DO SOCIOECONOMIC FACTORS OF A COUNTRY AFFECT ITS SPORTS ACHIEVEMENTS IN COMMONWEALTH GAMES?

¿Afectan los factores socioeconómicos del país a sus resultados deportivos en los juegos de la Commonwealth?

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ABSTRACT: Several studies have analysed the factors affecting the performance of a country in various sports events. The empirical literature on the effect of socioeconomic factors of a nation on its sports achievements is scarce. The existing studies have been focused on the Olympic Games and have ignored the other mega-events like Commonwealth Games. This study contributes to the surprisingly sparse empirical literature on the socioeconomic factors that contribute to the sports achievements of a country. The study is aimed at investigating the relationship of socioeconomic factors of a country with its sports achievements in Commonwealth Games during 1962–2014. The total number of medals won measures the sports achievements in a Commonwealth Games edition. By using panel data of 10 major countries that have participated during the period, the study adopts Poisson regression and panel negative binomial regression analysis. The results of the study reveal that hosting advantage contributes maximum to the increase in sports achievements of a country. Life expectancy, per capita GDP and literacy rate also play a positive and significant role in getting additional medals for a country.

KEYWORDS: Commonwealth games, medal counts, negative binomial regression, socioeconomic factors

RESUMEN: *En varios estudios se ha analizado los factores que afectan al rendimiento de un país en diversos eventos deportivos. La literatura empírica sobre el efecto de los factores socioeconómicos de una nación en sus logros deportivos es escasa. Los estudios existentes se han centrado en los Juegos Olímpicos y han ignorado otros mega eventos como los Juegos de la Commonwealth. Este estudio contribuye a la escasa literatura empírica sobre los factores socioeconómicos que contribuyen a los logros deportivos de un país. El estudio tiene por objeto investigar la relación de los factores socioeconómicos de un país con sus logros deportivos en los Juegos de la Commonwealth durante 1962-2014. El número total de medallas ganadas mide los logros deportivos en una edición de estos juegos. Utilizando datos de panel de los 10 países más importantes que han participado en los Juegos durante este período, el estudio adopta la regresión de Poisson y el análisis de regresión binomial negativa de panel. Los resultados revelan que la ventaja de ser anfitrión contribuye al aumento de los logros deportivos de un país. La esperanza de vida, el PIB per cápita y la tasa de alfabetización también desempeñan un papel positivo y significativo en la obtención de medallas adicionales para un país*

PALABRAS CLAVE: *Juegos de la Commonwealth, recuento de medallas, regresión binomial negativa, factores socioeconómicos*

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1. BACKGROUND

Ever since the dawn of humankind, physical activity has been a necessity for humans. Primitive humans had to hunt and gather food for themselves. As the population increased, conflicts regarding territories arose amongst tribes. When the tribes clashed against each other for hunting in their territory, the battle turned into sports. *American heritage dictionary of the English language* (2000) defines sports as "an activity involving physical exertion and skill that is governed by a set of rules or customs and often undertaken competitively." Young people proved their strength and intelligence to lead and protect their people by winning the warrior-like play of the sports field. Team efforts were required to stalk, trap, kill, and transport animals. As a result, team sports evolved in the tribes. Communities together used to witness the battles resulting in the origination of the concept of the spectator of sports. After that, there was not any noticeable advancement in sports for thousands of years. In modern times, the first known effort for an organised sports tournament is the Ancient Olympic Games by Greece in 776 BC. The Games started in the honour of Zeus, the father of the Greek gods and goddesses. The Modern Olympic Games began in 1896 in Athens, Greece (Young, 2008). There were no wars, and divine peace persisted during the Games. After going through these processes, sports has become an integral part of humanity.

Apart from the Olympic Games, Commonwealth Games is a grand multi-national tournament that has participants from across the globe, including commonwealth nations and associate members. The first edition of Commonwealth Games was held in Canada in the year 1930 with only 11 participating countries. It was known as the British Empire Games at that time. The number had gone up to 71 participating countries in the year 2018 when the latest Commonwealth Games were held in Australia ("History of the games," n.d.). The existing literature has not focused on the factors determining the success of any country in the Commonwealth Games. Previous researchers have been concentrated on the Olympic Games. The success in Olympic Games in terms of medal counts has been modelled as a function of population, per capita income, hosting advantage, and other indicators related to socioeconomic progress of the country (Vagenas & Vlachokyriakou, 2012; Emrich, Klein, Pitsch, & Pierdzioch, 2012; Forrest, Sanz, & Tena, 2010). Apart from that, the impact of climatic factors has been analysed using temperature as a proxy variable (Hoffmann, Ging, & Ramasamy, 2002). In this study, an attempt has been made to empirically analyse the socioeconomic factors determining the sports performance of a country in the Commonwealth Games during the period 1962–2014. Sports performance has been measured by the total number of medals a country is winning, i.e., its medal achievements in the Commonwealth Games.

