute the total amount of prize money and points available for each tournament played during a year. Adding up these amounts for all tournaments played in a tennis season gives the total amount of prize money and points available that year.

*Table 8 - Total Prize Money and Points*

|     | A       | B                        | FR                       | FS               |
|-----|---------|--------------------------|--------------------------|------------------|
| 1   | Ranking | Player name              | Player Total PM          | Player total pts |
| 2   |         |                          |                          |                  |
| 93  | 91      | Tsitsipas                | \$ 211.131,20            | 155              |
| 94  | 92      | Lacko                    | \$ 228.423,76            | 205              |
| 95  | 93      | Copil                    | \$ 303.087,12            | 235              |
| 96  | 94      | Thompson                 | \$ 392.466,28            | 355              |
| 97  | 95      | Kicker                   | \$ 322.514,29            | 350              |
| 98  | 96      | Sandgren                 | \$ 128.683,93            | 65               |
| 99  | 97      | Kavcic                   | \$ 50.000,00             | 10               |
| 100 | 98      | Jaziri                   | \$ 552.461,28            | 400              |
| 101 | 99      | Daniel                   | \$ 263.162,63            | 145              |
| 102 | 100     | G. Melzer                | \$ 110.732,71            | 160              |
| 103 |         |                          | \$ -                     | 0                |
| 104 |         | <b>Total top 100</b>     | <b>\$ 128.901.311,98</b> | <b>139380</b>    |
| 105 |         |                          | \$ -                     | 0                |
| 106 |         | <b>Total PM - Points</b> | <b>\$ 147.552.681,47</b> | <b>154660</b>    |
| 107 |         |                          |                          |                  |

Summing all total prize money earned by all top 100 players in a given year provides the total amount of prize money earned by the top 100 that year. This amount is denoted in red in Table 8, as well as the same calculation for points earned by the top 100. This can be compared to the total prize money and points in all tournaments played in a year, in blue, leading to information on how prize money is distributed generally. Indeed, the difference between total prize money and points in play, in blue, and those earned by the top 100, in red, gives the prize money and points earned by the players ranked outside the top 100 in Grand Slams and on the ATP World Tour.

The databases also allow to compute the number of matches played by each player of the top 100 on the ATP World Tour and in Grand Slams. Dividing the total amount of prize money earned by each top 100 player in a given year by the number of matches he played that year provides a measure of performance. Indeed, prize money increases with the importance of a tournaments, as well as with the rounds of tournaments. Hence, players going deep into major tournaments will have a significantly higher average prize money per match played than players reaching the last rounds of small tournaments or players losing early in big tournaments.

This is shown in table 9. Blaz Kavcic (ATP 97) received a Wild Card - an invitation - to play in the main draw of the Masters 1000 of Miami. He lost in the first round of the tournament, earning 10 ranking points and \$50,000. As this was the only match he played on the ATP World Tour in 2017, he has an average prize money per match of \$50,000. This is an outlier in the population, as very few players manage to make it into the top 100 by playing so few matches on the main tour.

*Table 9 - Prize Money per Match Played*

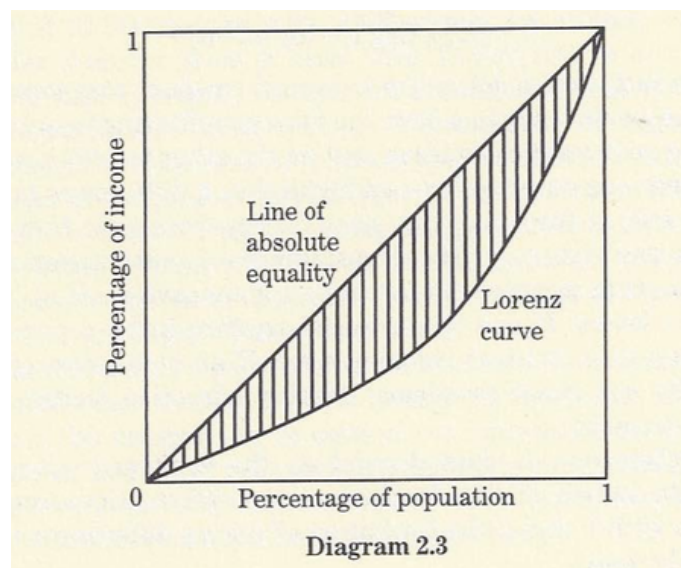
|     | A       | B           | FR              | FS               | FT              | FU                    |
|-----|---------|-------------|-----------------|------------------|-----------------|-----------------------|
| 1   | Ranking | Player name | Player Total PM | Player total pts | #Matches played | erage PM/match played |
| 2   |         |             |                 |                  |                 |                       |
| 92  | 90      | Marterer    | \$ 129.842,87   | 20               | 10              | \$ 12.984,29          |
| 93  | 91      | Tsitsipas   | \$ 211.131,20   | 155              | 14              | \$ 15.080,80          |
| 94  | 92      | Lacko       | \$ 228.423,76   | 205              | 16              | \$ 14.276,49          |
| 95  | 93      | Copil       | \$ 303.087,12   | 235              | 21              | \$ 14.432,72          |
| 96  | 94      | Thompson    | \$ 392.466,28   | 355              | 26              | \$ 15.094,86          |
| 97  | 95      | Kicker      | \$ 322.514,29   | 350              | 22              | \$ 14.659,74          |
| 98  | 96      | Sandgren    | \$ 128.683,93   | 65               | 8               | \$ 16.085,49          |
| 99  | 97      | Kavcic      | \$ 50.000,00    | 10               | 1               | \$ 50.000,00          |
| 100 | 98      | Jaziri      | \$ 552.461,28   | 400              | 35              | \$ 15.784,61          |
| 101 | 99      | Daniel      | \$ 263.162,63   | 145              | 13              | \$ 20.243,28          |
| 102 | 100     | G. Melzer   | \$ 110.732,71   | 160              | 14              | \$ 7.909,48           |

Finally, using these databases, income inequality due to ranking can be measured.

First, a simple proportion has been computed, providing the shares of prize money earned by players inside the top 100 and those outside of it. For instance, it is possible to determine which share the top one percent population earns from the total income in play.

Second, some Lorenz curves have been drawn to illustrate the extent of income inequalities among professional tennis players. Specifically, it shows the cumulated amount of prize money earned by cumulated population. In a perfectly equal world, that is, if 10% of the population earned 10% of prize money and so on, the distribution would be equivalent to a 45° line, denoted as “line of absolute equality”. When there is inequality in prize money distribution among players, the distribution becomes a curve, known as the Lorenz curve, which shows the extent of income inequality in the population. The further the Lorenz curve is from the 45° line, the higher the income inequalities within the population.

*Figure 3 - Lorenz Curve<sup>23</sup>*



<sup>23</sup> SEN, A. (1997), *On Economic Inequality*, expanded edition, Clarendon Press, Oxford (U.K.), p.30

Third, the Gini coefficient can be derived from the Lorenz curve. It is equal to the dashed area between the 45° line and the Lorenz curve divided by the entire area below the 45° line. Thus, the further away the Lorenz curve, the higher the Gini coefficient. In a perfectly equal society, the Gini coefficient is equal to zero. In a perfectly unequal society, that is, if one individual earns the entire revenue, the Gini coefficient is equal to one. This coefficient is an abstract measure of inequality which can be used to compare inequality between populations at a particular point in time, or to analyze the evolution of inequality within a population across time. This paper will use the Gini coefficient to assess the latter.

For the purposes of this research question, the analysis will not be based on the 'best of' systems of ATP and WTA rankings, but rather on the total amount of points earned by each player over one calendar year. This allows for a clearer and more logical comparison between the total prize money and points earned during the year, as well as the relative prize money and points earned during each tournament.

## 3.2 Remarks and Downsides

This method has several drawbacks.

### 3.2.1 Limitations

The first is that the databases only include top 100 players. For all players ranked outside of the top 100, it is impossible to know exactly how Tour money is distributed among them. Therefore, it is assumed that there is a linear distribution of all remaining prize money, that is, Tour prize money that is not earned by players ranked in the top 100. This assumption is clearly inaccurate, as players ranked outside the top 100 do not all participate in the ATP World Tour or the WTA Tour. Most of them usually play in smaller tournaments organized by the ITF or the ATP Challenger Tour, which are not included in this analysis.

### 3.2.2 Missing Data

Missing data has been a major issue in this paper.

On the WTA Tour, tournament draws were only available for the year 2017 during that year using the ATP/WTA application. This application resets at the beginning of a new tennis season, therefore the draws used in this paper are no longer available to the public at this time.

Tournament draws of the men's tour are available on the ATP website from 2009 to 2018 if the tournaments have already been played. Prior to 2009, the tournaments are listed but their draws are not included, although ATP officials are currently recovering this data. Without the tournament draws, prize money distribution among different rounds of the tournament is unknown. Hence, this paper's analysis cannot be performed.

Moreover, even in the years for which tournament draws were available, a few of them are still missing.

### 3.2.3 Other Sources of Income

Finally, another disadvantage of this method is that it does not include all sources of income available to players.

The ATP Challenger Tour is not included in this analysis. Therefore, all prize money and points earned by players in tournaments of this category are not taken into account. The same goes for players playing in doubles as well as singles. Their earnings and points coming from doubles matches are not included in the analysis. Tournament qualifications, yielding points and prize money to their participants and offering a few spots in a tournament's main draw are also not taken into account here.

Sponsorship money is also ruled out of the analysis, although it most likely would increase income disparities between top players and lower-ranked players. Indeed, top players are the ones who get the most lucrative sponsorship deals, as well as players with the most flattering looks. As the contracts between players and sponsors are private, it is quite difficult to obtain information regarding the amounts in question.

Therefore, the analysis is looking at singles' tennis played in the main draws of Grand Slams as well as the ATP World Tour and WTA Tour.

Chapter four will provide a detailed analysis of the results obtained in this paper.

## IV. Results

### 4.1 Association of Tennis Professionals

#### 4.1.1 2017 Analysis

First, let us look at the distribution of male tennis players ranked within and outside the top 100 in 2017. The top 100 players accounted for 5% of all male professional tennis players. The remaining 95%, that is, 1885 male players, were ranked outside the top 100.

*Figure 4 - 2017 ATP Population Distribution Within and Outside Top 100*

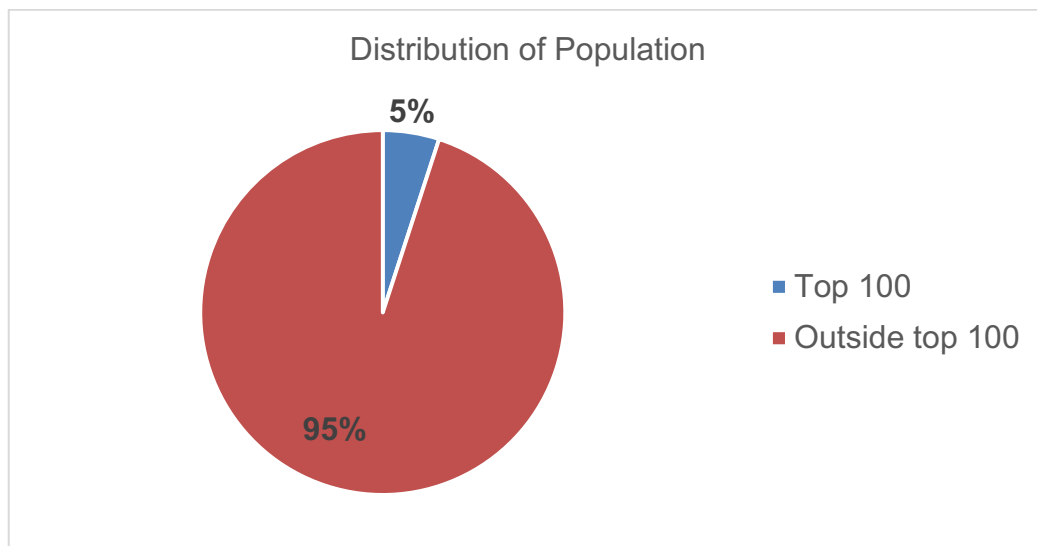
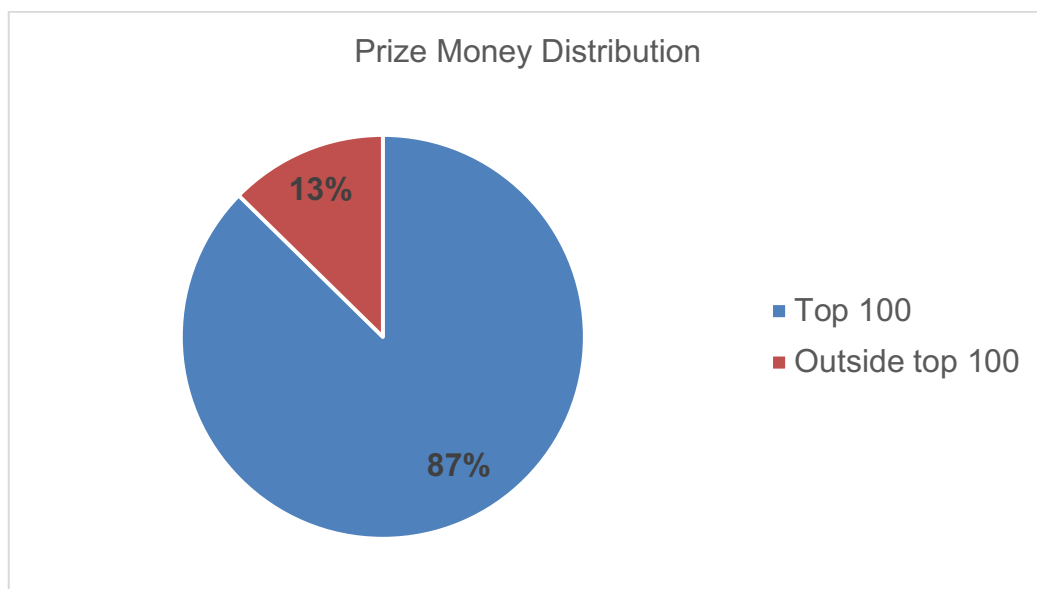


Figure 5 shows the distribution of prize money across professional male players.

