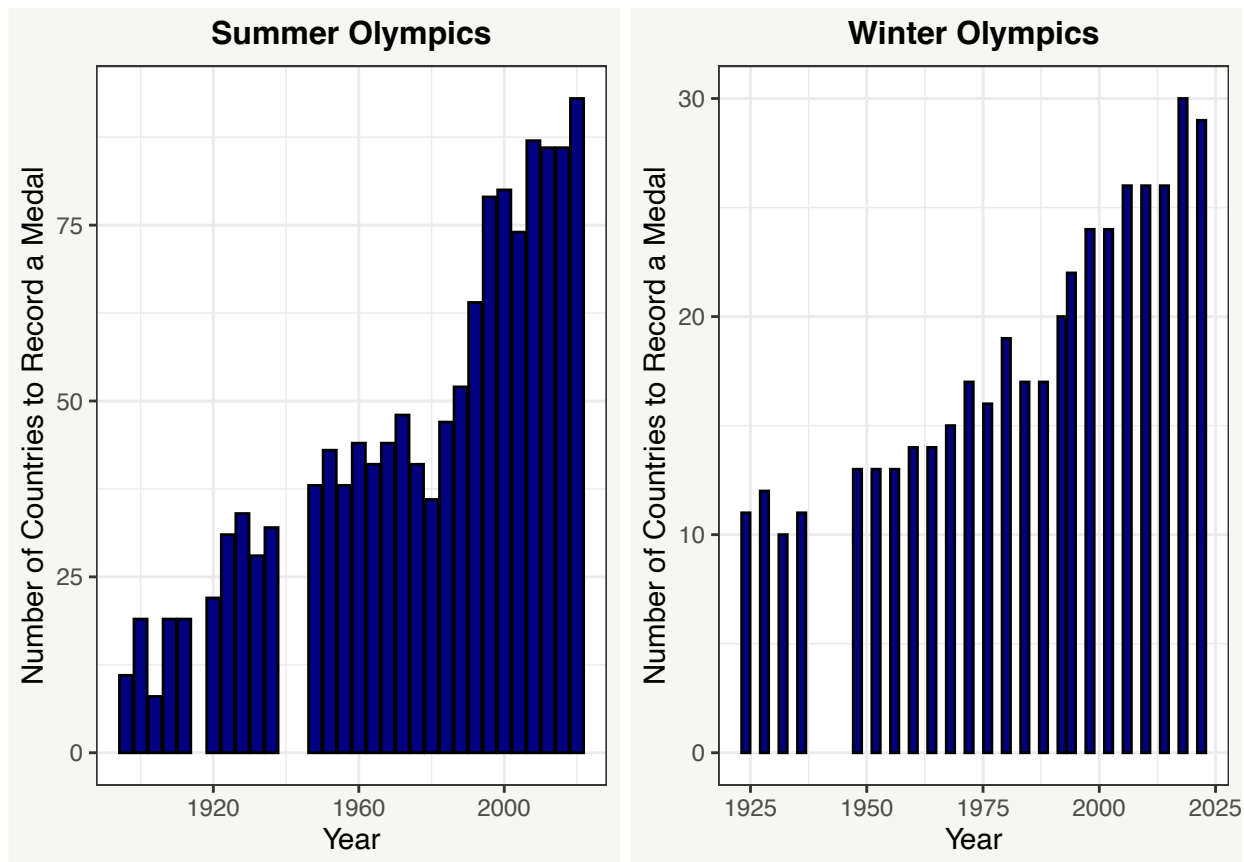


Olympic Performance and Competition Dynamics Analysis

With the first event taking place around 3,000 years ago², the Olympics are one of the most ancient and iconic sporting events in world history. After a 1,500-year hiatus, the Olympics were revived in 1896. In the 128 years since the first modern Olympic Games, there has been a great deal of change to the Games, in its magnitude, its events, and its athletes.

The Olympics have become noticeably more competitive throughout its modern history, the number of countries to record at least one gold, silver, or bronze medal has skyrocketed. In the 1896 Summer Games, just 11 countries recorded a medal compared to 93 in the 2020 Olympics. The graphs below show the trend of a fairly consistent increase in the number of countries to win a medal in each Olympics.

