What Contributes to Winning Gold?

A Cross-Section Analysis of Olympic Success

Shannon Gay[a]

Abstract:

This paper investigates the relationship between Olympic success and economic factors, does it take more than just athleticism to win a medal at the Summer Olympic Games? This study is a cross-section analysis of eighty-three countries at the 2016 Rio Summer Olympics who won at least one medal, using share of medals won at the 2016 Summer Olympic Games as the dependent variable and factors including gross domestic product, country population, life expectancy, HDI, host country status, political environment, and past Olympic performance as the independent variables. The results show that there is a positive and statistically significant relationship between medal share and population, and medal share and GDP. Past performance was also highly significant in this study, and is the greatest indicator for future success.

JEL Classification: C31, L83, Z20, Z29

Keywords: Sports Economics, Olympics

[a] ECO490 Capstone Economics Seminar, Bryant University, 1150 Douglas Pike, Smithfield, RI 02917. Email: sgay2@bryant.edu

1.0 INTRODUCTION

The Olympic Games is an international spectacle that has been around for hundreds of years with the first installment of the Modern Olympic Games occurring in 1896 in Athens, Greece. Since then, the Olympics has grown into the largest international sporting event known to man, with 206 nations and 11,238 athletes participating in the most recent installment of the Summer Games. However, the Olympics is not just any old sporting event, it is a time that the world unites every four years for the opportunity to watch their countries' highest achieving athletes push themselves to the limits in the hope of winning a gold medal. During the Olympic Games, political differences are pushed aside, the Olympic spirit is encouraged, and athleticism is at the forefront. But what if it takes more than just athleticism to win a medal at the Olympic Games? What economic, social, and political factors play a role in total medal count? What does it take to actually become an Olympian? These are the questions that this study attempts to answer.

This study aims to discover what economic determinants effect Olympic performance besides athleticism. The International Olympic Committee stands behind the notion that the Olympics is about representation and participation by athletes from around the world, with the goal to "contribute to building a peaceful and better world by educating youth through sport practices without discrimination of any kind, in a spirit of friendship, solidarity, and fair play" (IOC, 2018). However, with this in mind, the focus on winning medals is always at the top of the list during Olympic years, with polls and forecasts being constantly published by the media in the time leading up to the Olympic Games. While the Olympic Movement celebrates international sportsmanship and competition, all nations do not have the equal ability to not only

win medals, but even just participate. Although, this relationship of unequal opportunity can be inferred, this study hopes to confirm it.

This analysis intends to determine why out of the 206 nations participating in the Olympic Games, 10 go home with over half of the total medals available. It is not solely coincidental that this occurs, and past economic research has already proved this theory. This paper hopes to add to the research already published by confirming their ideas and adding new ones. It has already been shown that population size, income levels, and past performance all have an effect on Olympic performance, but other factors such as health and social development have not been studied as greatly. This paper intends to fill that void.

The rest of the paper is organized as follows: Section 2 reviews trends in Olympic performance and participation over the years. Section 3 gives a literature review of the topic. Section 4 discusses the data and methodology used in this study. Section 5 assesses the empirical results of this analysis. Lastly, section 6 concludes the paper, followed by references and appendices.

2.0 PARTICIPATION RATES AND MEDAL TOTALS AT THE OLYMPIC GAMES

The International Olympic Committee (IOC), the governing body of the Olympic Games, emphasizes the importance of sports participation across the globe as a main characteristic of their mission. The Olympic Charter states under the Fundamental Principles of Olympism that "the practice of sport is a human right. Every individual must have the possibility of practicing sport, without discrimination of any kind and in the Olympic spirit which requires mutual understanding with a spirit of friendship, solidarity and fair play" (IOC, 2018). However, with this in mind, it is clear that not everyone in the world has equal opportunity when it comes to

sports participation. This is due to many factors including cultural importance of sport, government expenditure on sports recreation, policies regarding sports participation, as well as general exposure to sports as a whole. This large disparity between countries ability to succeed in sports across the globe can be seen most prominently at the Olympic Games.

