1. Introduction

The Olympic Games are a periodic sporting event held every 4 years by a designated country/city. During the Games, the world's best athletes compete in several events spanning a multitude of disciplines with the goal of winning gold, silver, and bronze medals. While winning a medal is the crowning achievement for most athletes, being an Olympian is also considered by many as one of the most important feats in their lifetime. It symbolizes to some athletes the fact that they have reached the top of their discipline and the results of their hard work will be on display for the world to see.

Beyond the individual or team aspect for the athletes, the Games also mean for those with a patriotic sense a chance to represent and compete for their country. Not only important for the athletes but also for the country/nation they represent; the countries keep a count of the medals won by the athletes in their delegation and the counts are compared at the end of the games with the country having the most medals at the end being named top nation.

The end of the second World War somewhat left the world in limbo, the major European countries were decimated and impoverished by the war while the United State and the Soviet Union found themselves at the top in terms of economic and military power. This bipolarization and the resulting tensions led to what we now know as the cold war, during that time those two major superpowers were involved in proxy wars, economical, geopolitical, ideological, and technological conflicts[1,2]. The rivalry and tensions between the two nations were extremely high and the threat of a nuclear war was a possibility. The rivalry also extended to the world of sports and the Olympics Games, the only 2 nations at the top of the medals count post second World War and before the dissolution of the Soviet Union were the United States and the Soviet Union. With 11 Olympic Games held, from 1948 to 1988, they split the top nation ranking with 5 for the United States and 6 for the Soviet Union.

The top nation accolade and the Olympics success being enjoyed and fought over by two of the richest and most powerful nations in the world does not appear illogical. However, sporting competitions are supposed to reward the gifted athletes at the top their disciplines and this aspect should not be overshadowed. Is it possible that just like during the cold war era, the Games can be turned into a competition between the world's wealthiest and most powerful nations? This project investigates and tries to answer this question, challenging the fairness of the competition. The project solely focuses on the post cold war era as the answer is already clear for that period, also the winter games are not included as countries with cold weather are already favored to host and compete in the

competition. For this investigation we examine the top nation for each Olympic Games and look at their Gross Domestic Product (GDP) per capita as compared to the rest of the world to determine if there are any clear advantages with dominating the games and rich country population.

Although not a controversy, if just presented in that light, it would make sense for the richest countries with more money than their counterparts to be able to send larger delegations with more athletes and provide them with the necessary tools and resources to increase their chances during the competition. Additionally, it is important to note that this investigation in no way attempts to discredit the talented athletes of the more successful and richest countries.

2. Methods

For this study we collected 2 sets of data and combined them for the analysis, Olympic game data and GDP per capita data. The following section details how we acquired the data and how we got them ready for the analyses.

a. Olympic Data

We gathered Olympic games data from the TidyTuesday[3] project repository, which contains sets of raw datasets added weekly with the objective of learning data analysis, exploration, and visualization. For the Olympics Games, the data included information about the competition starting from Athens 1896 to Rio 2016, the variables and description are given in Table 1. First, we filtered the dataset to remove the games prior to 1991, the year of the dissolution of the Soviet Union, and keep the games from the summer season.

Variable	Description
Id	Athlete ID
Name	Athlete Name
Sex	Athlete Sex
Age	Athlete Age
Height	Athlete Height in cm
Weight	Athlete weight in kg
Team	Country/Team competing for
NOC (National Olympic Committees)	NOC region
Games	Olympic games name

Year	Year of Olympics
Season	Season either winter or summer
City	City of Olympic host
Sport	Sport
Event	Specific event
Medal	Medal (Gold, Silver, Bronze, or NA)

Table 1: Olympic Data Dictionary

We worked with a compact dataset that did not include the individual athletes and their personal information, we focused on the countries/teams, the year and removed the non-medal winning rows. To ensure that the data was correct we made sure that the medals won were counted once when tallied, as the original dataset included multiple counts for team sports and events. The final check was done by comparing the medal count of the top countries in the year 1992 with the results from the official Olympic games[5]. A preview of the organized is given in Figure 1.

```
  year country        medals
  <dbl> <chr>          <int>
1 1992 Unified Team    112
2 1992 United States   108
3 1992 Germany         82
4 1992 China           53
5 1992 Cuba            31
6 1992 Hungary         30
```

Figure 1: A top preview of the Olympic data used

b. GDP per capita Data

We obtained the dataset for the GDP per capita from GAPMINDER, a reliable and independent resource for data. The data contained the countries and their GDP per capita for each year, going back to 1959. For this study we were only interested in the data for the years in which Olympics Games were held, 1992, 1996, 2000, 2004, 2008, 2012 and 2016. After filtering the data for those years, we merged it with the Olympics data based on the names of the countries, we recognized that due to characters used and possible mistakes and mismatches in the datasets we have the potential to lose some data in that process. One noticeable example is that the Unified Team from the year 1992 was excluded from the remaining data. The Unified Team consisted of several soviet athletes unable to compete under the umbrella of the dissolved union.