*Figure 5 - 2017 ATP Prize Money Distribution Between Players Within and Outside Top 100*

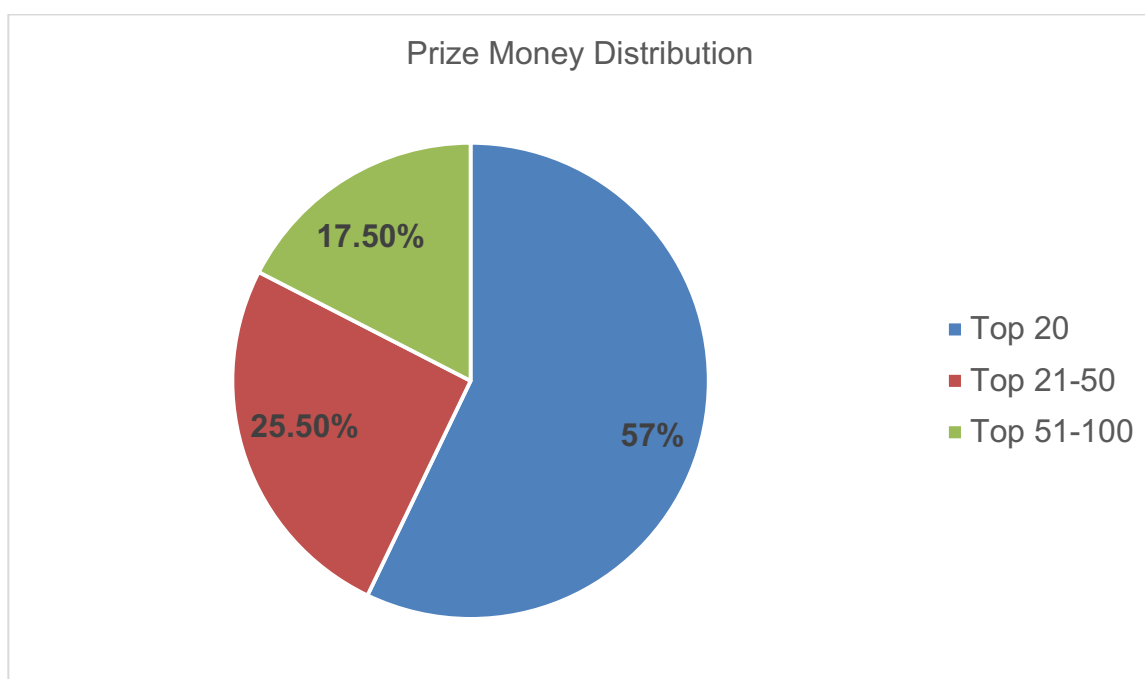


The top 100 players, or the top 5% of the population, earned 87.35% of total prize money available in 2017. This leaves the remaining 95% of the population with a share of 12.65% of total prize money.

According to the ITF's 2014 report, "the top 1% of ranked male players (top 50) earned 60% of the total prize money pool" in 2013. The top 50 earned 72% of the prize money pool computed in this analysis, which does not include prize money provided by the ATP Challenger tour and ITF Men's Circuit, although these tournaments provide less prize money than any ATP World Tour tournament.

The next figure shows how prize money is allocated within the top 100. Hence, it represents how prize money earned by the top 100 is distributed among those players.

*Figure 6 - 2017 ATP Prize Money Distribution Within Top 100*



Inequalities are also striking within the top 100, as the top 20 players earn over 55% of the prize money earned by the top 100 that season. Players ranked in the second half of the top 100 earn less than a fifth of that prize money.

The next figure is the Lorenz curve for ATP players in 2017, which is a more accurate representation of inequalities between players depending on their rankings.

*Figure 7 - 2017 ATP Lorenz Curve – Prize Money Distribution*

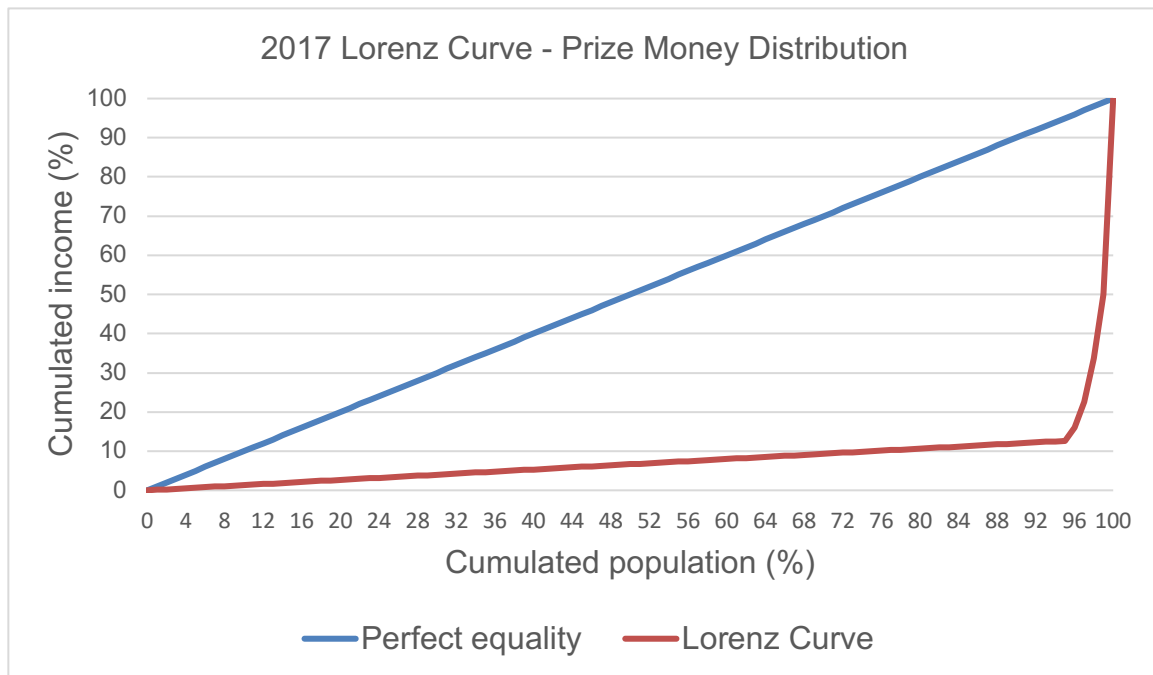


Figure 7 shows how prize money is distributed among players as a function of their ranking. Cumulated population is represented on the horizontal axis, from the lowest to highest ranked percentages of population. Cumulated prize money is represented on the vertical axis, from 0 to 100%. This figure summarizes results illustrated in the previous pie figures, that is, that the top 100, which represents 5% of the population, earns almost 90% of available income. The higher the ranking, the more disproportionate prize money earned becomes.

Note that the first part of the curve, representing the first 96% of the population, is actually a linear function. Indeed, the data provides a detailed distribution of prize money within the top 100 only. Therefore, the distribution of prize money earned by players ranked outside of the top 100 is unknown and has been assumed to be linear, although it is not the case in reality. Players ranked outside the top 100 usually do not play on the ATP World Tour but on the ATP Challenger Tour or the ITF Men's Circuit.

The Gini coefficient can be derived from the Lorenz curve by dividing the area between the 45° line and the Lorenz curve by the entire area under the 45° line. In 2017, the Gini coefficient was equal to 0.9143 in men's professional tennis, showing again that inequalities are extremely high in the sport. Indeed, most of the income available in this tennis season is concentrated among the very last percentiles of the population. Although the analysis does not include the Challenger tour and the ITF Men's Circuit, this statement is still true, simply because the total prize money at play in any of those smaller tournaments is 2 to 400 times smaller than the ATP World Tour tournament offering the lowest total prize money.<sup>24</sup> Therefore, it is clear that income is concentrated in the ATP World Tour, which is analyzed here.

<sup>24</sup> [https://en.wikipedia.org/wiki/Association\\_of\\_Tennis\\_Professionals](https://en.wikipedia.org/wiki/Association_of_Tennis_Professionals)

Now let us look at the Lorenz curve of point distribution instead of prize money, in order to find out whether income inequalities are representative of the way that points are distributed, or if they reflect a phenomenon specific to the distribution of prize money.

*Figure 8 - 2017 Lorenz Curve - Point Distribution*

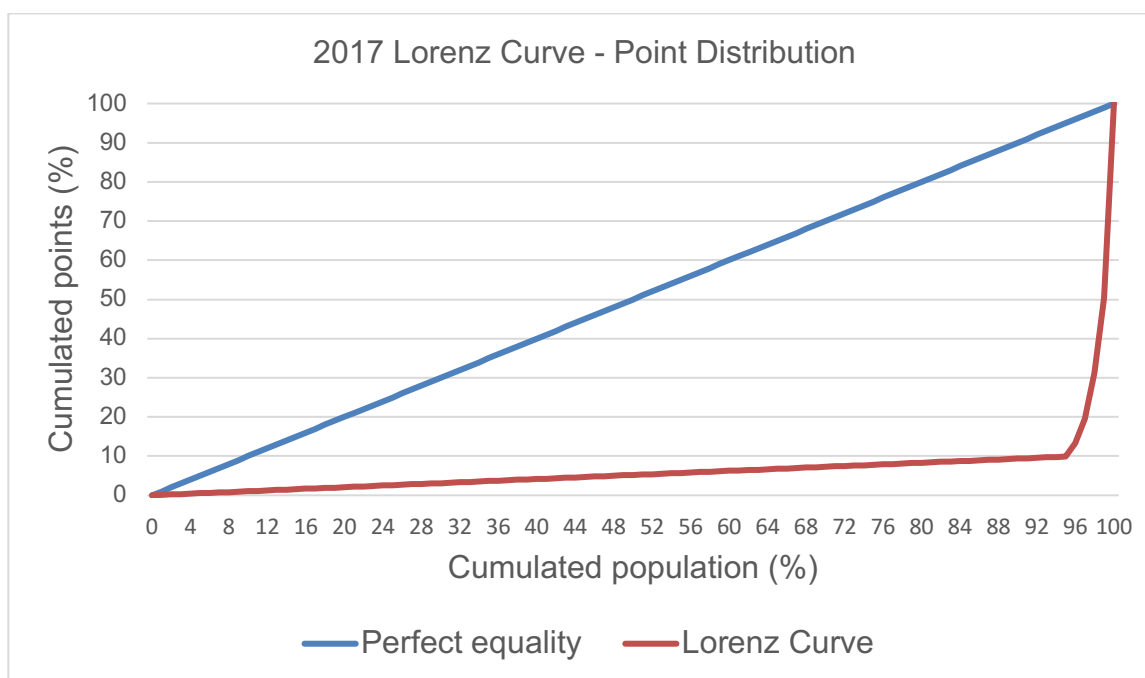
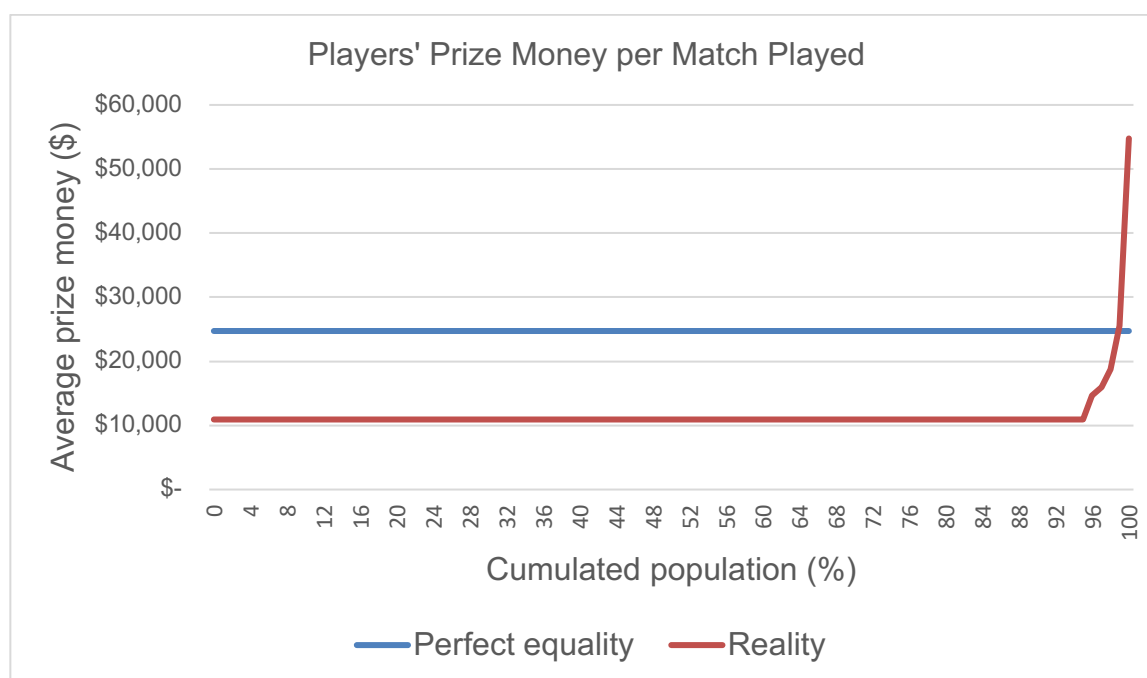


Figure 8 depicts the Lorenz curve as a function of point distribution rather than prize money. This graph shows that points are distributed in the same unequal manner as prize money, with high inequalities in the last percentiles of the cumulated population as well. Therefore, disparities in prize money in tennis are a reflection of the distribution of points among different rounds of different tournaments. Income differences due to ranking are not disproportionate compared to the point distribution. This means that top players not only earn an unequal amount of prize money during a season, they also receive an unequal amount of points, which increases the overall income inequalities. Indeed, if points are distributed in an unequal way, climbing up in the rankings becomes more difficult. Hence, it will be harder for a lower-ranked player to be automatically drawn in main tournaments and therefore it will require more efforts to reach the last stages of a tournament. Lower-ranked players who do not have direct access to the main draw of an important tournament either have to play in the qualifications and thus play two or three additional matches in order to enter the main draw, or they will have to enter smaller tournaments with less prize money and points at stake instead. To some extent, the actual distribution of prize money and points can lead to the existence of a vicious circle, where top players are automatically drafted in the main draws of all important tournaments with high amounts of prize money and points at stake, whereas lower-ranked players need to earn their spot in those same tournaments in order to have a shot at these rewards, which would also enable them to access these tournaments more easily in the future.