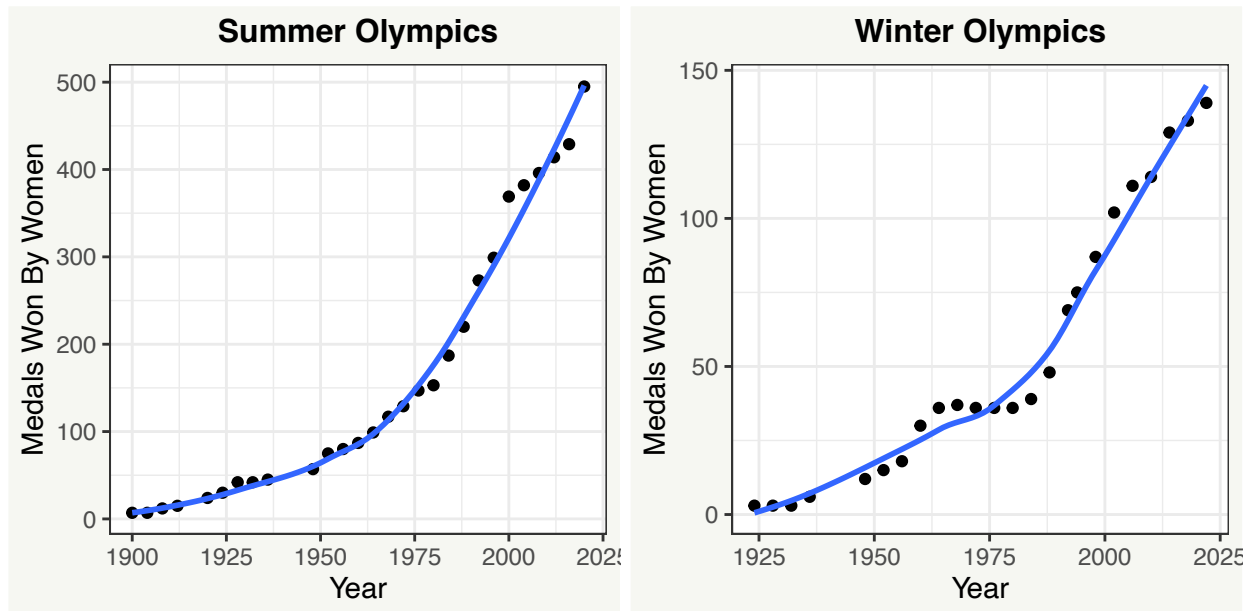


Many factors can help explain this difference. For starters, the introduction of new events increases the number of medals that can be won, which inherently increases the chance of any country to win a medal. At the 2020 Summer Olympics, two different skateboarding events were introduced for both men and women, along with a three-on-three basketball event, among other events. In the 2022 Winter Olympics, a couple of the new events that were introduced included monobob for women and big air freestyle skiing for both men and women. Adding new events in a variety of categories gives athletes from many different countries an opportunity to compete, increasing the number of opportunities their country has to win a medal.

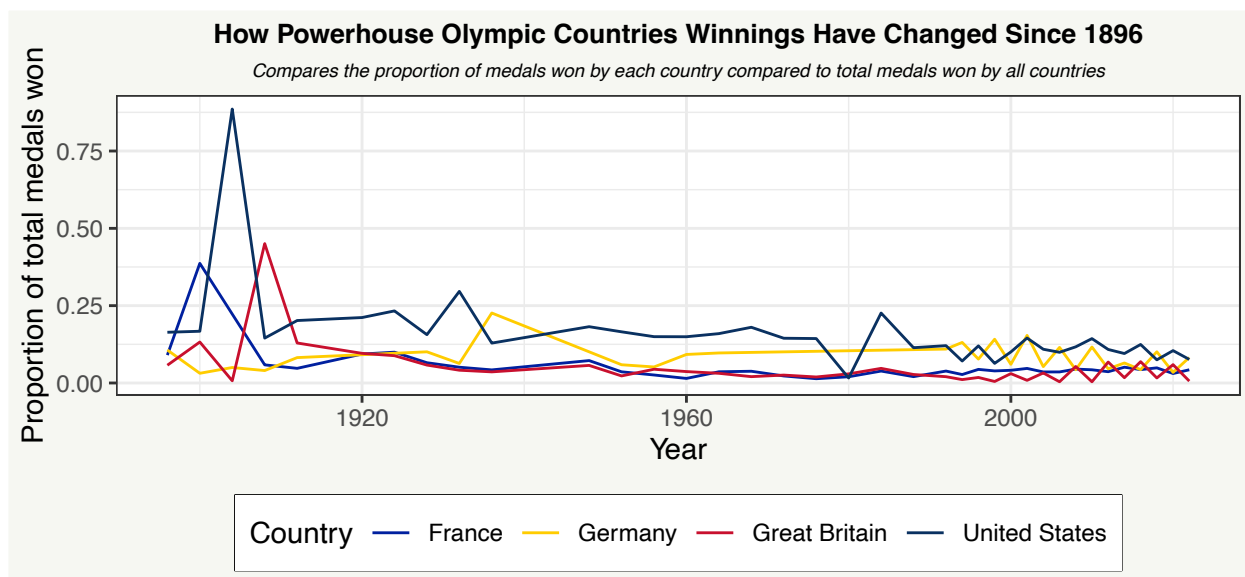
Another factor is the increase in events for women. As shown by the graphs below, after the first female Olympians competed in 1900, the number of medals won by women has increased exponentially. Similarly to the introduction of brand new events, the introduction of events for women gives more opportunities for countries to win medals. The 495 medals won by women in 2022 compared to the 7 in 1900 shows the

²“What is the origin of the Olympic Games?” Paris 2024 Olympics, 2024, <https://olympics.com/ioc/faq/history-and-origin-of-the-games/what-is-the-origin-of-the-olympic-games>. Accessed 23 July 2024.

stark expansion of the Olympic Games and just how much more opportunity there is for athletes and their countries to win medals.



While the addition of more events is one explanation for the 845% increase in the number of countries to record a medal between 1896 and 2020, simply adding more events does not mean that the Olympics were more competitive and more countries won medals. Shown on the graph below is the proportion of medals won at each Olympics by four powerhouse countries: The United States, Great Britain, Germany, and France. Clearly shown on this graph is the outlier of the 1904 Olympics, where the United States won almost 90% of all medals at the entire Olympic Games³.