For the final dataset, we grouped the games by years, and we have the medal count for each country, their GDP per capita, their rank in the remaining Olympic nation and rank based on their GDP per capita. A preview of the final dataset is given in Figure 2.

```
   country        year medals gdp_per_capita gdp_rank o_rank
1  United States  1992    108          40100        5      1
2        Germany  1992     82          30600       10      2
3          China  1992     53           1240       81      3
4           Cuba  1992     31           3290       59      4
5        Hungary  1992     30           7330       34      5
6         France  1992     29          28700       14      6
```

Figure 2: A top preview of the final dataset used for analysis

3. Results and Discussion

After acquiring a dataset, we believed was appropriate to answer our initial queries we proceeded with the analysis. As we intended, we looked at the first 15 top nations of each Olympic games, their rank according to their GDP per capita among the 115 nations from the dataset and how often they appeared in the top 15. The Figures 3 & 4 give a breakdown of our findings.

We can observe recurring nations in the top 15, and this can lead to the conclusion that the games are in fact a competition among some of the most powerful nations in the world. However, this would not give a complete picture as some of the nations appearing in the top 15 do not rank highly with respect to the GDP per capita.

We can say that the results partially answer the questions we were asking ourselves at the beginning of the study, but we are unable to make a definitive claim. Although the GDP per capita is an important metric we do not believe it allows us to qualify the nations in terms of power and riches, to fully perform this study several additional metrics would have to be considered to properly rank the nations. The method used only offers a snapshot of the countries' economics, which we know are highly volatile and dynamics complex systems.

Additionally, other factors specific to the games need to be considered, as an example we have purposefully excluded the winter games as some nations were already favored due to their climates, similarly some nations have advantages regarding certain disciplines or are prioritizing specific disciplines in order to be collect the maximum amount of medals during the games.
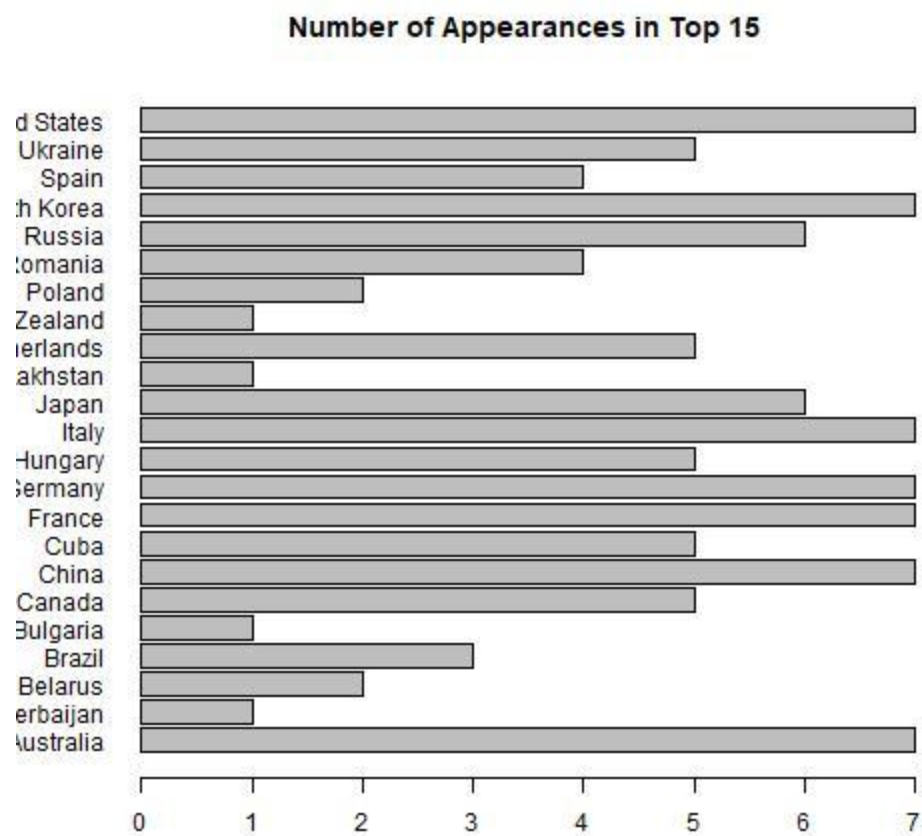
Number of Appearances in Top 15