Let us now look at the issue of income inequalities by adding a proxy for performance. This proxy consists of the average prize money earned by match played for any player. Hence, it represents the total amount of prize money earned by a player in a given year divided by the total number of matches played by that player in the same year. This measure can be seen as a proxy for performance, as players going deep into big tournaments will earn higher amounts of prize money than players winning small tournaments or players repeatedly losing in early rounds.

*Figure 9 - Average Prize Money per Match Played*

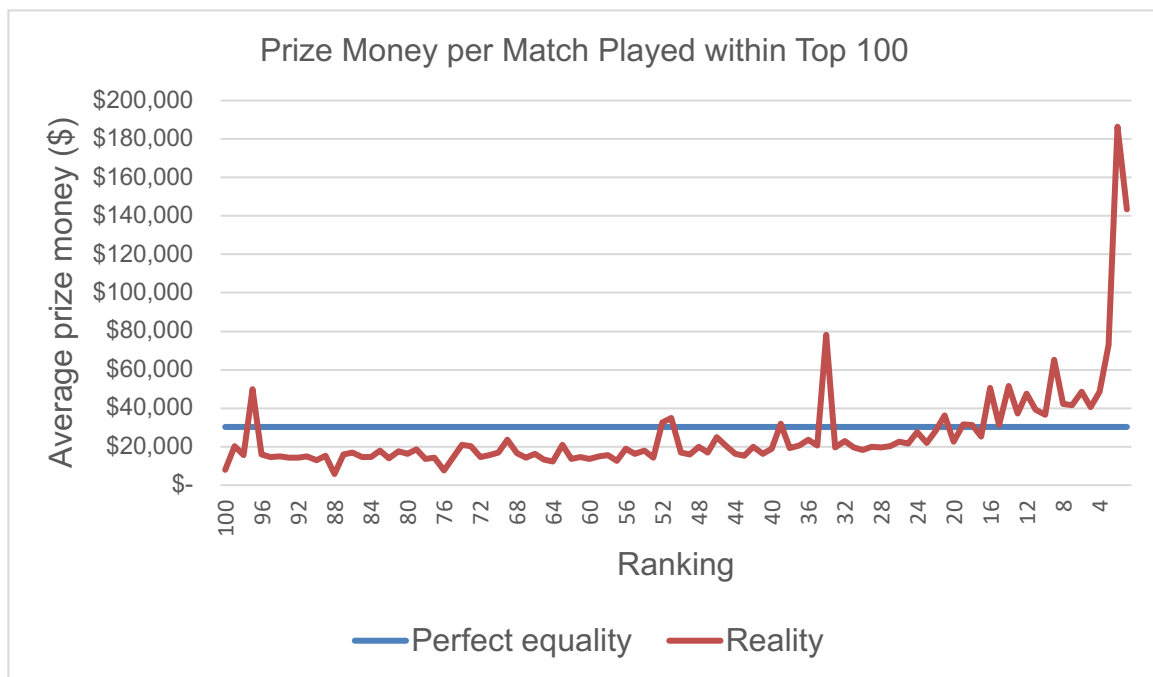


As in the Lorenz curve chart, the horizontal axis represents cumulated population. However, the vertical axis does not show cumulated income but the level of average prize money earned per match played. If total prize money was split equally between players, that is, if total prize money was divided by the double of matches played, since there are two players in a match, the distribution would be the blue line. In that theoretical framework of perfect equality, players would always receive the same amount of money when they played a match, regardless of the type of tournament or of the round of the tournament.

In reality, most players earn less than half of this equal distribution. The top 1%, representing top 20 players, pick up 50% of all prize money, whereas the remaining 99% of the population earn the other half of total prize money available in Grand Slams and in the ATP World Tour. Top 20 players are those players consistently going deep into the main tournaments, where prize money is the highest.

Figure 10 shows the same distribution within the top 100 only.

Figure 10 - Average Prize Money per Match Played within Top 100



The horizontal axis represents top 100 players from 100 to 1. The blue line represents a perfectly equal prize money distribution of prize money per match played.

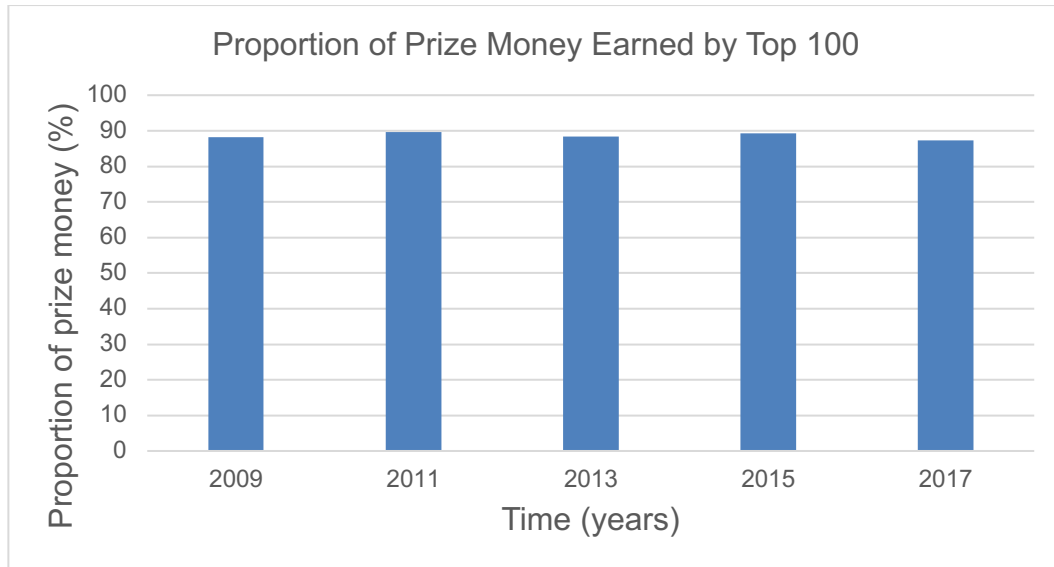
Disparities are still striking, as only top 15 players earn more than the average prize money per match of the top 100, meaning that they pick up half of top 100 total prize money. Note that the spikes show the presence of outliers. These players are Krajinovic (ATP 34) and Kavcic (ATP 97) who have entered one tournament on tour, a Master 1000, and earned significant amounts of prize money by playing very few matches on the ATP World Tour in 2017. Former top ranked players who lost ranking spots due to injury, such as Andy Murray (ATP 16), Stan Wawrinka (ATP 9) or Novak Djokovic (ATP 12), have an average prize money per match played of \$50,505, \$65,325 and \$47,587 respectively. This shows that even if their ranking does not reflect their performance in 2017 before their injuries, this proxy of performance still shows that they belong in the highest parts of the rankings. Note that the player with the highest average of prize money per match played in 2017, Roger Federer, is not ranked as world number one. Federer has played 63 matches in 2017, and earned about \$11,7 million in prize money, whereas Nadal, world number one at the end of the 2017 season, played 89 matches for a prize money of \$12,8. Hence, Federer's average is higher because he played less matches but he did not earn more ranking points than his number one competitor, Rafael Nadal.

The next section studies the evolution of inequalities on the ATP World Tour over the last decade.

#### 4.1.2 2009-2017 Evolution

Let us start by looking at the evolution of the proportion of total prize money earned by the top 100, represented in a pie chart earlier. The following figure shows the evolution of the percentage of prize money earned by the top 100 since 2009.

*Figure 11 - Proportion of Prize Money Earned by Top 100*



This proportion has been stable, fluctuating between 88% and almost 90% over the last ten years. This means that very little effort has been made to reduce income disparities between the top 100 and players ranked outside of it, or if any effort was made, it was not successful in reducing income disparities between players ranked within and outside of the top 100.

Then, let us look at how the Lorenz curve has evolved over time.

*Figure 12 - Lorenz Curve Evolution*

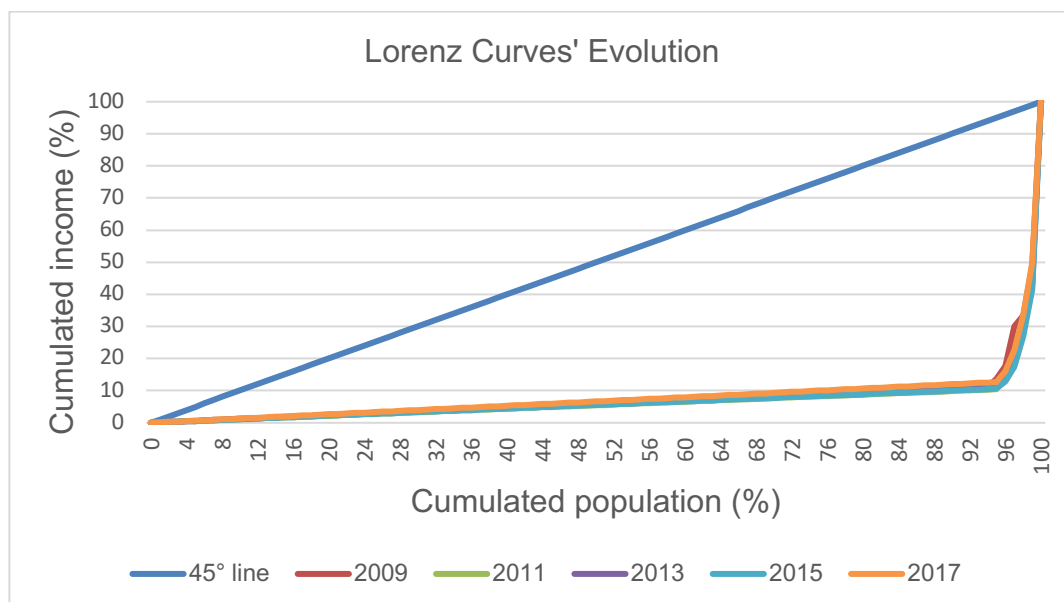


Figure 12 shows the evolution of the Lorenz curve for the same time span. Again, it shows that the distribution of prize money among players as a function of ranking is highly unequal, favoring the very top players, as all curves overlay.

The Gini coefficients remain stable around 0.91 for all five Lorenz curves depicted in this graph, showing that the level of inequality has not evolved over the last decade.

Finally, the following section analyzes the evolution of income inequalities within Grand Slam tournaments.

#### 4.1.3 Grand Slam Evolution

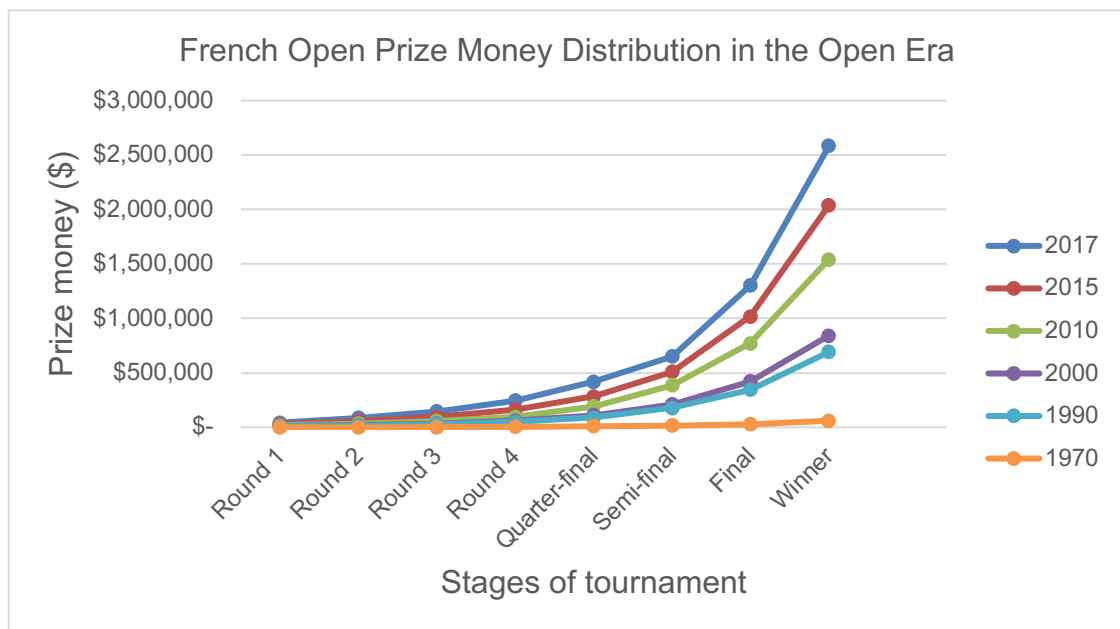
This third and final section of the analysis of income inequalities in men's professional tennis looks at the evolution of income disparities within Grand Slams. In order to assess the evolution of prize money inequality between the different stages of a Slam, a simple measure is computed. This measure consists in calculating the proportion of prize money earned during one stage of the tournament from the total amount of prize money distributed to all stages of the tournament, for several periods of time. This gives the evolution of this proportion and allows to find out how inequalities across rounds have evolved over time.

Note that 1990 has been chosen instead of 1970 to begin this analysis because in 1970, the Australian Open and the French Open did not have as many main draw rounds as the other two Slams, especially in the case of women's draws. Therefore, the analysis would be inaccurate if 1970 was used as first bound of the estimated period because it would not represent the same draw as the other two Slams and all other time periods studied here.

The four Slams have been analyzed in order to answer this question but only two will be displayed here, which have been randomly selected. The graphs for the other two are available in the appendix.

First is figure 13, showing the evolution of prize money for all rounds of the French Open since 1970, adjusted for inflation.