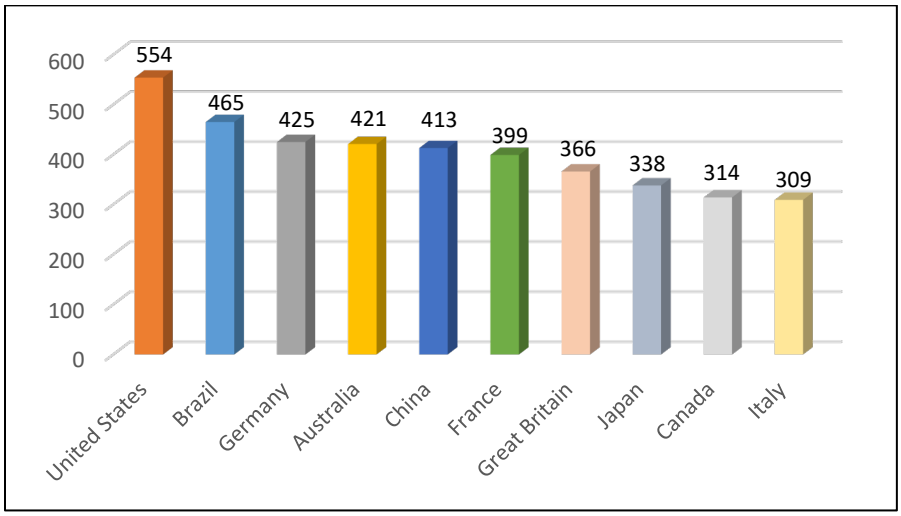
Figures 1, 2 and 3 below graphically depict this disparity between participation rates of countries and medal totals, specifically at the 2016 Summer Olympic Games. Figure 1 shows athlete participation totals by country at the 2016 Summer Olympic Games for the ten countries with the highest participation. As shown in the graph, the countries with the highest participation include several wealthy countries including the United States and China. The outlier in this group is Brazil, with 465 athletes representing them at the 2016 Summer Olympic Games. This increase in participation for Brazil comes from the fact that they were the host nation for this particular Games. Due to this reason, several athletes from Brazil did not have to undergo specific qualifying rounds in order to be eligible to compete.

Figures 2 and 3 both show medal totals at the 2016 Summer Olympic Games for the top ten medal winning countries. Figure 2 shows total medals won overall, while figure 3 is broken down by medal type: gold, silver, and bronze. The United States won the most medals in all three categories at the 2016 Games, finishing with a grand total of 121 medals. All ten nations that won the highest amount of medals at the Games are highly developed and wealthy countries.

When comparing figure 1 with the information shown in figures 2 and 3, the relationship between participation and winning can be seen. Nine out of ten of the top winning nations at the 2016 Rio Summer Olympic Games also fall under the top ten participating nations category. The only country with high participation that did not end up in the top medal totals was Brazil, which

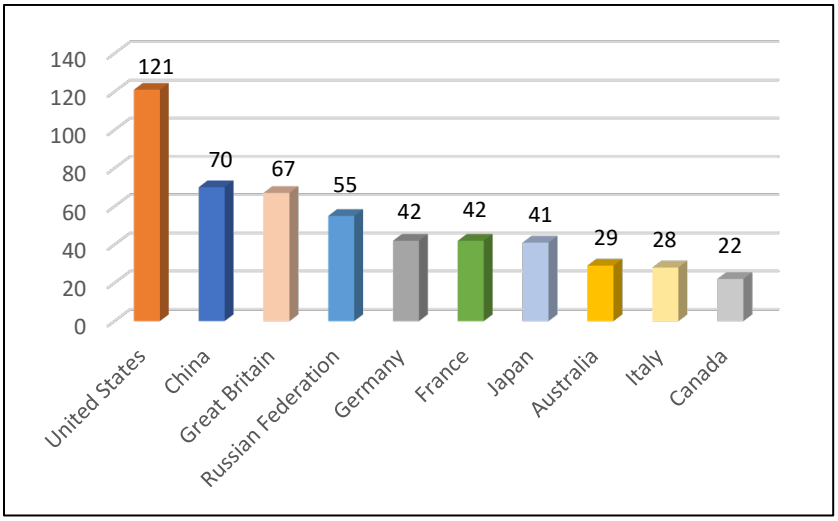
was replaced in the top ten by Russia. Again, this disparity between participation totals for Brazil equating to winning comes from the country playing host to this specific Games.