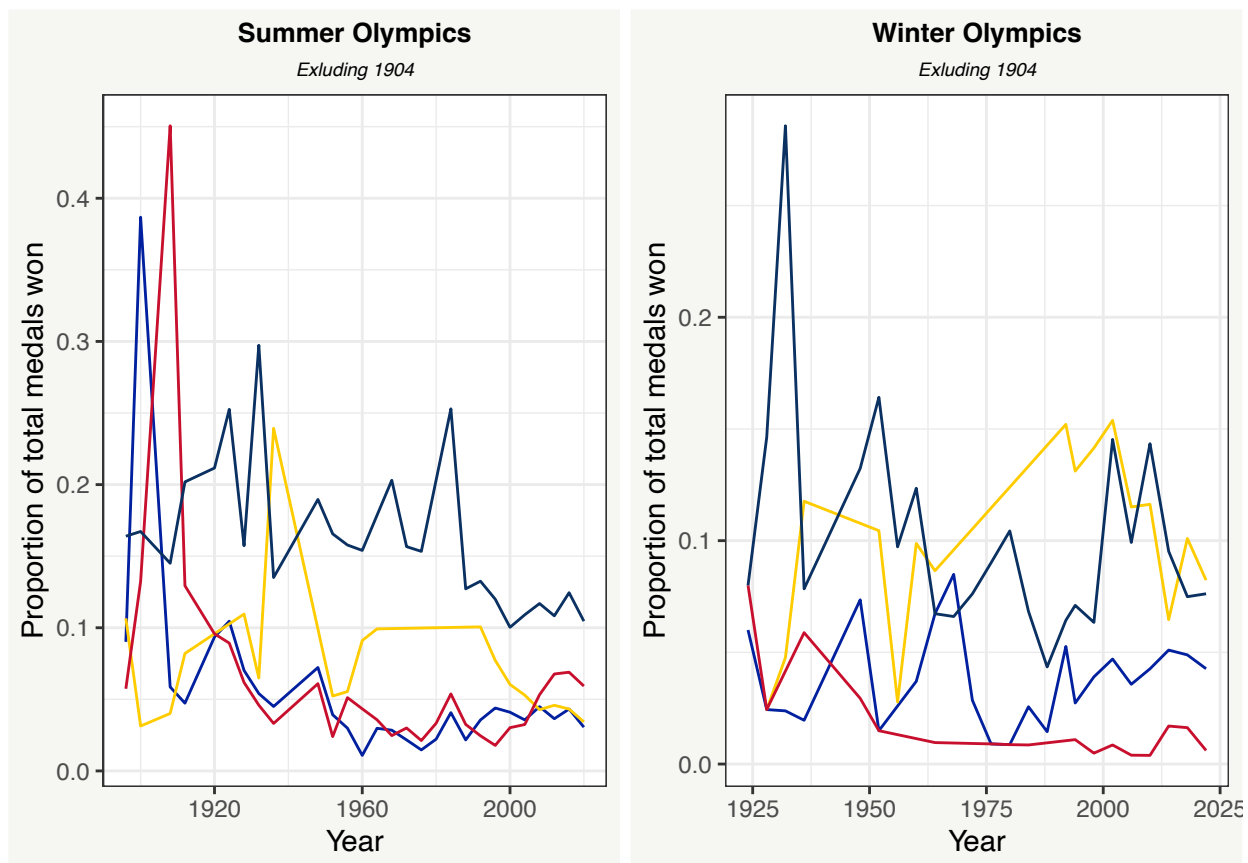


Due to war and tension within Europe and the difficulty of transporting athletes to St. Louis, the number of athletes who were not competing for the United States was incredibly low, which led to American domination.

Removing the outlier, it can be seen that compared to earlier Summer Olympics, these powerhouse countries win a lower proportion of the medals at each Olympics. As the years have passed, the Summer Olympics

³“St. Louis 1904 Olympic Games | History, Events, & Results.” Britannica, 24 June 2024, <https://www.britannica.com/event/St-Louis-1904-Olympic-Games>. Accessed 23 July 2024.

have been more competitive, with more countries winning medals and bigger countries winning less of the total medals. In addition, since the turn of the century, there has been less variation in the proportion of medals that these countries have won year-to-year, suggesting more consistency and predictability in terms of the percentage of the medals that these large powerhouse countries win.