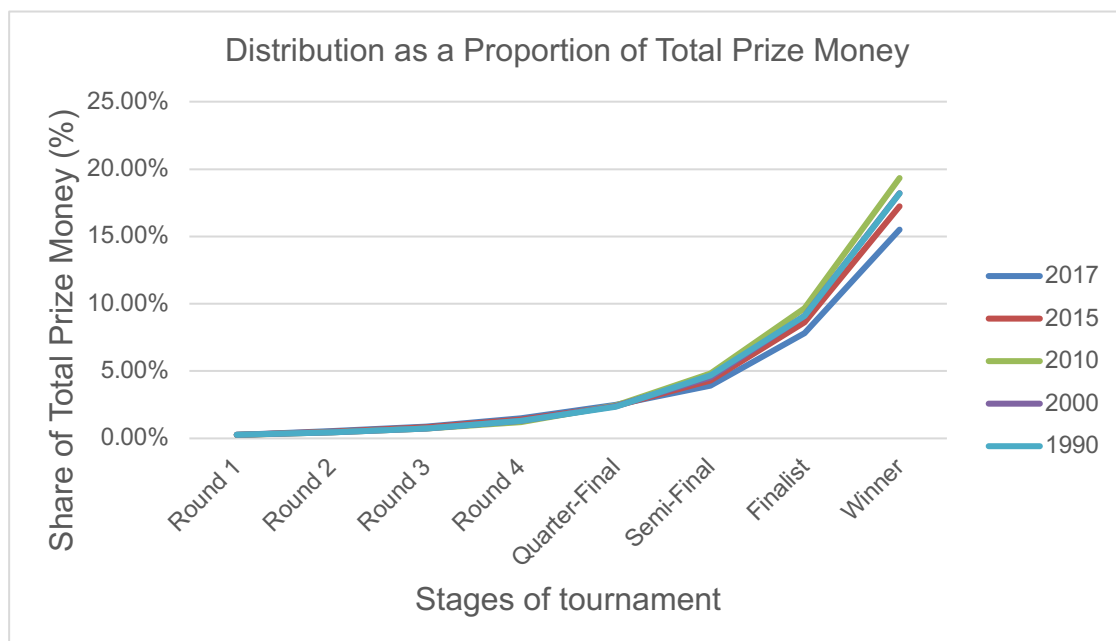
*Figure 13 - Evolution of French Open's Prize Money Distribution*



It seems that the massive increases in general prize money have been unequally distributed among the different rounds of the French Open's draw. Indeed, the curves get steeper over time which indicates that inequalities between rounds get bigger over time.

Then, let us look at figure 14 where prize money for each round is represented as a percentage of the total prize money at play each year at the French Open.

*Figure 14 - French Open Prize Money Distribution as a Proportion of Total Prize Money*



A first-round loser earned .25% of all prize money in 2017, whereas the winner received 15.5% of total prize money. However, the curve has started to lower after 2010, when inequalities across rounds reached an all-time high. In 2017, the semifinalists, finalist and winner earned a smaller fraction of total prize money than during any other year since 1990.

The next chart accounts for the number of players earning prize money at each round of the tournament. Hence, the percentages of the previous graphs have been multiplied by the number of players losing at each round of the tournament and thus earning that round's prize money.

*Figure 15 - French Open's Prize Money Distribution as a Proportion of Total - incl. number of players*

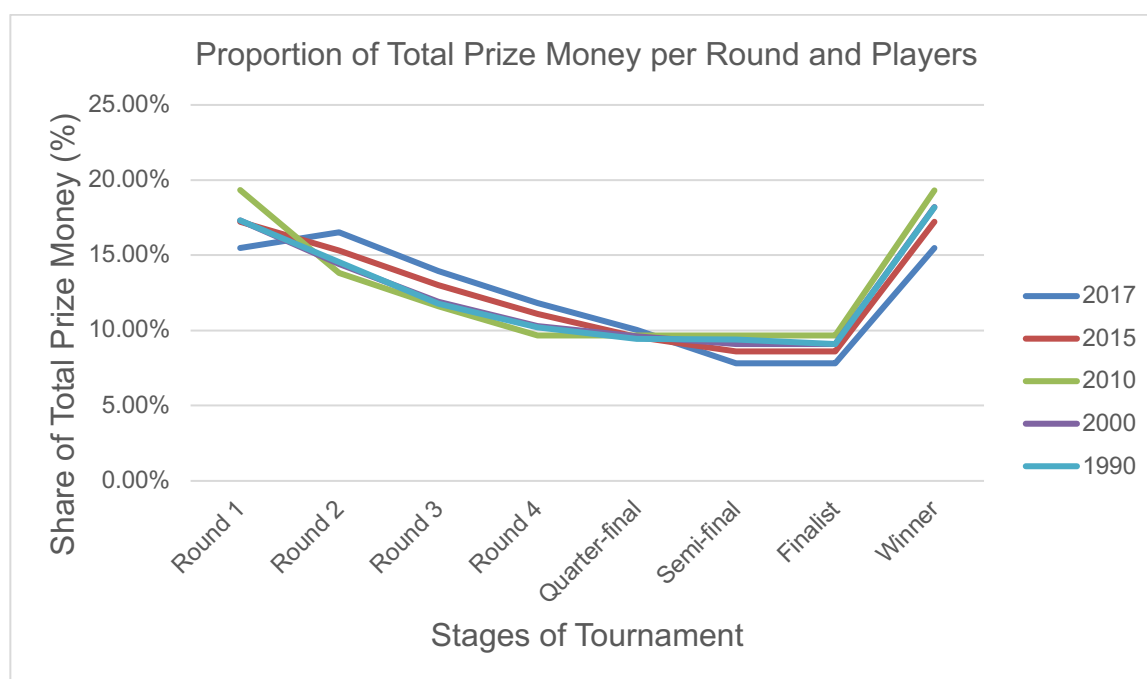
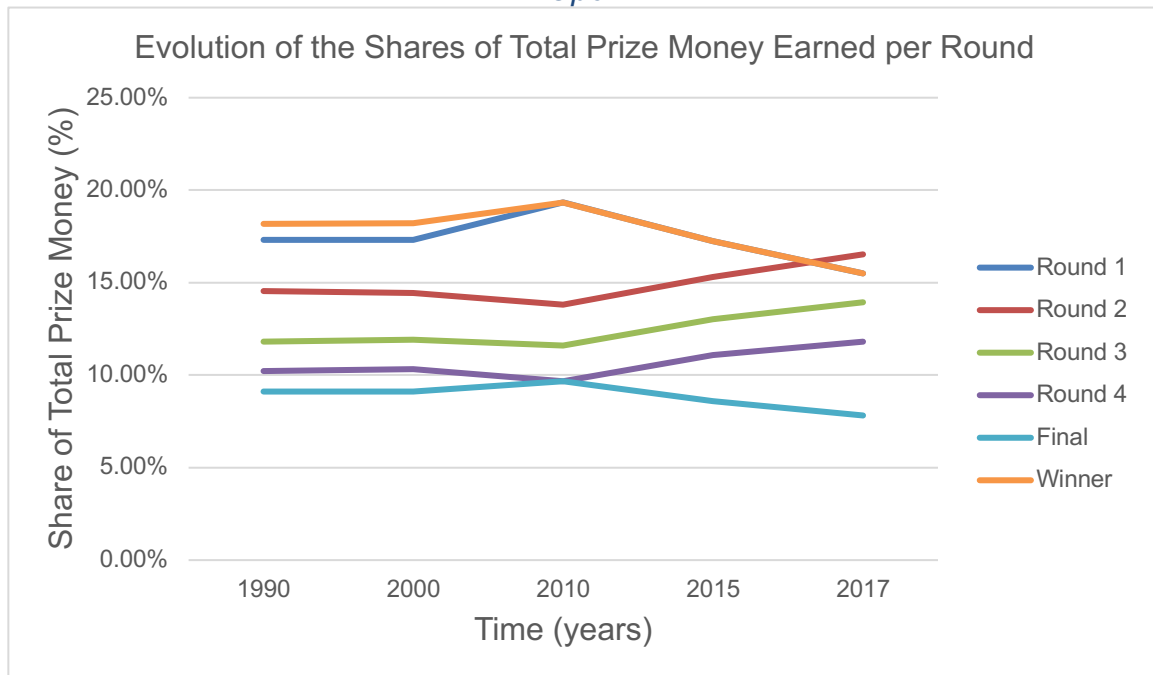


Figure 15 shows that together, the 64 players losing in the first round of the tournament earned 15 to 20% of the tournament's total prize money, which is about the same proportion as the winner's earnings. Furthermore, the proportion decreases after the first round, because the number of losing players is divided by two every round until the semifinals. Then, the proportion of total prize money earned by the quarterfinalists, semifinalists and the finalist is constant for all periods except 2017. This means that the finalist usually earns twice the prize money of a semifinalist, who in turn picked up twice the prize money of a quarterfinalist. In 2017, the share of total prize money distributed in the second to fourth round increased, whereas the proportion granted to the semi-finalists, finalist and winner decreased compared to previous years. Hence, there has been a lowering of inequalities across rounds over the last few years at the French Open, which was also noted in table 6.

The next figure depicts the evolution of these shares over time.

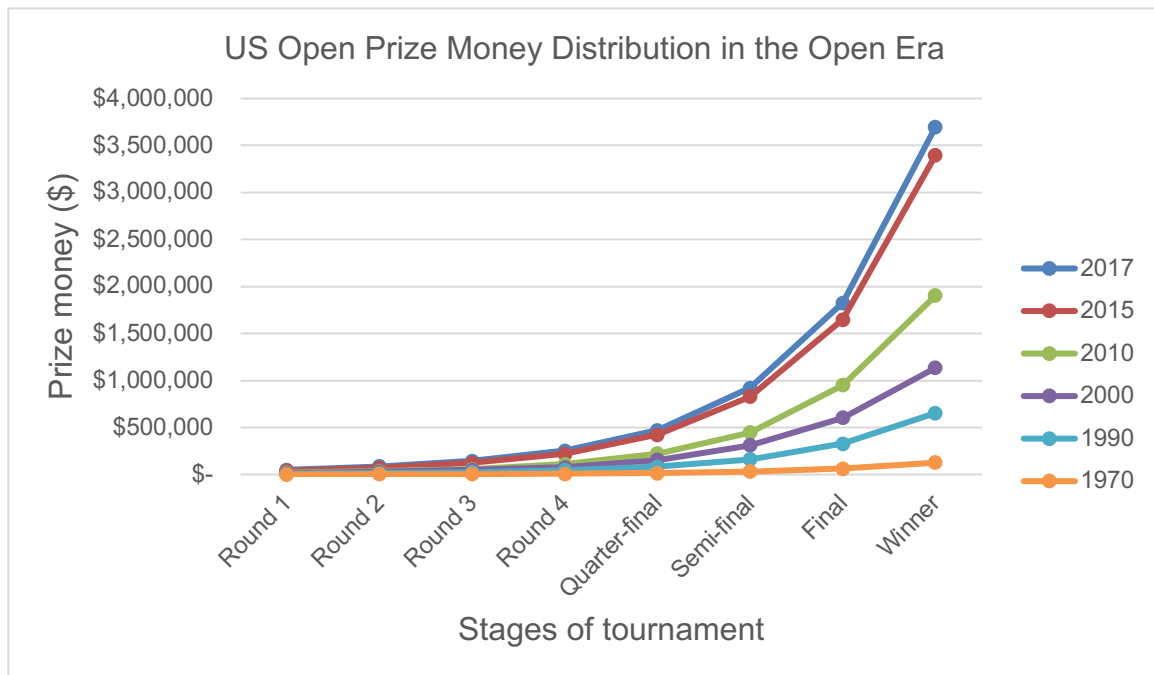
*Figure 16 - Evolution of Shares of Prize Money Earned per Round at the French Open*



This figure illustrates the reduction in inequalities across different stages of the French Open over time. The finalist and the winner's shares of total prize money have been decreasing since 2010 at the benefit of rounds two, three and four. the share earned by first-round losers has been following the same pattern as the one of the winner since 2010. The quarterfinalists' share has remained constant over time, whereas the semifinalists' share has evolved in the exact same manner as the finalist's share, which is why they are not represented on this graph.

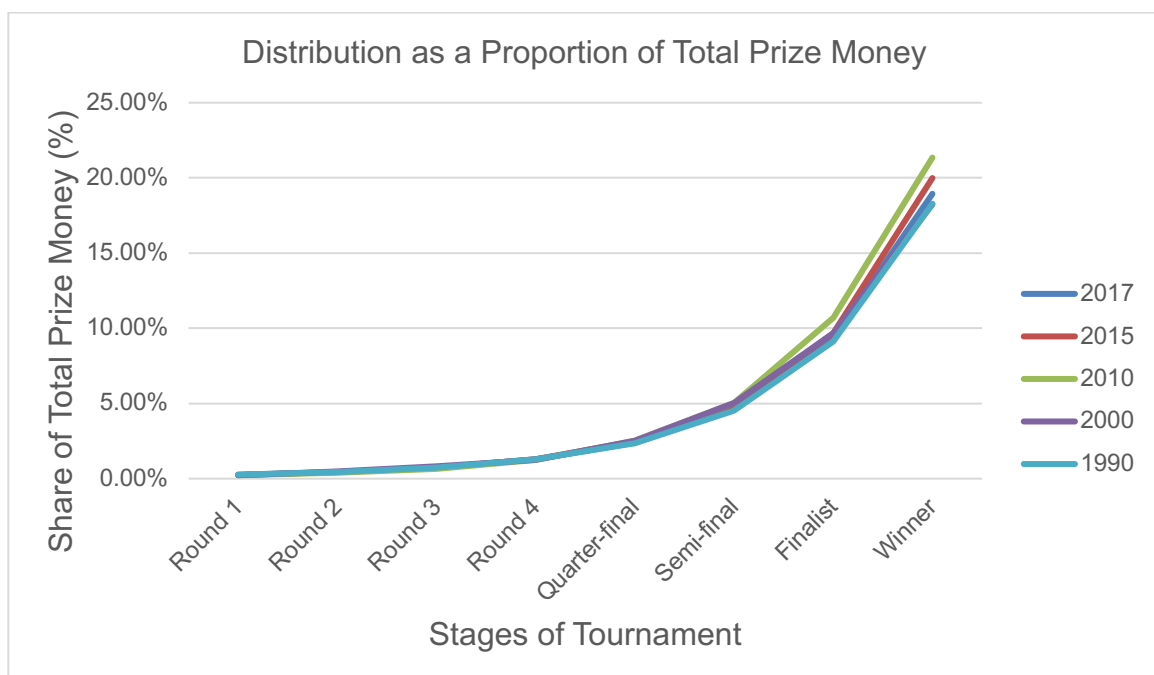
Figure 17 depicts the same evolution in the case of the US Open and is adjusted for inflation as well. Inequalities seem even more intense within this Grand Slam since 2015, where the curves get even steeper than in the case of the French Open.