Figure 1: Athlete Participation by Country at the 2016 Summer Olympic Games



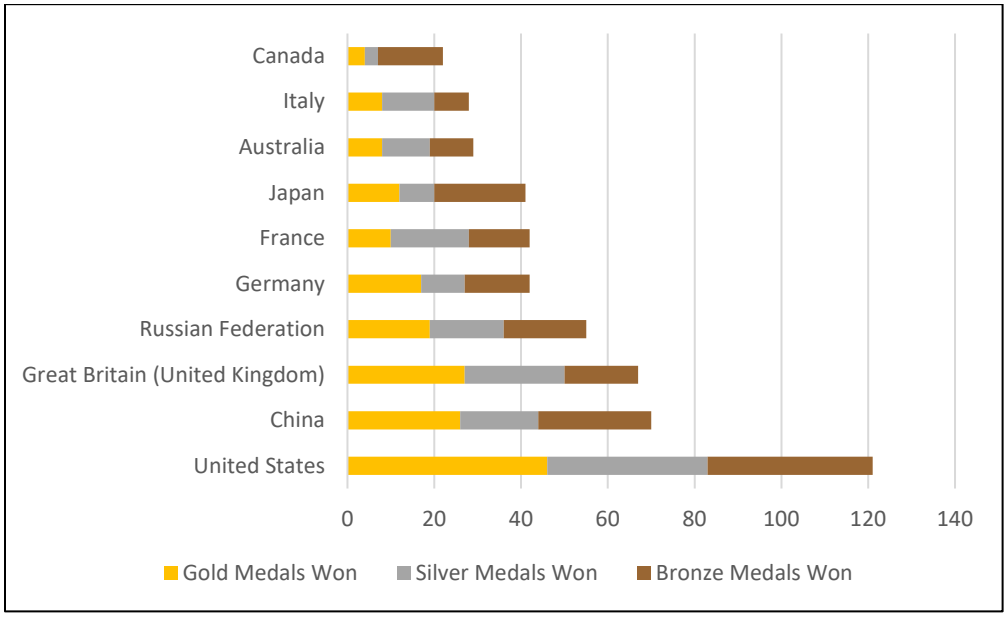
Source: International Olympic Committee

Figure 2: Total Medals Won per Country at the 2016 Summer Olympic Games



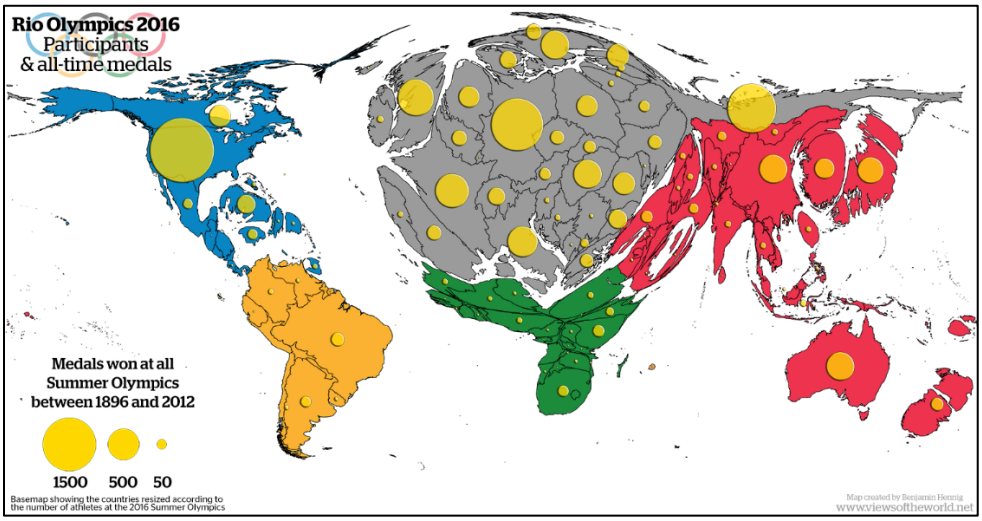
Source: International Olympic Committee

Figure 3: Total Medals Won per Country by Type of Medal at the 2016 Summer Olympic Games