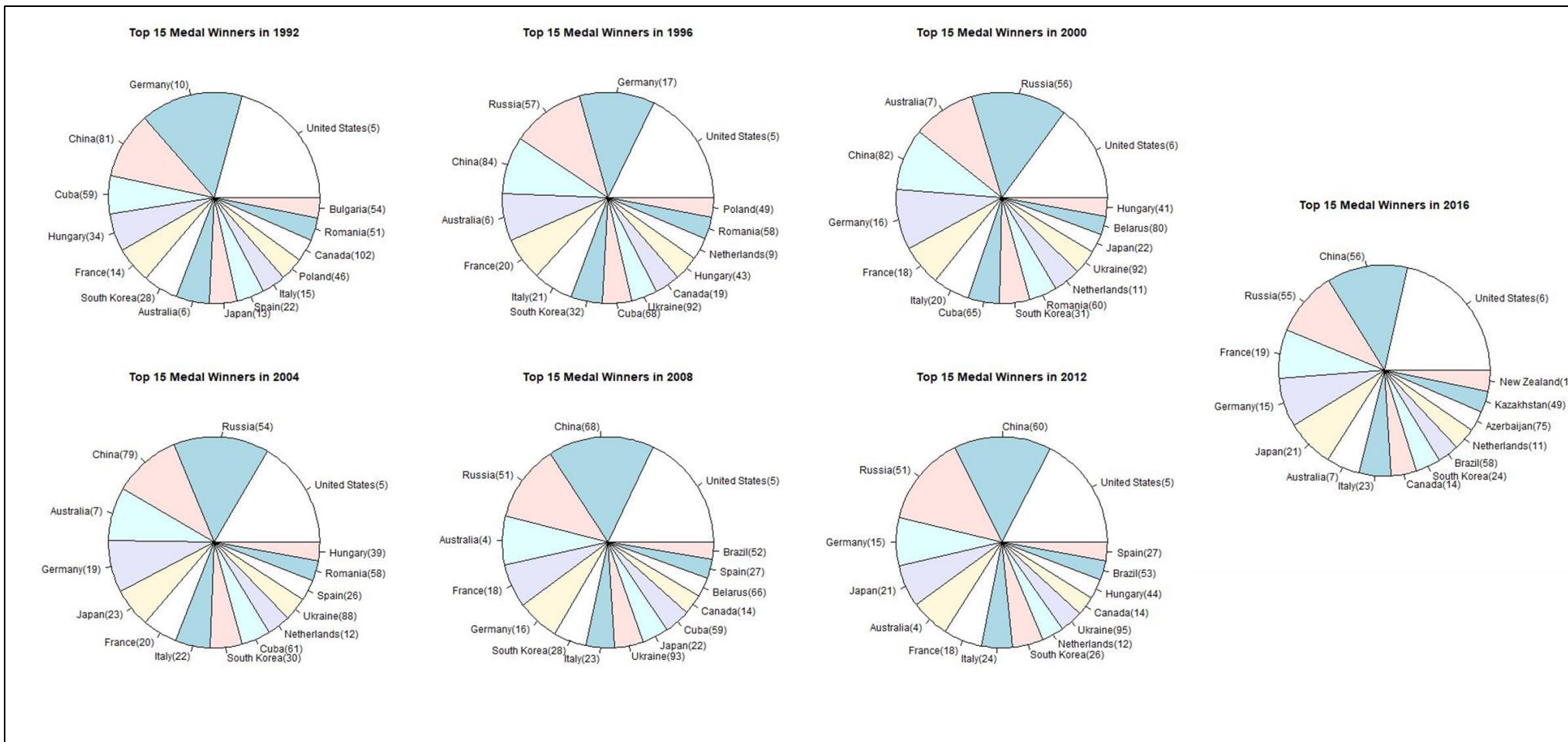*Figure 3: Number of appearances within the top 15 of the games*

Figure 4: Top 15 Medal winners of the Olympics Games, with their GDP per capita rank given in brackets out of the 115 nations from the dataset

References

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