*Figure 17 - Evolution of US Open's Prize Money Distribution*



Figures 18 and 19 depict proportions of total prize money rather than actual amounts of prize money. Figure 19 accounts for the number of players earning these amounts, whereas figure 18 represents the situation of one player at every round.

*Figure 18 - US Open Prize Distribution as a Proportion of Total Prize Money*



This graph shows that inequalities are slightly more intense in prize money distribution at the US Open than in the French Open. In the 2010 US Open, the winner earned over 21% of total prize money, which is almost 2% higher than during

the 2010 French Open. In 2017, inequalities had decreased to about 19%, which is still 4.5% more than the winner's share of prize money at the French Open that year.

*Figure 19 - US Open Prize Money Distribution as a Proportion of Total - incl. Number of Players*

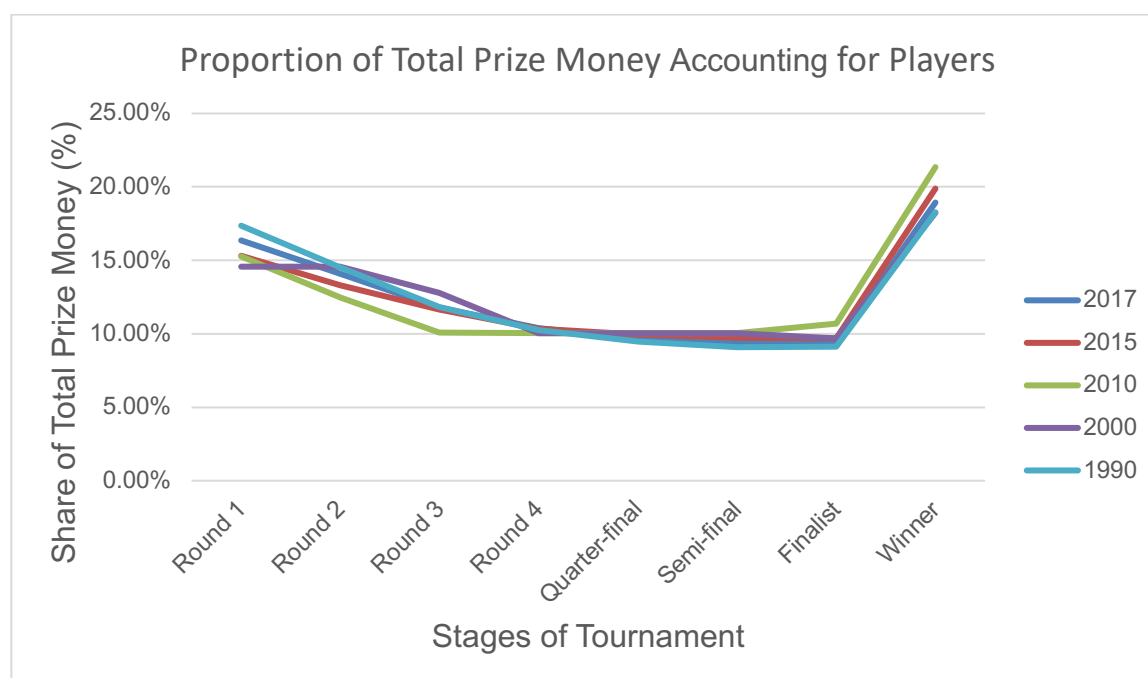
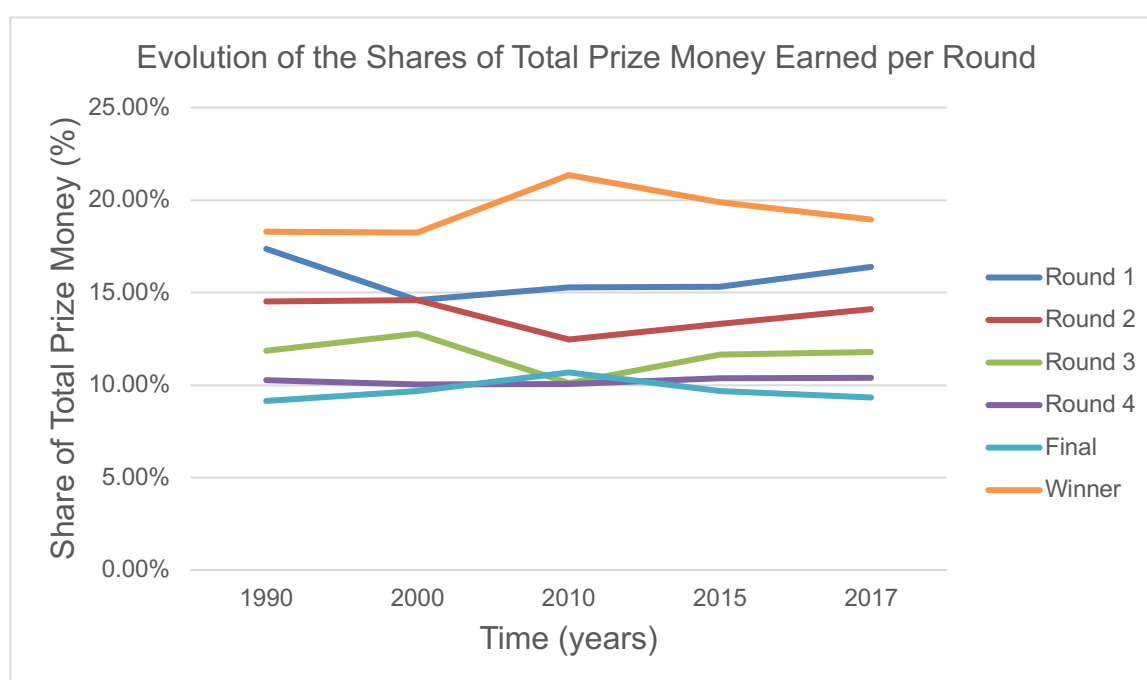


Figure 19 tells the same story. Where the share of total prize money earned by first-round losers was very similar to the one of the winner in the case of the French Open, there has always been a difference of at least 4% in the case of the US Open. Again, although inequalities across rounds have been decreasing since 2010, this has happened at a much slower pace than at the French Open.

Figure 20 shows how these proportions of total prize money per round have evolved over the last 30 years.

Although the shares earned by the winner and the finalist have decreased since 2010 and those attributed to rounds one to three have increased and thus reduced inequalities across rounds, there are still some significant disparities in the US Open prize money distribution. The winner's share was still 2.5% higher than the share of first-round losers in 2017, whereas the French Open had equalized them right after 2010. Quarterfinalists, semifinalists and fourth-round losers' shares have remained more or less stable over this period of time.

*Figure 20 - Evolution of Shares of Total Prize Money per Round at the US Open*



The graphs regarding the other two Grand Slams, the Australian Open and the Wimbledon Championships, are available in the appendix. The results found in their analysis are the following.

Income inequalities in a Grand Slam reached an all-time high during the 2010 Australian Open, when the winner earned a share of total prize money over 10% higher than the first-round losers. In 2017, this difference was divided by four, as first-round losers earned a 2.5% smaller share than the winner, indicating a reduction of income disparities across rounds.

During the 2010 edition of the Wimbledon Championships, the winner earned a share of total prize money that was 6.5 percentage points higher than the share of first-round losers. However, the winner's share has started to decrease since 2010 and in 2017 first-round losers earned a higher share of total prize money than the winner. Rounds two and three have also benefited from a reduction in the shares of the winner and the finalist.

Hence, the Wimbledon Championships and the French Open have reduced inequalities within rounds the most, whereas the Australian Open and the US Open are falling a bit behind their European counterparts.

The following section will focus on the analysis of the WTA Tour for the year 2017 as well as the evolution of inequalities within Grand Slams. This allows for a comparison between men and women's tennis, in order to find out whether inequalities in prize money due to ranking follow the same patterns in women's tennis as it does in the men's game.

Note that the 2009-2017 evolution of inequalities on Tour are not computed for women's tennis, as data was not available.

## 4.2 Women's Tennis Association

### 4.2.1 2017 Analysis

The analysis of inequalities due to ranking in women's professional tennis follows the same steps as the one in men's professional tennis.

First, simple proportions are computed in order to find out if a similar concentration of income is observed in the women's top 100.

Figure 21 shows that, in 2017, 8% of female professional tennis players were ranked within the top 100. The 1175 remaining ones were ranked outside the top 100.

*Figure 21 - 2017 WTA Population Distribution Within and Outside Top 100*

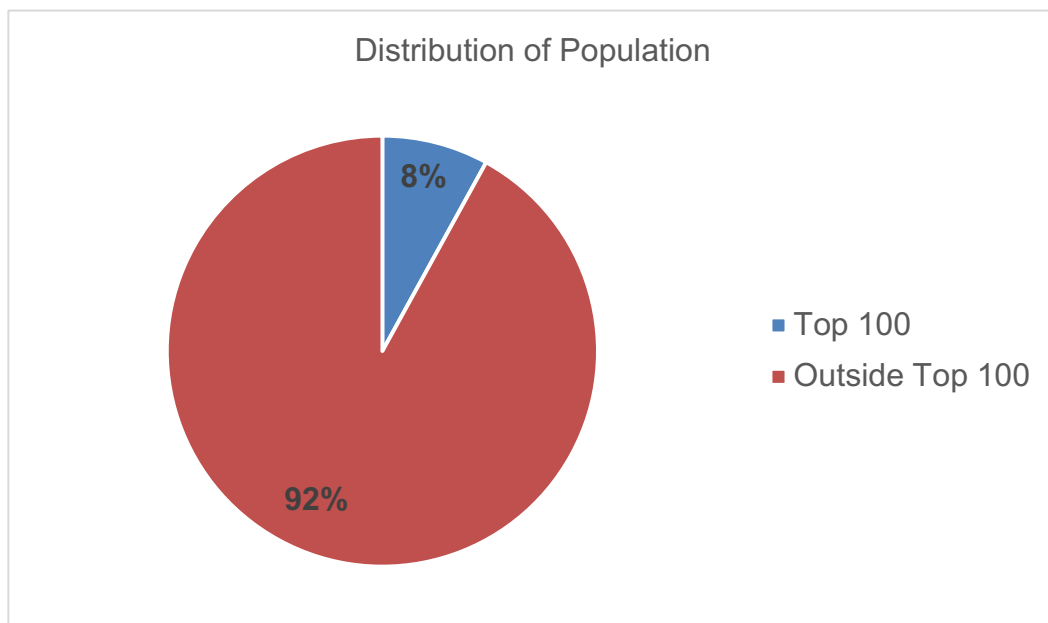
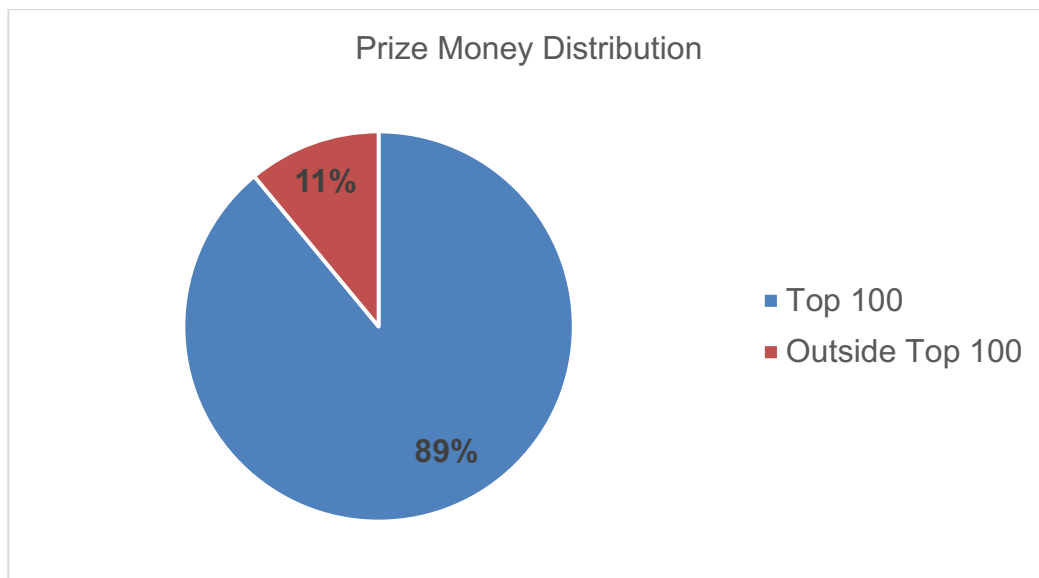


Figure 22 depicts the prize money distribution between female professional tennis players for the year 2017.

*Figure 22 - 2017 WTA Prize Money Distribution Between Players Within and Outside Top 100*

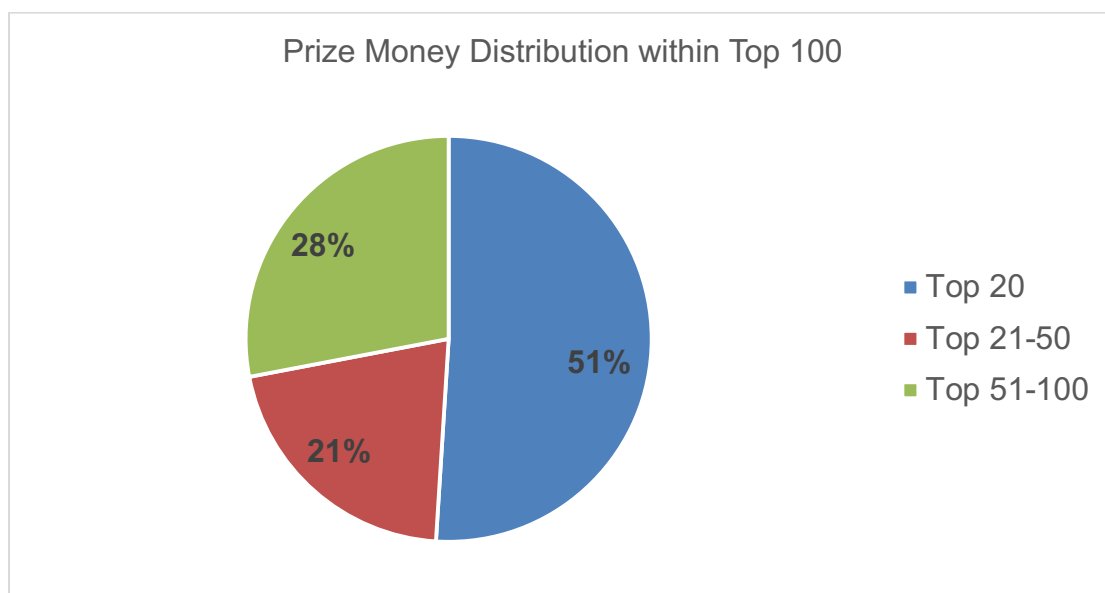


Players ranked within the top 100 earned 89% of available prize money in 2017. That means that 8% of the population received 89% of total income. As in the case of men's tennis in 2017, the distribution of prize money is highly unequal between female players ranked within and outside the top 100.