Source: International Olympic Committee

Figure 4: World Map Depicting Participation and Performance at the Olympic Games



Source: Benjamin Hennig (2016)

Figure 4 above shows the same type of relationship described in Tables 1 through 3, but on a world map, to further demonstrate the uneven distribution of medal earnings and participation at the Olympic Games across the globe. All countries are resized according to the number of athletes participating at the Rio 2016 Summer Olympic Games, and the circles placed on top of each country represent all time medals won at the Summer Olympic Games. This map shows the considerable differences globally of Olympic participation and performance, with the developed world displaying greater performance over time, as well as, higher participation rates. These trends can be seen as a reflection of the wealth distribution across the world.

Since the instalment of the modern Games, the Olympics have come leaps and bounds from where it once was, with total participation from athletes and countries increasing every cycle. The International Olympic Committee constantly updates the rules of the Games, by including new sports, and updating participation rules and gender rules, among others, in order to account for the changing trends of society. While the Games is more inclusive now than ever before, there is still a lot of progress to be made in order to truly make sports participation available to everyone.

3.0 LITERATURE REVIEW

There is a remarkably large amount of prior research conducted in the field of determining Olympic success levels. Several of which took a forecast outlook with the attempt to determine the predicted number of medals earned per country at the next Olympic Games. With the growth and evolution of the Olympics over time, interest has grown in the possible medal tallies of countries, especially in the time leading up the Games. Media coverage and public interest are attracted to the idea of guessing the next “big winner” at the Olympic Games.

Although the media and public usually look at qualitative factors of each country, especially prior sport performance by specific athletes, economists have tended to take a more quantitative approach in the determination of their forecasts. Most studies look at GDP per capita and population as their main, and sometimes only, factors that have an effect on medal count by country, but others look at things such as hosting, climate conditions, and political system as other possible elements.

The main analysis examined during the creation of this paper is "Modelling Olympic Performance: Economic Briefing Paper" by John Hawksworth (2012). This study looked into factors found significant in explaining the number of medals won by each country at the prior Games in order to determine the number won at the upcoming London 2012 Games (Hawksworth, 2012). Hawksworth (2012) looked at population, average income levels, level of GDP, whether the country is currently a Communist nation or previously a part of the former Soviet Union, whether the country is the host nation, and performance at the previous two Olympics in terms of medal share all as possible statistically significant factors (Hawksworth, 2012). Hawksworth (2012) found that in general, "the number of medals won increases with the population and economic wealth of the country, but less than proportionately…superpowers like the U.S., China and Russia continue to dominate at the top of the medal table". The study also found that countries from the former Soviet bloc continue to outperform relative to the size of their countries, but that affect is beginning to fade and is no longer statistically significant (Hawksworth, 2012). Being the host nation is also a statistically significant variable with host nations generally outperforming at the Olympics (Hawksworth, 2012).

It is fair to say that based on prior research, size and income levels of a country are found to be the most commonly used factors to determine Olympic success in terms of medal counts.

Hawksworth (2012) found that the coefficients on population and income variables were similar, suggesting that total GDP matters most in predicting Olympic performance, but less than proportionately. This implies that there are diminishing returns from economic size in terms of increased sporting success, meaning, size matters, but it is not everything (Hawksworth, 2012). Bernard and Busse (2004) found a similar result in their analysis; they hypothesized that medals should be proportional to population, but this fails to adequately explain the distribution of medals across countries. Their ultimate result was that total GDP is the best predictor of national Olympic performance, and both a large population and high per capita GDP are needed to generate high medal totals (Bernard and Busse, 2004). This trend has been seen to consistently repeat itself over time, with both population size and Gross Domestic Product being needed to portray an accurate picture of medal wins (Celik and Gius, 2014; Jayantha and Ubayachandra, 2015; Rathke and Woitek, 2008). However, Olympic success cannot be determined by just population size and GDP alone, other variables must be taken into account when running any type of statistical analysis.