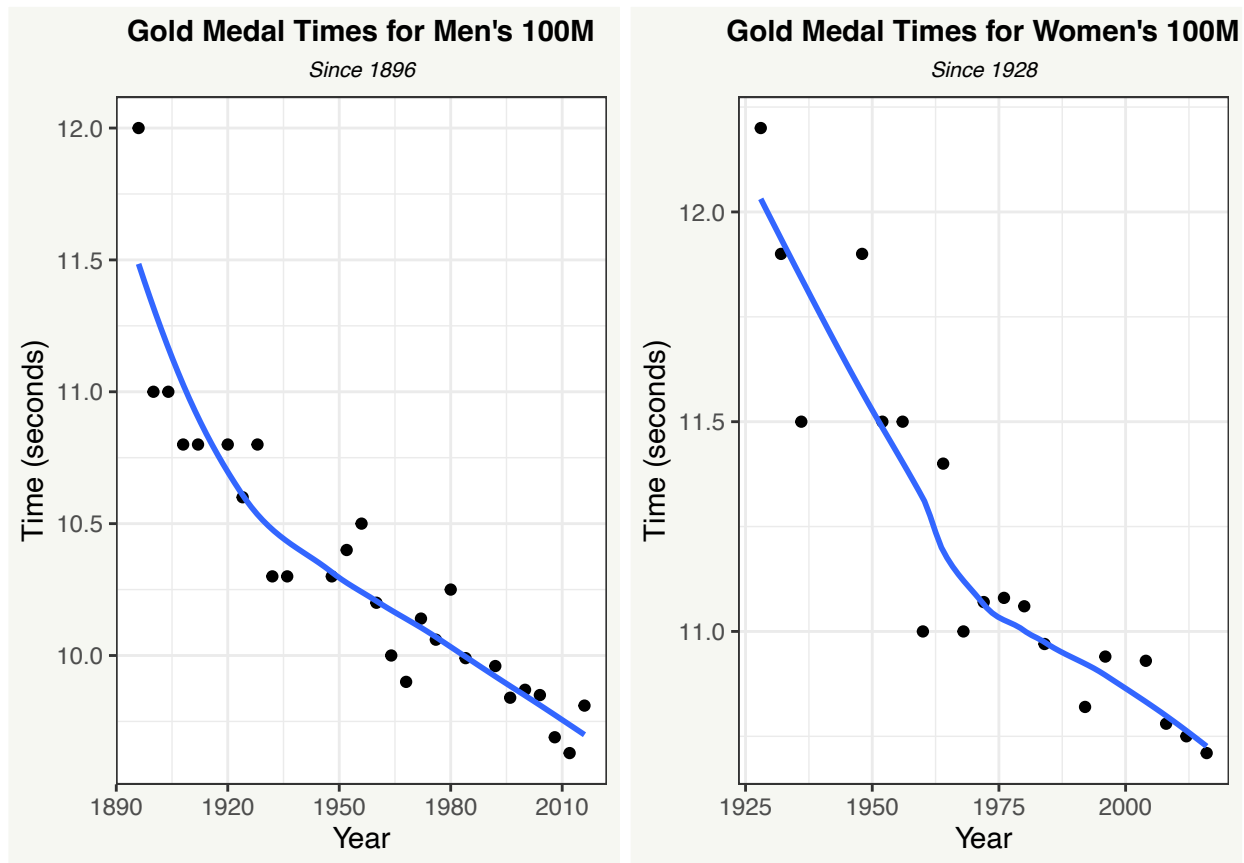
However, looking at the same graph for the Winter Olympics, the trend differs. France, Germany, and the United States have tended to win a higher proportion of medals at the Winter Olympics since 2000 than they did in the decades prior. This difference in competitiveness also holds when looking at the data for the total countries recording a medal, as 93 countries recorded a medal in the 2020 Summer Olympics compared to just 29 in the Winter Olympics. 2022 was not just a down year for competitiveness in the Winter Olympics — 29 was the second-highest total for countries to record a medal in the Winter Olympics, just trailing the 30 countries in 2018. While both the Summer Olympics and the Winter Olympics have had a relatively constant increase in the number of countries to record a medal since the start of the modern Olympic Games, there have always been more countries able to win a medal in the Summer Games.

According to the Olympic medal data, there have been around three times the number of countries to record a medal in the Summer Olympics than in the Winter Olympics. This is because fewer countries can participate in the Winter Olympics, so there is less competition for the larger countries. Many countries do not have the climate to train athletes in extreme winter sports, such as skiing, snowboarding, bobsledding, etc. In addition, it costs a great deal of money to build facilities for these extreme sports, so poorer countries that do not have cold climates would have a harder time sending athletes to the Olympics for these events. In contrast to that, it does not cost much to train athletes in sports like running, which is a reason for the larger size of the Summer Olympics.

Compared to the early 1900s, the world is overall richer, which helps to explain how much countries have been able to compete in both the Winter and Summer Olympics, even if there is a large difference in the size of the two events. Overall, the Summer Olympics have become more competitive in the last few decades, with larger countries winning a lower share of medals and more and more countries winning medals each

Olympics. The Winter Olympics have not shared the same trend of the larger countries winning a lower share of the medals, but as more countries have been able to participate in the games, more have been able to win medals.

Running – perhaps the most popular and one of the most difficult Olympic sports, has been a part of the Olympics since its ancient origins. Since running does not require expensive equipment, at every Olympics, countless phenomenal runners are competing from all over the world. As time has passed, these runners have gotten faster and faster. Looking at the data for all of the gold medal winners of the 100M in the modern Olympic era, times have dropped rather consistently.



⁴The trend is the same for both the men's and women's 100M. Gold medal times have dropped significantly, and the trend has been steady. Sprinters have gotten much faster throughout the years – since 1996, only one men's 100M dash medal winner has had a time over 10 seconds. In the 21 Summer Olympics prior, only 3 of the 63 medal winners had a single-digit time in the men's 100M.