The ITF's 2014 report stated that "the top 1% ranked female players (top 26) earned 51% of the total prize money pool" in 2013. In 2017, the top 26 earned 58% of the total prize money computed in this analysis, which excludes ITF tournaments, smaller in terms of prize money and points than any WTA tournament.

Figure 23 shows the distribution of prize money within the top 100 for the same season.

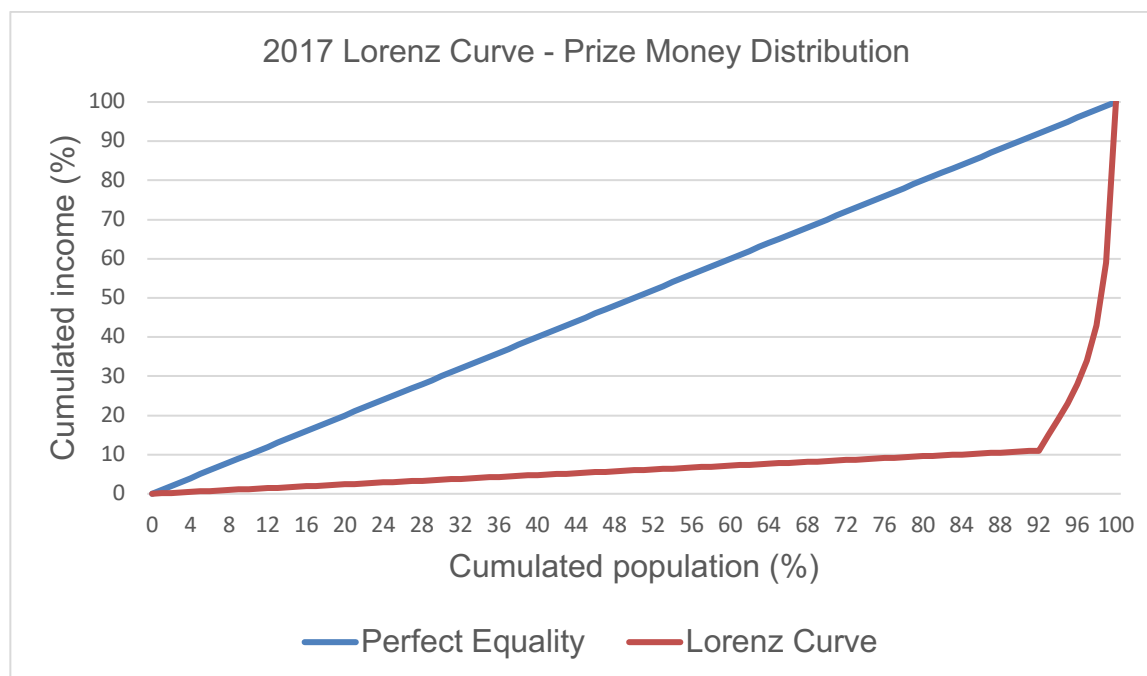
*Figure 23 - 2017 WTA Prize Money Distribution Within Top 100*



Top 20 players picked up over half of the income earned by the top 100, which is very similar as the distribution in the men's case. However, in women's tennis, the second half of the top 100 earns over a quarter of that income, whereas their male counterparts did not earn a fifth of the top 100 revenue.

The following figure represents the 2017 Lorenz curve for women's tennis.

*Figure 24 - 2017 WTA Lorenz Curve – Prize Money Distribution*

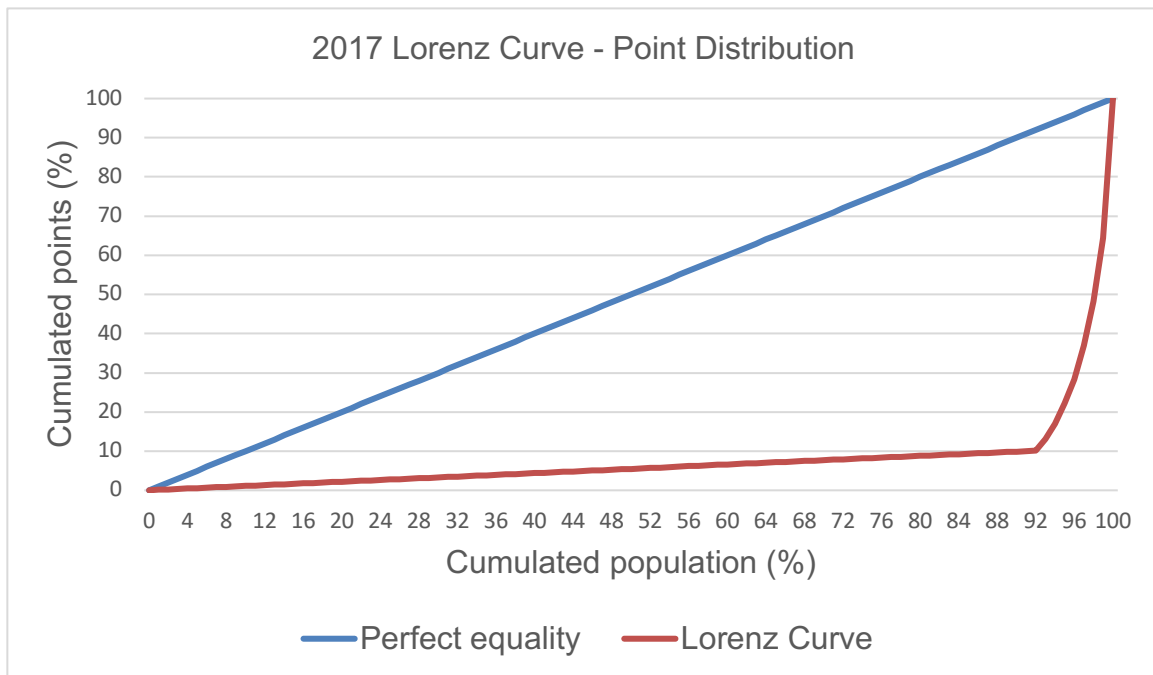


The 2017 Lorenz curve for women's prize money distribution depicts similar results as the one for men's, although they are slightly less unequal. Indeed, there were less female tennis players than men's in 2017. Therefore, the top 100 accounts for a bigger proportion of the population than in the case of men. Hence, prize money distribution in the case of women's tennis is slightly less unequal than their male counterpart, although it remains highly unequal in absolute terms.

The Gini coefficient is very similar to the one in the men's case for the 2017 tour. Indeed, it is equal to 0.9058 here, compared to 0.9143 in the men's 2017 tour.

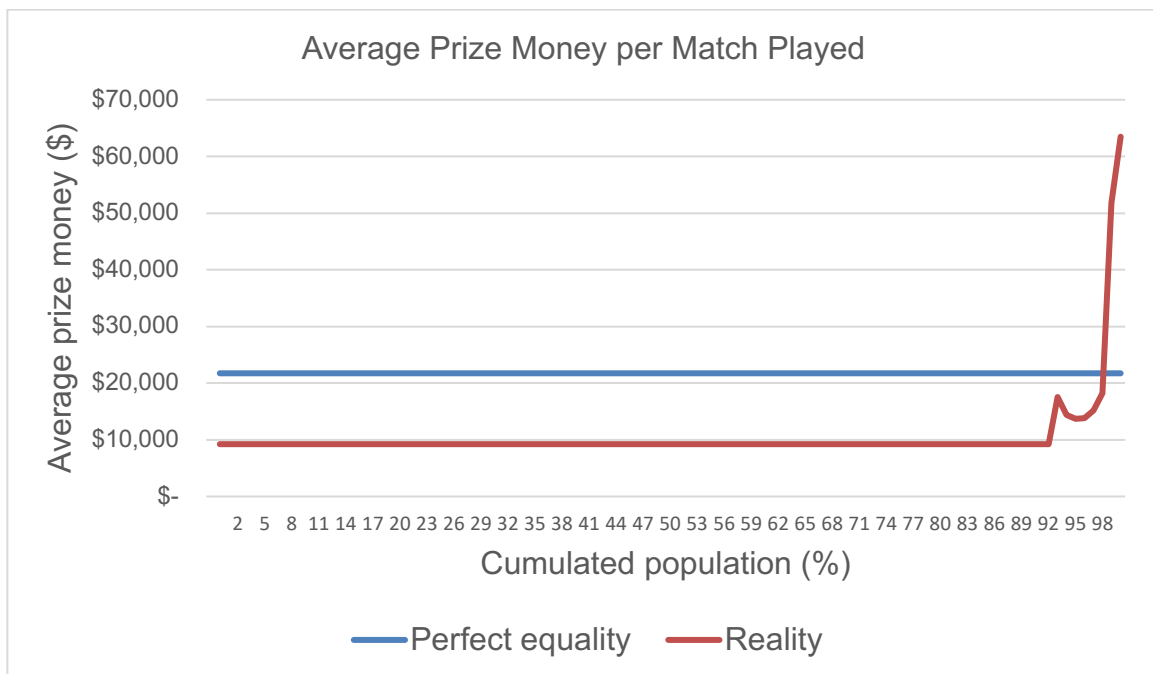
The point distribution is also very similar to the prize money distribution in women's tennis in 2017. This indicates again that inequalities in prize money are not a phenomenon that is specific to income. They are a reflection of the way that points are attributed across rounds and types of tournaments.

Figure 25 - 2017 Lorenz Curve - Point Distribution



Figures 26 and 27 show how the proxy for performance and income inequalities are related.

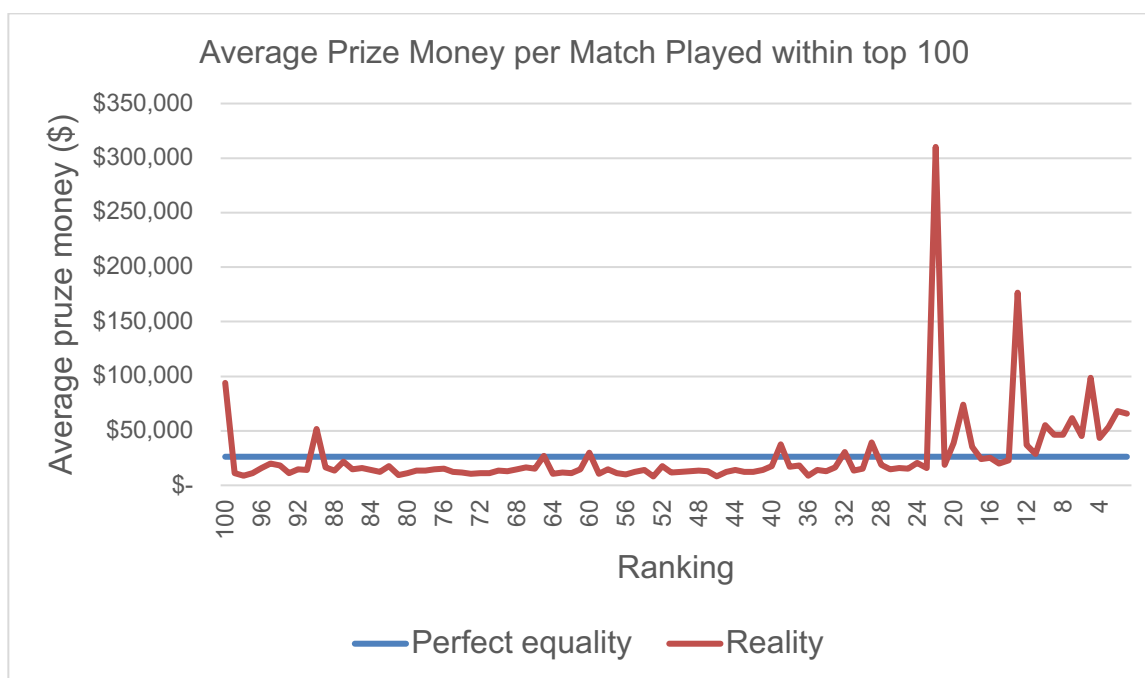
Figure 26 - Average Prize Money per Match Played



In 2017, as in the men's case, top 20 female players earned 50% of all prize money. Outliers are even more striking in women's tennis. Kaia Kanepi (WTA 100) made her comeback from injury at the US Open, where she reached the quarterfinals. As this was the only tournament she played on the WTA tour, her average is very high. Serena Williams (WTA 22) has the highest average as she only played in January and won the Australian Open before announcing her pregnancy

and staying away from competition for the rest of the season. Finally, Sloane Stephens (WTA 13) made a vibrant comeback from injury in the summer, claiming the US Open crown in the process. These three players have been as least as performant as top 10 players using this particular proxy, which is shown in figure 27.