It has been observed in prior research that being the host city has its economic benefits, but it surprisingly can also have athletic performance benefits as well. Several studies have determined that being the host city to the Olympic Games can give the home country an advantage that allows them to perform higher than its expectation, usually between 1.5 and 2 percentage points (Hawksworth, 2012; Bernard, 2008). It is unclear as to why that happens, but over time, it can be seen as a clear trend. Possible explanations include that the host country may benefit from additional capital spending on sports or potential home field advantage in terms of fans (Celik and Gius, 2014). This effect is significant, and being a host country can not only

raise performance at the hosted Games, but also those immediately preceding it (Forrest et al., 2010).

The influence of past performance cannot be ignored when attempting to determine future performance. Many theorists have found that their models have become more accurate when past Olympic performance is taken into account (Hawksworth, 2012). It is observed that history will repeat itself, although not perfectly.

With any economic analysis, there will always be gaps and limitations to research because a model can never fully account for all influential factors. Hawksworth (2012) felt that his model did not account for the human factor of exceptional individual performance, state and corporate funding, sporting clusters, and Olympic importance. Jayantha and Ubayachandra (2015) limited their sample to one Olympic Games, which may have skewed their results. Similar to Hawksworth (2012), both Bernard and Busse (2004) felt that their models missed the possibility of nation-specific expertise in a particular event, for example Jamaican sprinters. The problem is that no matter how sound a model is, it can never fully account for human behavior.

All the models explored above focus on the importance of accounting for country population and income levels in terms of exploring determinants of Olympic performance, but they fail to include other measurable factors such as social development and health factors. This paper hopes to fill the void within the prior research by including these types of variables.

4.0 DATA AND EMPIRICAL METHODOLOGY

4.1 Data

This study uses cross section data from 2015, obtained from several different sources. Olympic data from the 2016 Summer Olympic Games and 2012 Summer Olympic Games were

obtained from the International Olympic Committee (IOC, 2018). Population, GDP, GDP per Capita, and life expectancy were obtained from the World Bank (The World Bank Group, 2018). HDI levels were acquired from the United Nations Development Programme (2018). Political system dummy variable was generated from data on the World Factbook (2018) website, and host country dummy variable was generated from the IOC (2018) data.

Summary statistics for the data used in this analysis are provided in Table 1 below.

Table 1: Summary Statistics

Variable	Observation	Mean	Std. Dev.	Min	Max
MED	83	.01196	.01907	.00102	.12448
*log*POP	83	16.649	1.6831	11.578	21.038
GDPCAP	80	19288.4	19603.21	300.67	82016.02
GDP	79	524497.48	395494.14	29120.15	800768.23
HOST	83	--	--	0	1
POL	83	--	--	0	1
LIFEEXP	83	75.295	6.523	52.977	83.843
HDI	80	.7833	.1252	.353	.949
PAST	83	1.178	1.968	0	10.751

This analysis includes data from eighty-three countries that participated in the 2016 Rio Summer Olympic Games and won at least one medal. Medal information uses the results from the 2016 Olympics, and all other variables use data taken from the year prior to the Games, 2015. There were 206 National Olympic Committees (NAC) that participated in the 2016 Rio Summer Olympics, eighty-five of these 206 won at least one medal, and the other 121 did not, and are

therefore not included in this study for that reason. Two NAC's that did win a medal are not included in this analysis due to lack of country data: Chinese Taipei and Independent Olympic Athletes.

4.2 Empirical Model

Following Hawksworth (2012) this study adapted and modified their model for 2012 Olympic estimates that included variables such as GDP per capita, GDP, population, political dummy, host country dummy, and past Olympic performance, by running the analysis for the 2016 Summer Olympic Games. This model also includes life expectancy and HDI variables to fill the gap of social and health factors that may affect Olympic performance that Hawksworth's (2012) model failed to capture.

The model used is written as follows:

$$MED = \beta_0 + \beta_1 logPOP + \beta_2 GDPCAP + \beta_3 GDP + \beta_4 HOST + \beta_5 POL + \beta_6 LIFEEXP + \beta_7 HDI + \beta_8 PAST + \varepsilon$$

The dependent variable used is *MED,* which is the medal share won per country at the 2016 Rio Summer Olympic Games. It was generated by taking the total medals won per country and dividing that by the total medals available to win, adjusted into a percentage. In this case, medal share was chosen as the dependent variable instead of total medals won because it captures a country's performance at the Olympics better than the alternative. Since, the amount of medals available to be won per Olympic Games always changes due to changes in sports and events played at the Games, medal share depicts a better picture of overall performance per country, especially when time is brought into the equation.