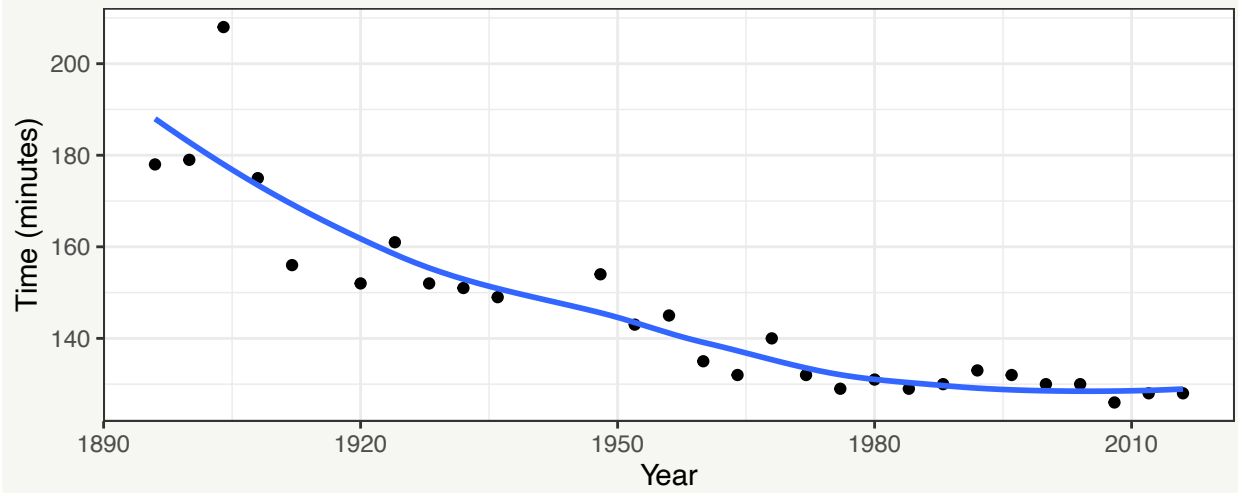
Going from the shortest running event in the Olympics to the longest, again the trend of the faster gold medal time is seen.

⁴No gold medal is recognized for the women's 100M in 2000 due to the winner, Ekaterini Thanou, missing drug tests in 2004, but her winning time was 11.12 seconds.

"Katerina Thanou to be listed as 100m winner at 2000 Sydney Olympics." The Guardian, 14 December 2009, <https://www.theguardian.com/sport/2009/dec/14/katerina-thanou-100m-sydney-olympics>. Accessed 23 July 2024.

Gold Medal Times for Men's Marathon Since 1896

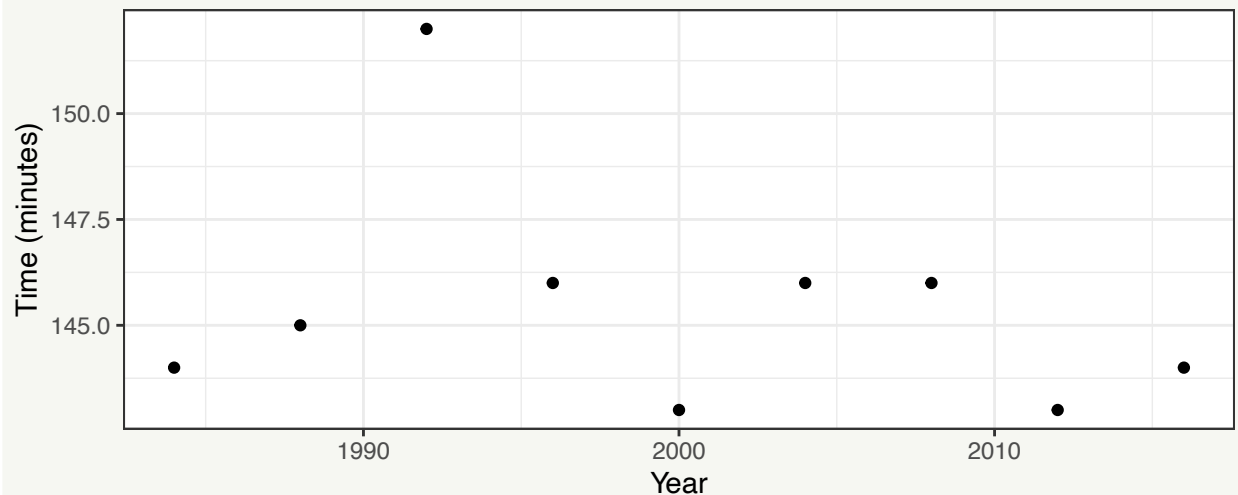
Just like the short distance runs, marathon times have greatly improved



With modern technology, training regimens, and an understanding of nutrition, sleep, and muscle recovery, athletes of all different sports have been able to greatly boost their performance, and this is clearly shown by the times of the Olympian runners. Men's marathon gold medalists have consistently finished around 130 minutes over the last 40-plus years, while no runner close to that number 70 years ago.