*Figure 27 - Average Prize Money per Match Played within Top 100*



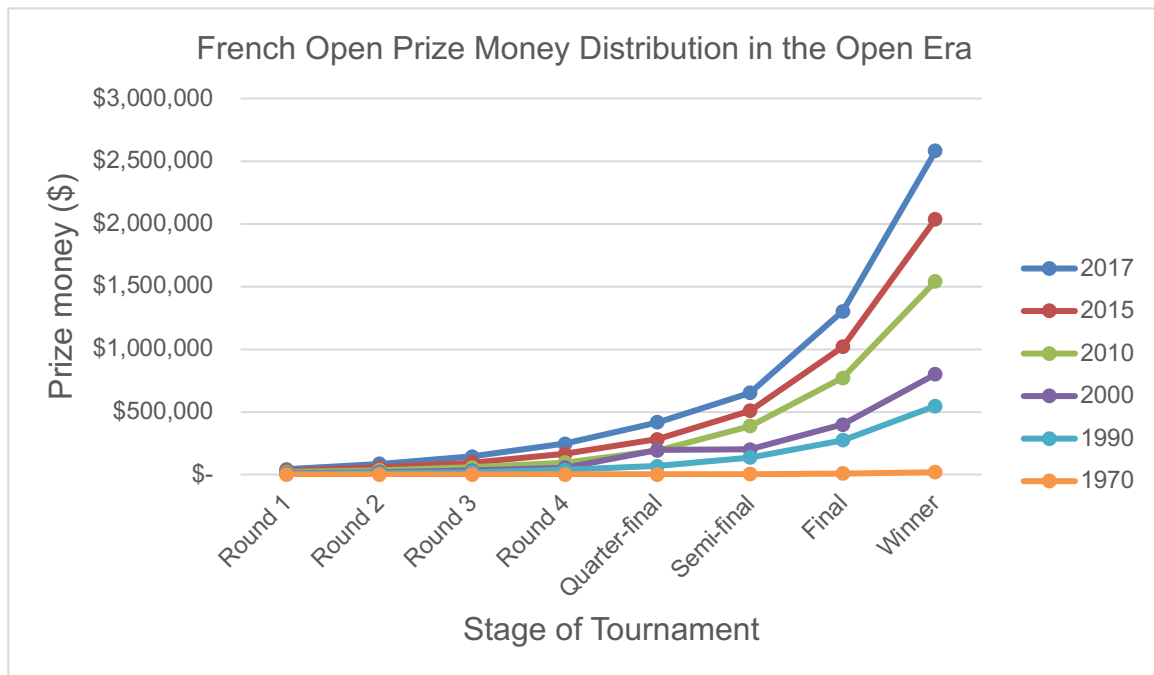
The next section will look at the evolution of prize money distribution in Grand Slams.

#### 4.2.2 Grand Slam Evolution

So far, women's tennis and men's tennis have shown similar characteristics when it comes to inequalities due to ranking differences. To continue the comparison, the same Grand Slams have been chosen to represent the evolution of prize money disparities within Grand Slams' rounds. Graphs for the other two Slams are available in the appendix as well.

The French Open's women case exhibits the same patterns of inequality as in the men's case. The increasing steepness of the curves shows higher inequalities across rounds in the main draw, especially since 2010. Again, all numbers have been adjusted for inflation.

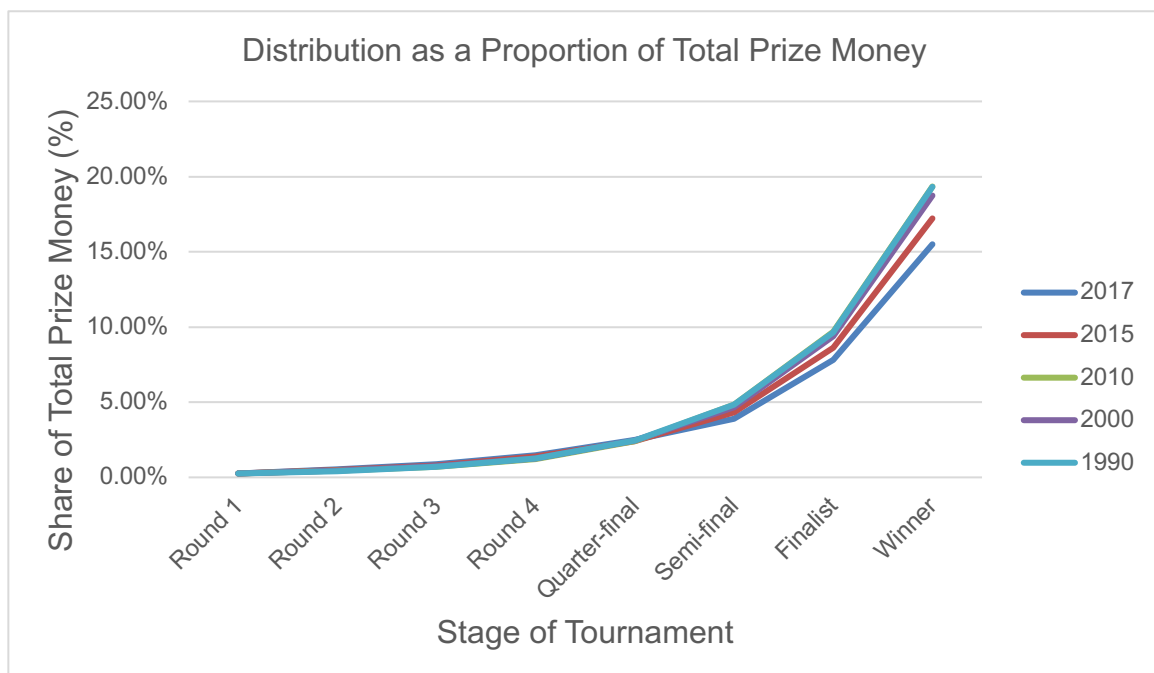
*Figure 28 - Evolution of French Open's Prize Money Distribution*



The shares of total prize money attributed to each round of the tournament are very similar to those of the men's game, and exactly the same after parity was introduced in 2007. Hence, the same reduction in prize money inequalities can be observed in recent years. However, the all-time high was not achieved in 2010 as in the men's case but in 1990, which the earliest year studied in this paper.

Figure 29 depicts the evolution of the proportions of total prize money earned by one female player at each round of the French Open.

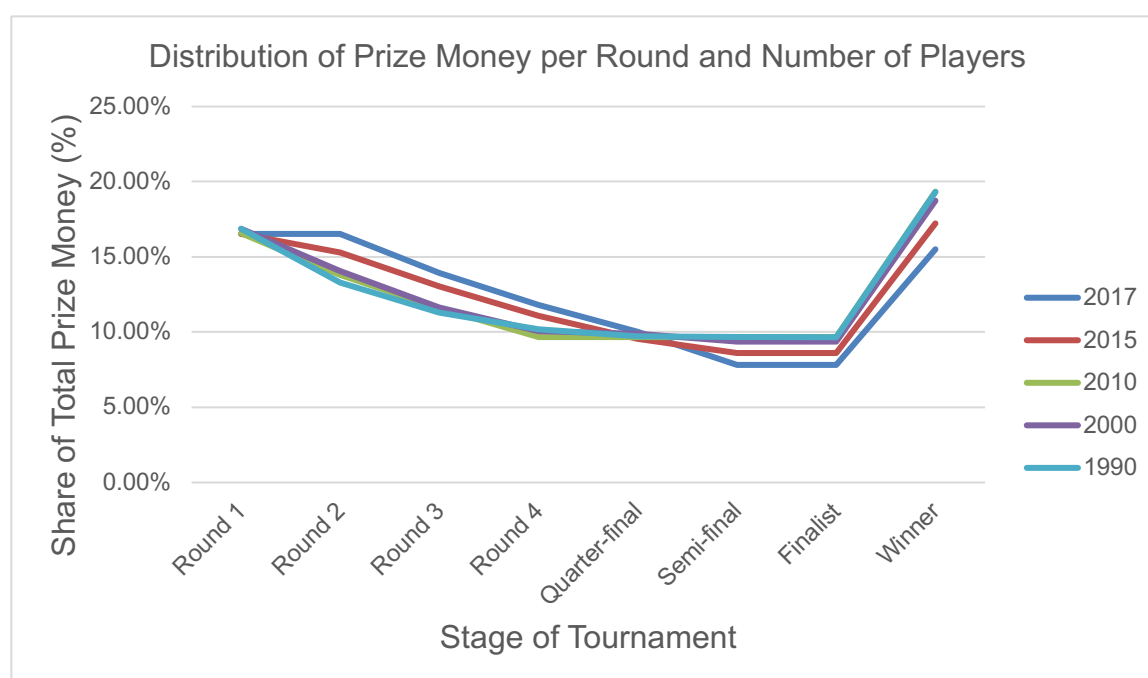
*Figure 29 - Shares of Total Prize Money per Round of the French Open*



The share of total prize money earned by the winner has been decreasing since 1990, especially since 2010, which has a prize money distribution almost perfectly equal to the one of 2000. In the men's case, the winner's share increased until 2010 before being reduced to an all-time low in 2017 which is common to both men and women's tennis.

The next figure represents these shares multiplied by the number of players losing at each round and thus earning that round's amount of prize money.

*Figure 30 - French Open Distribution of Prize Money per Round - incl. Number of Players*

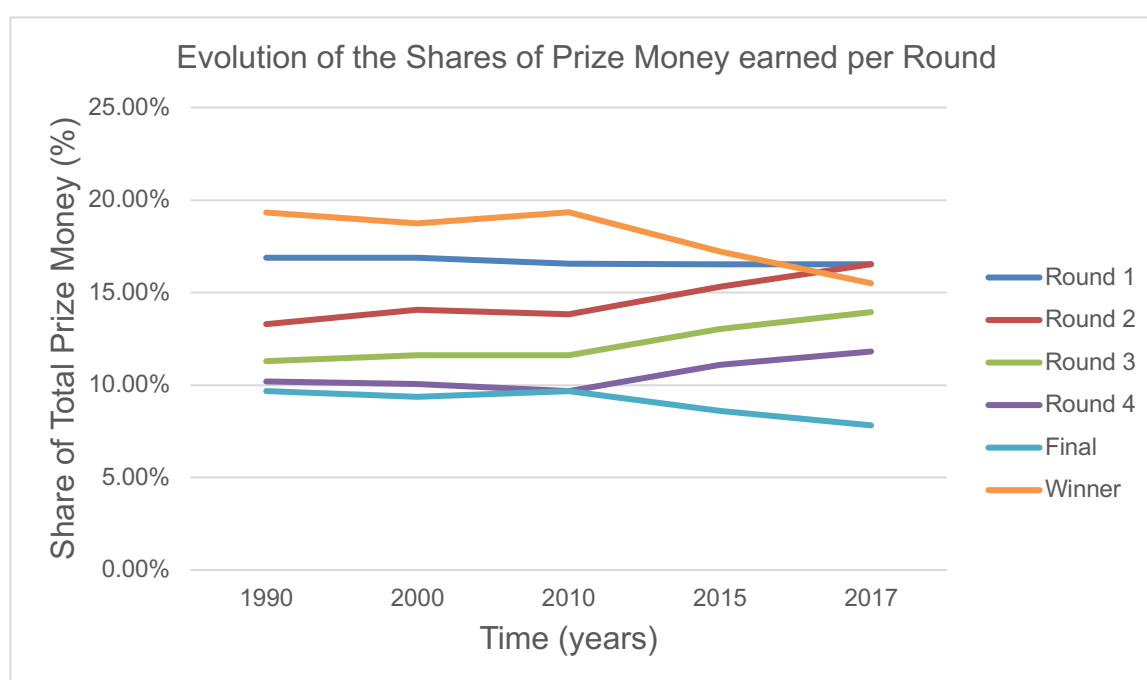


The reduction in income inequalities is clearly shown in this graph. In 2015, the shares of rounds two to four were raised to higher levels than in previous years and the shares of the semifinalists, finalist and winner were reduced. This cutback from the latest stages to the benefit of earlier stages of the tournament were enhanced in 2017, thus pushing the reduction in income inequalities across rounds of the French Open even further.

Figure 31 represents the evolution of these shares across time.

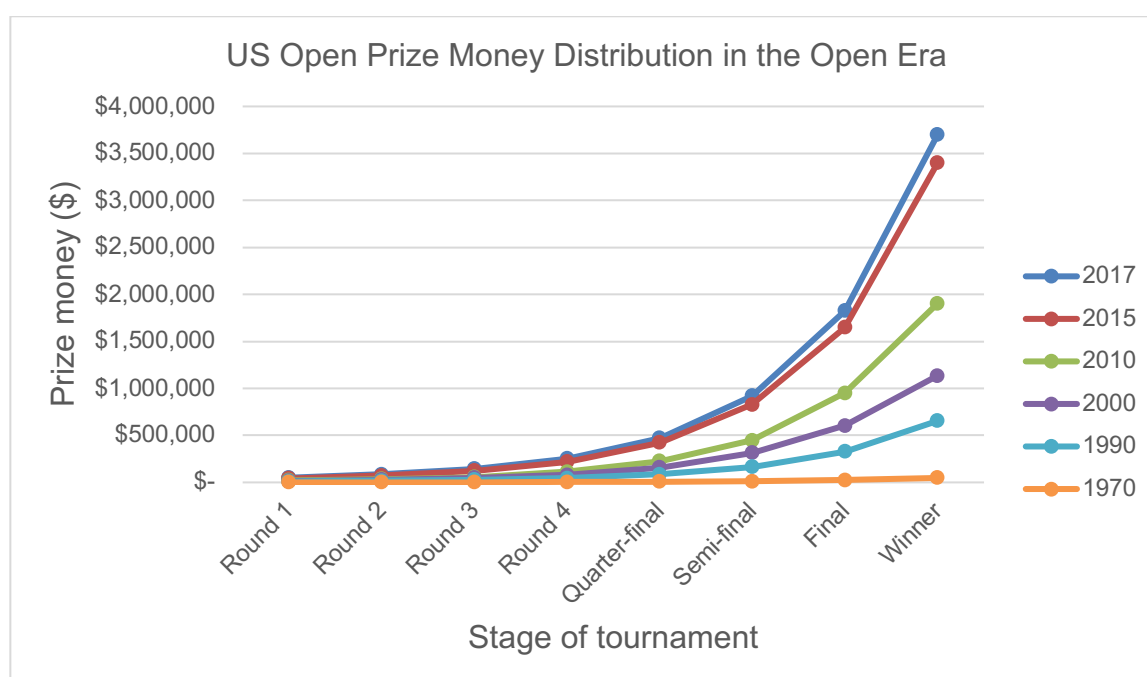
All shares of total prize money remained more or less stable between 1990 and 2010. Then, as in the men's case since prize money parity was established in 2007, the winner's, finalist's and semifinalists' shares were lowered in order to increase the shares granted to rounds two to four. Round one's and the quarterfinalists' shares remained stable over time, while the share of the semifinalists follows a similar pattern as the one of the finalist.