There are eight different independent variables used in this analysis that try to capture the factors contributing to successful Olympic performance other than pure athletic ability. These variables were obtained from several different sources including the International Olympic Committee, the World Bank, the World Factbook, and the United Nations Development Programme. Tables 1A and 2A, located in the Appendix, provide descriptions, explanations, sources, and expected signs of all variables used.

First, *logPOP* represents population total by country for 2015 based on the de facto definition of population using midyear estimates. This data counts all residents regardless of legal status or citizenship. For analysis purposes, the log of total population was used instead of leaving it as a total number. Second, two different types of GDP were used in this study, GDP and GDP per capita. Both variables were in current U.S. dollars and the data was for the year 2015. GDP per capita captures the individual income levels for a specific country, while GDP accounts for the total wealth held by a country. Both population and GDP variables were included in this analysis because they have both been found to be highly significant in prior research.

HOST and *POL* were the two dummy variables included in this analysis. *HOST* denotes the host nation for the Olympic Games in question, in this case Rio de Janeiro, Brazil. The country was given a 1 if it was the host nation, and a 0 if it was not. The other dummy variable used was *POL*, which was a dummy variable of the political system of the participating countries. They were assigned a 1 if the country was an Ex-Soviet or Communist nation and a 0 if not.

The following two variables, *LIFEEXP* and *HDI,* were not included in Hawksworth's (2012) analysis, but were included in this case to account for possible social and health factors

that may be relevant. *LIFEEXP* is life expectancy at birth in total years for 2015, it indicates the number of years a newborn would live if patterns of mortality at the time of its birth were to stay the same throughout its lifetime. Life expectancy was included because if a child is not healthy, it is less likely that they will become involved in sport, especially at an elite level. Next is *HDI,* which is the Human Development Index for 2015 as listed by the United Nations Development Programme. HDI is a statistic of life expectancy, education, and per capita income indicators, which countries are then ranked by. HDI was included to account for social development of a country.

Lastly, *PAST* illustrates the medal share won per country at the London 2012 Summer Olympic Games, the Games immediately preceding Rio. This variable was calculated the same way as *MED*, dividing total medals won by total medals available. It is included to acknowledge that past performance likely dictates future success.

5.0 EMPIRICAL RESULTS

Table 2: Correlation Matrix

	MED	***log*POP**	**GDPCAP**	**GDP**	**HOST**	**POL**	**LIFEEXP**	**HDI**	**PAST**
MED	1.0000								
***log*POP**	0.4556	1.0000							
GDPCAP	0.2898	-0.1554	1.0000						
GDP	0.8722	0.4696	0.2468	1.0000					
HOST	0.0411	0.1653	-0.0616	0.0429	1.0000				
POL	0.0865	-0.1407	-0.2124	0.0295	-0.0602	1.0000			
LIFEEXP	0.2368	-0.1407	0.6539	0.1596	-0.0063	-0.0042	1.0000		
HDI	0.2942	-0.2180	0.7415	0.1839	-0.0344	-0.0128	0.8981	1.0000	
PAST	0.9679	0.4830	0.2406	0.8377	0.0303	0.1616	0.2267	0.2740	1.0000

Table 3: Regression Results

	Dependent Variable: MEDAL SHARE		
Variable	Model I	Model II	Model III
CONSTANT	-.0915*** (.0179)	-.1033*** (.0329)	.0027 (.00727)
*log*POP	.00582*** (.00105)	.00656*** (.00108)	
GDPCAP	.00327*** (.00308)	.00196 (.00127)	
GDP			$1.57e^{-15}$*** ($3.82e^{-16}$)
HOST		-.00238 (.01583)	.00141 (.00442)
POL		.00790* (.00446)	-.00218* (.00124)
LIFEEXP		-.00092 (.00062)	-.00016 (.00017)
HDI		.08896** (.0396)	.01442 (.00991)
PAST			.00774*** (.00048)
R^2	0.3435	0.4230	0.9539
Adj. R^2	0.3265	0.3742	0.9500
F-statistics	20.15***	8.67***	244.59***
Number of obs.	80	78	78