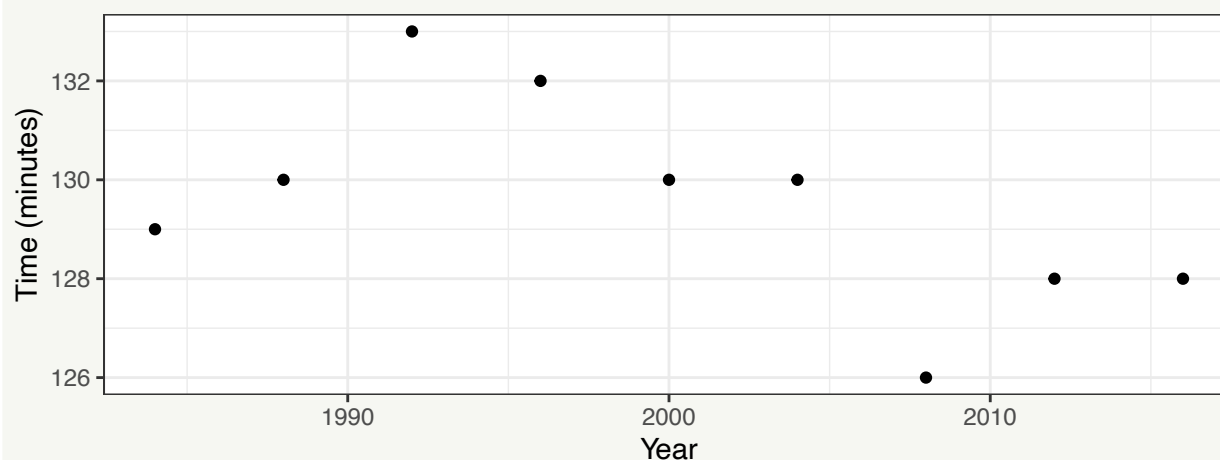
Despite the men's marathon being around since the beginning of the modern Olympics, there was no women's marathon until 1984, nearly a century after the first modern Olympic Games. Due to the relatively recent introduction of the event, the times are not necessarily faster than they were when the event was introduced.

Gold Medal Times for Women's Marathon Since 1984



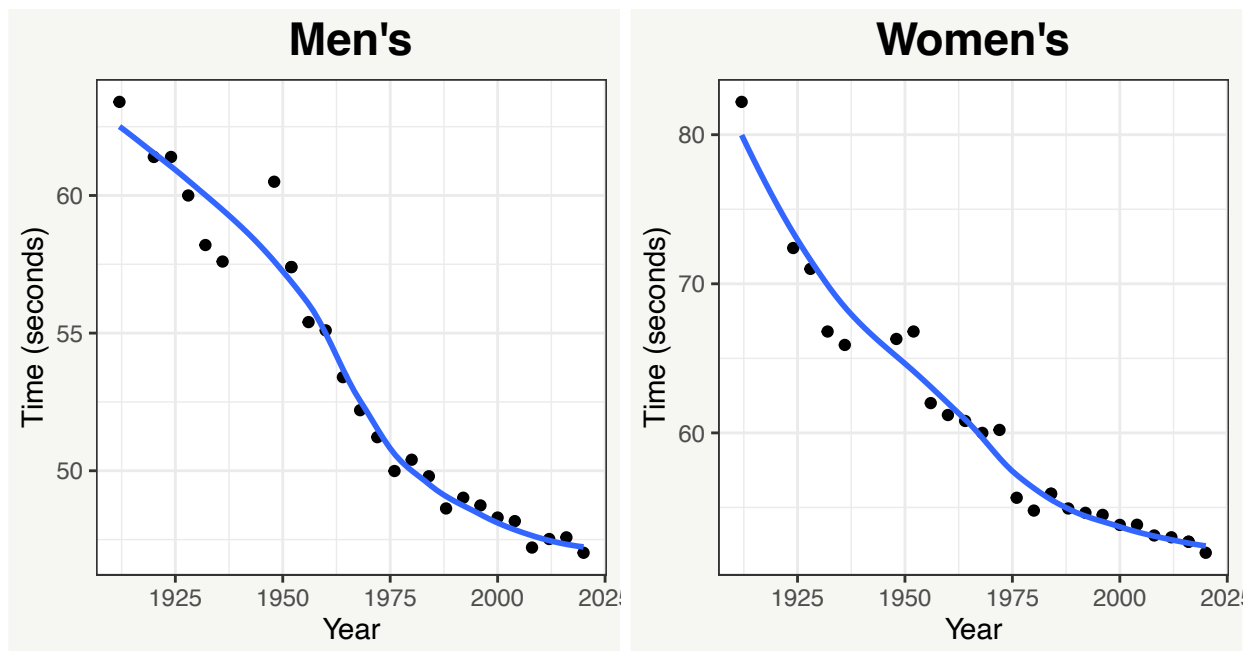
The gold medal winner in 2016, Jemima Jelagat Sumgong, finished less than 50 seconds faster than the gold medal winner in 1984, Joan Benoit. However, looking at the men's times just since 1984, this is not surprising.

Gold Medal Times for Men's Marathon Since 1984



The rate of improved performance in the men's marathon has decreased significantly in recent decades, which suggests that it is not the case that there has not been improvement in female long-distance runners, but rather that the 1980s were rather late in the development curve for the long distance runs, as most of the improvement for the men came before then. Due to the women's marathon, 10,000M, and 5,000M events being added in the last 40 years, there is not enough data to definitively confirm the trend of improved performance in Olympic long-distance running for women too. However, based on the trend showed by the men's marathon data and how similar the graphs were for the men's and women's 100M, it would make sense to conclude that the trend would've looked similar for the women's marathon if it was instituted as an Olympic event sooner.