*Figure 31 - Evolution of Shares of Total Prize Money per Round of the French Open*



The following figure, representing the same issue for the US Open, also shows the same trends as in the men's case. Inequalities are also striking, and as in the men's case, they have gotten drastically bigger since 2010.

*Figure 32 - Evolution of US Open's Prize Money Distribution*



As prize money parity was introduced in 1973 at the US Open, all graphs drawn in the men's analysis represent the situation in women's tennis at the US Open as well. Therefore, the conclusions are the same, that is, that the US Open has been decreasing inequalities across rounds at a smaller pace than the French Open.

The analysis of the evolution of prize money inequalities in the Australian Open and the Wimbledon Championships are similar to the one of the men's game. Indeed, as the main changes in prize money distribution happened after 2010 and thus after the setting up of equal pay, the patterns are the same.

The Australian Open was the most unequal Grand Slam in terms of prize money distribution across rounds in 2010 but started to take measures in order to reduce them afterwards.

The Wimbledon Championships have reduced income disparities in a more drastic way, which is more similar to the French Open than to its other Anglo-Saxon counterparts.

Hence, the results found in the analysis of the evolution of income inequalities in Grand Slams are similar in men and women's tennis. The European Slams have been the biggest fighters for the reduction of prize money disparities across rounds. They have been followed by the Australian Open and the US Open to a lower extent.

## V. Gender Inequalities

Women's tennis is one of the most successful and visible female sports there is. Equal pay has been introduced in Wimbledon in 2007, becoming the last of the four Grand Slams to provide parity in prize money at all levels of the major tournaments. *Forbes'* (2016) showed that eight of the ten world's highest-paid female athletes were tennis players.<sup>25</sup> Their measures account for total earnings in 2016, which goes beyond prize money. However, women tennis players still have some battles to fight if they want to achieve gender equality in their sport.

The first battle concerns prize money equality in tournaments of the WTA tour. There is equal pay in Grand Slams, as well as in a few other mixed events, but this is where gender equality ends. Prize money in all other tournaments is usually twice as high for men than it is for women. Furthermore, in 2017 there were ten more tournaments played in men's tennis than in women's tennis, reducing opportunities for female players to earn prize money. On this matter, two main positions can be adopted.

On the one hand is the point of view of merit. Czech player Lucie Safarova, member of the players' council, argues that women should earn the same amounts of money as men because *"they train as hardly as men do, fill stadiums and attract audience. Top players do very well but between the 50<sup>th</sup> and 200<sup>th</sup> ranking spots, many players are struggling. There are less women's tournaments than men's and smaller amounts of prize money outside of Grand Slams. But we are the number one female sport, and that is extraordinary."*<sup>26</sup> Andy Murray adopts this position as well, stating that *"women make the same sacrifices, are as determined as men and have the same work ethic."*<sup>27</sup>

On the other hand is the aspect of sport attractiveness. Novak Djokovic argues that *"stats are showing that we have much more spectators on the men's tennis matches"*.<sup>28</sup> Hence, if men's tennis gathers more audience and thus higher earnings, men should be paid more than women.

In *Advantage men: The sex pay gap in professional tennis*, C. Flake, M. Dufur and E. Moore use measures of 2009 productivity and career productivity in order to determine whether there is unequal pay due to gender in professional tennis. Their analysis for the year 2009 *"provides evidence of a sex pay gap in tennis: even when differences in tournaments are controlled for, women are paid less for their productivity (wins) than men."*<sup>29</sup>

Comparing a male player to a female player in order to assess unequal pay would be inaccurate, as no two players share the same tournament and match records. Being aware of this bias, what would happen if two players of the same caliber were to be compared? Roger Federer and Serena Williams are arguably the best male and female players of all time. They are both 36 years old and have achieved several records in their sport. Roger Federer has won a total of 97 tournaments so far, including 20 Grand Slams and 33 tournaments worth more than

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<sup>25</sup> <https://www.forbes.com/pictures/mli45ffmff/the-worlds-highest-paid/#6fb10284610e>

<sup>26</sup> *Tennis Magazine* (12/2017), 492, p.77

<sup>27</sup> *Tennis Magazine* (12/2017), 492, p.77

<sup>28</sup> <https://www.sportskeeda.com/tennis/novak-djokovic-completely-right-male-tennis-players-should-be-paid-more-than-female-ones>

<sup>29</sup> <http://journals.sagepub.com/doi/pdf/10.1177/1012690212442166>

500 points (i.e. ATP Masters 1000 and year-end championships).<sup>30</sup> Serena Williams has lifted the trophy in 72 occasions, including 23 Grand Slams, the Olympic gold medal and 28 tournaments worth over 500 points (WTA Tour Championships, WTA Premier Mandatory and Premier Five).<sup>31</sup> Roger Federer has earned a total career prize money of over \$116 Million<sup>32</sup> and won 53 big tournaments, whereas Serena's is slightly under \$85 Million<sup>33</sup> for 42 big tournaments. Their career prize money differs by \$30,000,000, which accounts not only for gender disparities but also for all differences in their career, such as number of tournaments and matches played.

The second battle relates to unequal visibility, in the sense that men are disproportionately scheduled to play on the biggest stages, whereas top female players are more likely to be relegated to smaller courts during mixed events. This debate was particularly heated during last year's Wimbledon Championships, where a highly anticipated match between two female Grand Slam champions was played on a packed Court 2 because a majority of men's singles matches had been scheduled on the main courts, where more seats are available to spectators. Andy Murray, former world number one and from Great-Britain, defended women players' quest of equal access to main courts. Another issue raised during last year's Wimbledon happened as British female player Johanna Konta played a nail-biting round four match. The broadcasting of this match was interrupted to show Andy Murray warming up on a small court ahead of his upcoming match, implying that the warm up of a male player is more interesting to watch than a tight three-setter in the women's game.

This leads to one important question. Is it because people prefer to watch men's matches on television that there is unequal broadcasting? Or is there reverse causality, in the sense that people will watch what the media chooses to show? Both are probably true. This reasoning can also be applied to tennis magazines, and in particular, the French version, *Tennis Magazine*. Indeed, over the last twenty-one issues of this magazine, only two involved a woman on the cover. One of them showed Ana Ivanovic<sup>34</sup>, a female tennis player also famously known for her modelling abilities, who had not won any title in a long time. The other displayed a woman's almost naked bottom.<sup>35</sup> Needless to say, these covers were chosen for their selling potential and not in order to celebrate a female player's performance, as is almost always the case when a male player is shown on their magazine's cover. Business is business and the economic reasoning behind those choices is mainly based on customers' tastes and marketing, however unequal or sexist. Nevertheless, one could wonder what would happen if the media induced gender parity in representation, for the "right" reasons. Would their magazines sell less if they celebrated women for their performance in the same manner that they celebrate the men's? Would people stop watching Wimbledon if men and women's matches were broadcasted equally?

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<sup>30</sup> [https://en.wikipedia.org/wiki/Roger\\_Federer\\_career\\_statistics](https://en.wikipedia.org/wiki/Roger_Federer_career_statistics)

<sup>31</sup> [https://en.wikipedia.org/wiki/Serena\\_Williams\\_career\\_statistics](https://en.wikipedia.org/wiki/Serena_Williams_career_statistics)

<sup>32</sup> [https://en.wikipedia.org/wiki/Roger\\_Federer](https://en.wikipedia.org/wiki/Roger_Federer)

<sup>33</sup> [https://en.wikipedia.org/wiki/Serena\\_Williams](https://en.wikipedia.org/wiki/Serena_Williams)

<sup>34</sup> *Tennis Magazine* (11/2016), 480

<sup>35</sup> *Tennis Magazine* (09/2017), 489

Finally, another issue related to gender is the comments made about women's bodies and harassment in the sport. As E.J. Trolan wrote in "The impact of the media on gender inequality within sport" (2013)<sup>36</sup>,

*"The first context of sexualization is the concept of appearance. Numerous studies (Harris, 2005; Messner, Duncan & Jenson, 1993; Vincent, 2004; Rowe and Brown, 1994) observed that print media focused on the physical appearance of women athletes much more than their athletic skills and abilities. These studies referenced hair, make-up, and body shape for the women but rarely if ever focused on the same things for men. The references on their physical appearance and aesthetic appeal highlighted the idea that gender inequalities are common place within the media. In [Vincent (2004)'s] study of print media coverage of Wimbledon, the extensive coverage given to former tennis star Anna Kournikova highlighted this concept. With her scantily clad figure and Eurocentric features she was the most photographed athlete. Throughout the text accompanying the photographs there were numerous references to her family life, boyfriends, nightlife and not her skill or athletic ability."*

Some cases of harassment have been observed in tennis. Last year, during a Fed Cup tie between Great-Britain and Romania taking place in Constanta, the Romanian captain, former world number 1 Ilie Nastase, made numerous inappropriate comments directed at all British players and their captain. This resulted in the exit in tears of Johanna Konta and Nastase's banning from such events until 2020. Fabio Fognini is also infamous for his sexist comments towards a female umpire which lead to a final warning before Grand Slam banishment from the International Tennis Federation. These are a few extreme examples of gender inequality on courts, which are not representative of everyday matches' conditions.

Although these three issues of gender inequality in women's tennis still need to be addressed, it is important to point out that tennis is probably the best sport to play for women, as it is more broadcasted and offers higher prize money than many other female sports. As Fluke, Dufur and Moore wrote, *"If women in a highly popular and economically successful sport such as tennis are encountering a pay gap, what are the implications for women's sports that have yet to gain a foothold in the global sports marketplace?"*<sup>37</sup>

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<sup>36</sup> [https://ac.els-cdn.com/S1877042813025512/1-s2.0-S1877042813025512-main.pdf?\\_tid=68eab22a-a104-4929-ab85-0bdec04c3415&acdnat=1525268262\\_e120e70fb8caf0384777ad671f28cac8](https://ac.els-cdn.com/S1877042813025512/1-s2.0-S1877042813025512-main.pdf?_tid=68eab22a-a104-4929-ab85-0bdec04c3415&acdnat=1525268262_e120e70fb8caf0384777ad671f28cac8)

<sup>37</sup> <http://journals.sagepub.com/doi/abs/10.1177/1012690212442166>

## Conclusion

Several academic papers have already discussed inequalities within sports as well as gender inequalities within tennis. However, there were no academic papers that I could find that analyzed prize money disparities due to ranking in professional tennis as this thesis was being written. Therefore, this paper lays up the groundwork for further research on this topic.

The Lorenz curve and the Gini coefficient are the two measures used to assess inequalities in this paper. They are computed from databases that were constructed specifically for this research question. These databases include information on all prize money and points earned in all tournaments by singles' players ranked in a top 100 for a given year. However, qualifications and doubles' matches, as well as the secondary tennis circuits are excluded from the analysis.

The main results highlighted by this paper reflect a high concentration of earnings in the top players for both genders in 2017. The top 100 male players, representing 5% of the total men professionals, earned 87% of the total prize money at play that year. In the women's game, the top 100 players accounted for 8% of overall female tennis professionals and picked up 89% of 2017 total prize money. Derived from the Lorenz curve, the Gini coefficient had a value of around .90 and .91 in the women's and men's games respectively. These results show that tennis is a highly unequal sport in terms of prize money earnings as a function of ranking.

Furthermore, the Gini coefficient has been stable around this level, as showed the analysis of the men's game over the last decade. Hence, the issue of these high disparities in revenue has not been dealt with in recent years on the ATP World Tour.

However, the French Open and the Wimbledon Championships have started to reduce prize money disparities across rounds of their events since 2010. The other two Grand Slams, the Australian Open and the US Open, have followed the path of their European counterparts to a lower extent. These results are derived from the evolution of the shares of total prize money attributed to the different rounds of the tournaments. This indicates an intention from the Major tournaments to reduce the income gap between top players and lower-ranked ones and to show the way forward to smaller events in the ATP World Tour and the WTA Tour. The Grand Slams also lead the fight for gender equality as they all provided equal pay at all rounds of their tournaments in 2007.

This paper focuses on the main tennis circuits, which include the Grand Slam tournaments as well as the ATP World Tour for men and the WTA Tour for women. Suggestions for further research would then be to include all professional tennis players at all levels of the game over an extended period of time. Indeed, the ATP Challenger Tour, the WTA 125K series and the ITF men's and women's circuits are smaller in magnitude but foster the majority of professional tennis players.

Furthermore, as data for women's tennis was very limited, it would be important to extend the reach of the analysis to women's tennis in more details. The same can be said regarding the availability of data over time, as tournament data was not available prior to 2009 in men's tennis.

Therefore, it would be interesting to extend research in a way that would account for all professional players on all tennis circuits in order to provide an accurate and complete analysis of prize money disparities in tennis.

In *"Income Inequality in American Professional Sports Leagues"*, Thurman (2016)<sup>38</sup> income inequalities in the NBA, NFL and MLB. The Gini coefficients obtained in this paper ranged from 0.4887 in the NBA in 2014 to 0.6143 in the MLB in 2015. In these leagues, players receive a salary and are part of a player's union. In tennis, players earn prize money as a direct consequence of their performance in the tournaments in which they enter. There are players' councils but there is no players' union in tennis. At the beginning of this year, former world number one Novak Djokovic stated that "tennis players need a union"<sup>39</sup>, which would allow them to "negotiate pay increases", among other topics.

This paper is not aimed at painting a black picture of income disparities. Earning inequalities can be healthy and efficient, as they provide incentives and rewards for performance. But I believe that this statement is only true to some extent. Past a certain point in the magnitude of prize money disparities, the income gap between a few top players and the majority of tennis professionals becomes so extensive that lower-ranked players turn to game-fixing in order to make ends meet. When corruption and cheating poison a sport, one starts to question the fairness of what, at the end of the day, is still supposed to be a game.

*"I think inequality is fine, as long as it is the common interest. The problem is when it gets so extreme, when it becomes excessive. So the very difficult question, of course, is, when is it that it becomes excessive and it becomes useless for society?"* – Thomas Piketty<sup>40</sup>

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<sup>38</sup> <http://scholarworks.uark.edu/cgi/viewcontent.cgi?article=1015&context=econuht>

<sup>39</sup> <http://theconversation.com/why-djokovic-is-right-to-say-tennis-players-need-a-union-90321>

<sup>40</sup> <https://www.foreignaffairs.com/videos/2014-04-23/foreign-affairs-focus-books-thomas-piketty-economic-inequality>

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