Note: ***, **, and * denotes significance at the 1%, 5%, and 10% respectively. Standard errors in parentheses

Table 3 above presents the empirical estimation results found from this analysis. Three separate OLS regressions were run using three different models in order to see the different effects adding new variables had on the results. Before running these models, a correlation analysis was done with the purpose of viewing whether any of the variables used were highly correlated with each other or not. It was found that *MED* and *PAST* were highly correlated at 96%. This is not surprising to find since these variables were only taken from the two most

recent Olympic Games and many athletes tend to compete for more than one Olympic cycle. *GDP* and *MED* were also found to be highly correlated at 87%. All correlations can be seen in Table 2 located above.

The first regression was just run for population and GDP per capita due to the high focus paid to these variables in the literature. Similar to Hawksworth (2012), both variables were found to be positive and significant at the one percent level. The second regression added in *HOST, POL, LIFEEXP,* and *HDI* to the variables used in model I. In this case, only population, HDI, and political environment were found to be significant at the one percent, five percent, and ten percent levels, respectively. GDP per capita was found to no longer be significant at any level, which was an unexpected result, and may be due to its' relationship with one of the new variables added.

The last regression run, model III, included all variables pulled except for population and GDP per capita. In this case, total GDP was substituted for GDP per capita. Unsurprisingly, with the addition of past performance, this model was the most accurate with an R^2 of 95 percent. The R^2 is much higher in this case than the prior two models most likely due to the high correlation between 2016 medal share and 2012 medal share. In model III, GDP and past were both positive and significant at the one percent level, and political environment was negative and significant at the ten percent level. Both the host nation and political system dummy variables changed signs from model II to model III; *HOST* went from negative to positive, while *POL* changed from positive to negative. This effect may have been due to the multicollinearity caused from adding in past performance. Unpredictably, host nation was found to be statistically insignificant, which did not correlate with the results found in the literature. A possible explanation for this may be because this study only accounted for one Olympic cycle, Rio 2016.

Also, in this case, the host nation in question, Brazil, is a developing country and may not have benefitted from hosting the Games in the similar ways that China and London had in the recent past. Although, political environment changed signs, it remained significant at the ten percent level in both models II and III, which is the opposite of what Hawksworth (2012) found in his analysis. With the fall of Soviet Union occurring over twenty years ago and the IOC being stricter on policies of the Games, this effect should not remain significant for much longer. Overall, past performance was found to be the most significant variable included in this analysis, being statistically significant at the one percent level and having a positive coefficient of .0077. Past success has been found to contribute to future success, so it is not surprising that this result was also found to be true in this study.

6.0 CONCLUSION

Although the International Olympic Committee has worked hard on exposing the world to sport, there is still a lot of work to be done if equal opportunity is the end goal. This analysis reinforced what was found in the past literature, that population and income levels are good indicators of a country's ability to both participate and perform well at the Olympic Games. However, having one is not enough, both a high population and high GDP are needed to influence performance overall.

With this in mind, there are several limitations and gaps within this study, due to constraints in time and access to data. This study was only run for one Olympic cycle and the results may be different if time was taken into account. It also does not account for nation specific expertise in a certain event. This can be seen in the form of sporting clusters where a country excels highly at one event. For example, Jamaican sprinters that have dominated the

sprint events in track and field for decades, but barely come close to placing in other events. Or countries that may focus on a sport that is not played at the Olympic Games such as cricket or American football. Although the number of athletes competing per country is acknowledged, it is not taken into account in the final regression analysis. Therefore, the model overlooks athletes that won more than one medal in the Games, this may be relevant for some countries that have one high performing athlete that accounts for most or all of their medals. Further, this analysis does not recognize specific government policy regarding sport or government spending on sport. Both of those variables, along with culture, can be used to portray a better overall picture of the effect economic factors have on athletic performance.

In furthering this research, the hope is to be able to account for several of these limitations, as well as looking into other factors that were not researched as closely in this analysis. Specifically, comparing the results from this study to that for the Winter Olympic Games. Statistically, winter sports have been known to cost more money than summer sports, so it would be likely to find GDP continuing to play a significant role in overall performance. While population may be found to be less important since the Winter Games are much smaller than the Summer Games. The variable of climate will also have to be acknowledged in some way if this type of analysis were to be done. Other further research will include accounting for individual athlete's performances, as well as looking into gender differences found at the Olympics.