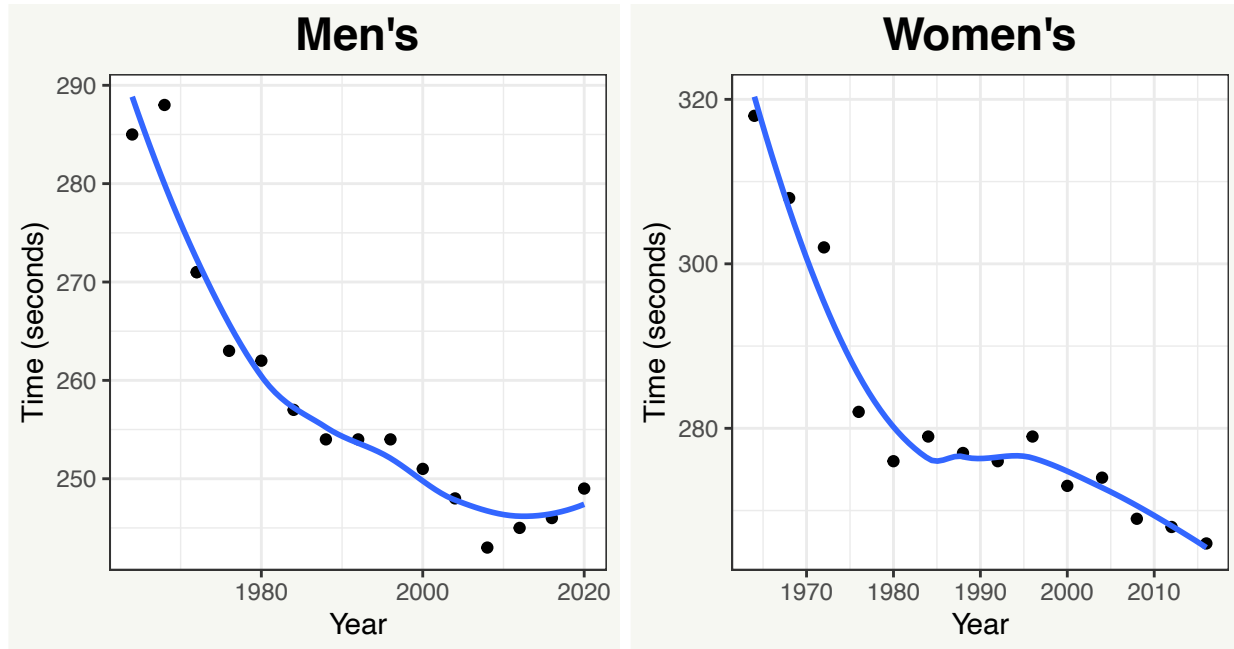
Just as popular and as physically demanding of an Olympic sport as running, swimming is critical to any country's success in the Olympic games. With about three dozen events, it is a highly anticipated sport in every Summer Olympics. Looking at the 100M freestyle event – the most popular swimming event – the gold medal times follow the same trend as the running events listed above.



The gold medal times fell reasonably fast from the introduction of the event in 1912 up until the 1980s, when the times still followed a decreasing trend, but it slowed considerably, just like the data above from

the men's and women's marathons. Just like the runners, swimmers have improved tremendously since the start of the modern Olympic era, but there have been diminishing returns on better technology, training, nutrition, etc over the last few decades.

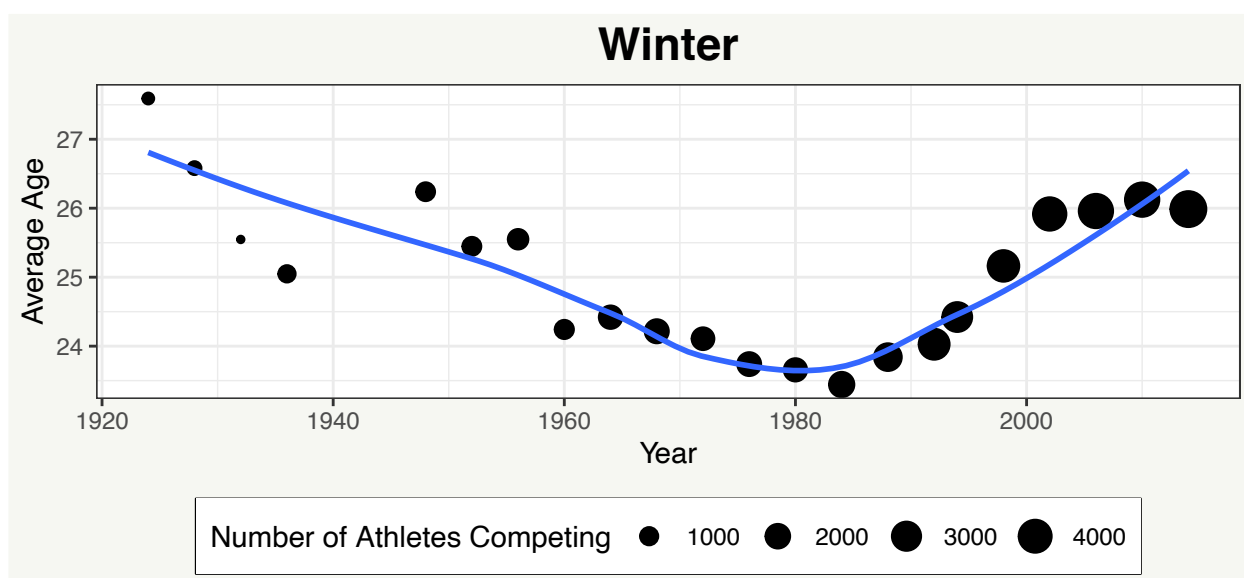
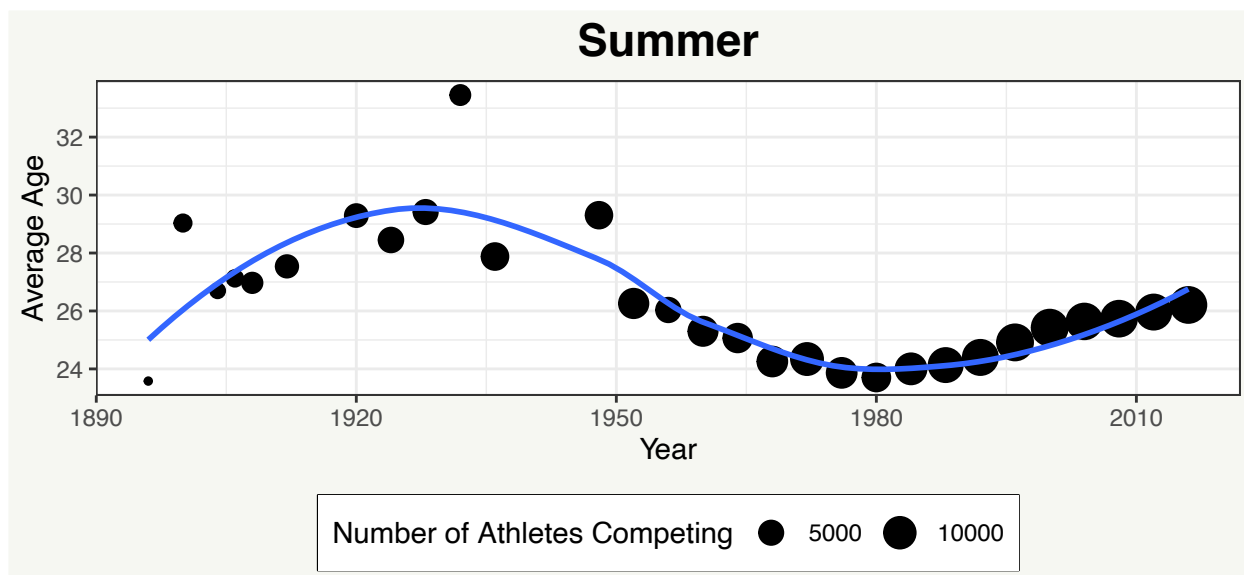
With the incredibly difficult task of a swimmer training for backstroke, breaststroke, butterfly, and freestyle all in one race, the individual 400M medley is another very intense and anticipated event. Introduced in 1964, there is not as much data for the 400M medley as there is for the 100M freestyle, however, the graphs of the gold medal times for the 400M medley below show similarities to the trend discussed earlier.



Again, it can be seen that before the early 1980s, the gold medal times dropped at a substantial rate, and then after the times still tended to drop but at a much smaller rate. While it is unlikely that swimmers have reached their peak athleticism and performance and times will probably decrease more as new technology and training are introduced, they are much closer to that peak now than they were 40 years ago. Being closer to that peak means it is harder for them to significantly improve than it was in decades prior.

Since running and swimming are very popular Olympic sports that do not require an excessive amount of technology to train for, and thus meaning countries from all over the world have opportunities to train their athletes for these events, they are good sports to look at the performance trends for. In both sports, there has been clear, significant improvement in the performance of these athletes throughout the modern Olympic Games. In recent decades, this rate of performance increase has been slowed rather considerably, suggesting that these athletes are approaching their peak performance with the current technology and training used in the present day.

With the improved technology, training, and knowledge acquired over the years, athletes have been able to stay in their primes longer and compete at older ages.



In both the Winter and Summer Olympics, the average ages of Olympians decreased up until the early 1980s and have been in a steady increase since, which lines up with the timeline observed with the slowing of the rate of performance in the aforementioned running and swimming events. While it seems that these Olympic athletes have been closing in on their possible peak performance over these last few decades, the increase in average age shows that more athletes can hit this level of performance and sustain it for longer. This is likely due to healthier lifestyles and smarter training. Since older athletes are still able to compete, more athletes are competing in the Olympics – the top five years in terms of number of competing athletes for both the Summer and Winter Olympics have come in the past 30 years.

Throughout modern Olympic history, more and more countries and athletes have been able to compete. In the Summer Olympics, this has meant a much more competitive Olympics recently, as the number of countries recording a medal continues to skyrocket and powerhouse countries have been winning a lower share of the total medals than ever before. While the powerhouse countries' share of the total medals decreasing is not quite the case for the Winter Olympics, more countries are winning medals than ever before, with the last two Winter Olympics having the highest recorded number of countries to win a medal.

Athletes are getting better and older, as shown by the change in gold medal times in various running and swimming events. While the rate of decrease in gold medal times has slowed since 1980, the average age and

number of athletes have risen, suggesting that athletes are closing in on their possible peak given current technology and more athletes are capable of hitting that peak.

Overall, the Olympics have generally become a more competitive event over its modern history and the performance of athletes has improved a great deal. As technology, training techniques, and sport science improve, athletes will get even better and be in peak shape for longer and longer. Based on its current trajectory, the Olympics is in fantastic shape from a competitive and entertainment point of view, as thousands of athletes from dozens of countries in tip-top shape have a chance at a medal each Olympics, making it truly must-see TV.