In conclusion, while population size and GDP were found to have a statistically significant effect on overall performance at the Olympic Games, they are not the only variables that need to be considered. Specifically, performance in the past. History is likely to repeat itself, especially in sports, and any analysis in this realm cannot be run without accounting for

this factor. It can be shown that while the Olympics main focus is revolved around exceptional athletic ability and performance, it can also reveal a lot about the constantly changing economic and political world.

BIBLIOGRAPHY

Bernard, A. (2008). Going for the Gold: Who Will Win the 2008 Olympic Games in Beijing.

Bernard, A. B., & Busse, M. R. (February 2004). Who Wins the Olympic Games: Economic Resources and Medal Totals. *The Review of Economics and Statistics, 86*(1), 413-417.

Celik, O. B., & Gius, M. (March 2014). Estimating the Determinants of Summer Olympic Game Performance. *International Journal of Applied Economics, 11*(1), 39-47.

Forrest, D., Sanz, I., & Tena, J. (2010). Forecasting national team medal total at the Summer Olympic Games. *International Journal of Forecasting, 26*, 576-588.

Hawksworth, J. (June 2012). Modelling Olympic Performance: Economic Briefing Paper. *PwC*.

Hennig, B. (2016, August 3). *Rio 2016: Participants and All-Time Medals*. Retrieved from Views of the World: http://www.viewsoftheworld.net/?p=4873

Human Development Index. (2016). Retrieved from United Nations Development Programme: http://hdr.undp.org/en/indicators/137506#

IOC. *The Olympic Games*. Retrieved from the International Olympic Committee: https://www.olympic.org/

Jayantha, K., & Ubayachangra, E. (June 2015). Going for Gold Medals: Factors affecting Olympic Performance. *International Journal of Scientificand Research Publications, 5*(6).

Rathke, A., & Woitek, U. (October 2008). Economics and the Summer Olympics: An Efficiency Analysis. *Journal of Sports Economics, 9*(5), 520-537.

The World Bank Group. (2018). *World Development Indicators*. Retrieved from The World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators#

The World Factbook. (2018). Retrieved from Central Intelligence Agency: https://www.cia.gov/library/publications/the-world-factbook/fields/2128.html

Appendix

Table 1A: Variable Description and Data Source

Acronym	Description	Data Source
MED	Total Medal Share won per country at the 2016 Rio Summer Olympic Games. Generated from Total Medals Won divided by Total Medals Available.	International Olympic Committee
*log*POP	Total population for 2015 based on de facto definition of population. Midyear estimates	The World Bank
GDPCAP	GDP per capita 2015, current US dollars	The World Bank
GDP	Total GDP 2015, current US dollars	The World Bank
HOST	Dummy Variable of Host Nation for 2016 Rio Summer Olympic Games. 1 if Host. 0 if not host.	Generated
POL	Dummy variable of political system of participating country. 1 if Ex-Soviet/Communist Nation. 0 if not.	The World Factbook
LIFEEXP	Life expectancy at birth. Total years (2015)	The World Bank
HDI	Human Development Index 2015	United Nations Development Programme

PAST	Medal Share at previous, London 2012 Olympic Games.	International Olympic Committee

Table 2A: Variables and Expected Signs

Acronym	Variable Description	What it captures	Expected Sign
MED	Total Medal Share won per country at 2016 Rio Summer Olympic Games	Percentage of medals won per country	N/A
POP	Total Population (2015)	Size of country relative to sport participation	+
GDPCAP	GDP per Capita, 2015. Current US dollars	Income level of country effecting exposure to sport	+
GDP	GDP total, current US dollars	^	+
HOST	Dummy variable of host nation of 2016 Rio Summer Olympic Games.	Host nation benefits	+
POL	Dummy variable of political system of participating country.	Government policy on sport	+
LIFEEXP	Life expectancy at birth, total years (2015)	Health factors	+
HDI	Human Development Index (2015)	Social development	--
PAST	Medal share won by country at 2012 London Summer Olympic Games.	Past performance	+