Bernard and Busse (2004) have examined the role of population, GDP per capita, host advantage, and Soviet sphere of influence in determining Olympic medal achievements during the period 1960–1996 at the country level. The study has used

the Tobit regression model to quantify the effects of these determinants. The study has found that population and GDP per capita of a country have a positive impact on the medal achievements by the countries. Hosting advantage results in a 1.8% higher number of medals by the countries while the Soviet sphere of influence results in a 3% higher number of medals than what is predicted by a country's population and GDP per capita. Klein (2004) has used the Probit regression model to find the probability of a country qualifying for Women's Soccer 1999 World Cup. The study reveals that countries with higher women participation in the labor force are more likely to qualify for the World Cup. An increase in income per capita, population, fertility rate, and women participation in government also increase the chances of World Cup qualification of a country. The study concludes that societies with more significant economic opportunities for women enable athletically talented women to reach their full potential in the form of higher achievements in sports. Lowen, Deaner, and Schmitt (2016) have studied whether women's empowerment correlates with women achieving higher number of medals in the Olympics. The study is based on panel data on Summer Olympics during the period 1996–2012. Using the Gender Equality Index, the study finds that higher gender equality results in better participation of women in the Olympics and higher medal achievements.

Johnson and Ali (2004) have employed a classical linear regression model to examine the medal achievements in all post-war Summer Olympic and Winter Olympic Games and the economic and political factors that determine the performance of the countries in these games. The results show that income, population, hosting advantage, and cold climate increase the participation in the Winter Olympics when compared with the Summer Olympics. Lui and Suen (2008) have analysed the medal achievements of countries in the Olympics during the period 1952–2004. Using the Poisson Regression Model, the study highlights that population size and income per capita are the significant determinants of the medal achievements of a country.

These studies have taken into account socioeconomic factors, e.g., population, gross domestic product (GDP), life expectancy, and host advantage as the factors that majorly determine the medal achievements for a country. However, the population as a determinant for medal achievements is highly debatable. A country like India, which has more than one-sixth of the world population, has won just 28 medals in the entire 124-year history of the Olympic Games. To put this into perspective, American swimmer Michael Phelps alone has won an equal number of Olympic medals ("The Most Decorated Olympian of All Time," n.d.). The ability to win medals is not affected by the number of countries participating, as reflected in Figure 1. During the period 1962–1970, more than 60% of the participating countries were winning the medals. After that, the percentage of participating countries winning medals came down to 45% in 1978. The 1986 edition of the Commonwealth Games was boycotted by 32 of the 59 eligible nations due to the sanctions imposed by The UK against apartheid South Africa. Since the 1990 edition, the number of

participating countries has increased, but the percentage of participating countries winning medals has remained close to 50 percent.
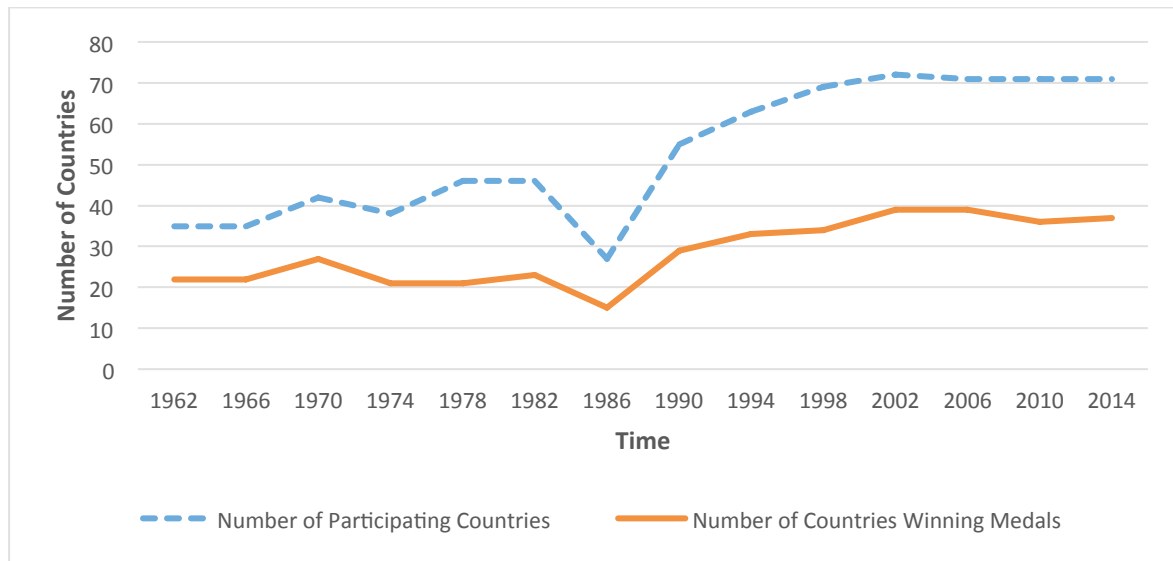

Figure 1. Participation and Medal Achievements of Countries in Commonwealth Games (1962–2014).

Source. Commonwealth Games Federation, Athletes, and Results (https://thecgf.com/results)

Table 1 gives an overview of the Commonwealth Games during the 1962–2014 period. It shows that the number of participating countries, athletes, sports, and events has significantly increased over the period making the Games genuinely global.

Table 1. Overview of Commonwealth Games (1962–2014).

| Year	Host Country	Participating Countries	Athletes	Sports	Events
1962	Australia	35	863	9	104
1966	Jamaica	34	1050	9	110
1970	Scotland	42	1383	9	121
1974	New Zealand	38	1276	9	121
1978	Canada	46	1474	10	128
1982	Australia	46	1583	10	142
1986	Scotland	26	1662	10	163
1990	New Zealand	55	2073	10	204
1994	Canada	63	2557	10	217
1998	Malaysia	70	3633	15	213
2002	England	72	3679	17	281
2006	Australia	71	4049	16	245
2010	India	71	4352	17	272
2014	Scotland	71	4929	17	261

Source. Glasgow 2014 factsheet, n.d.
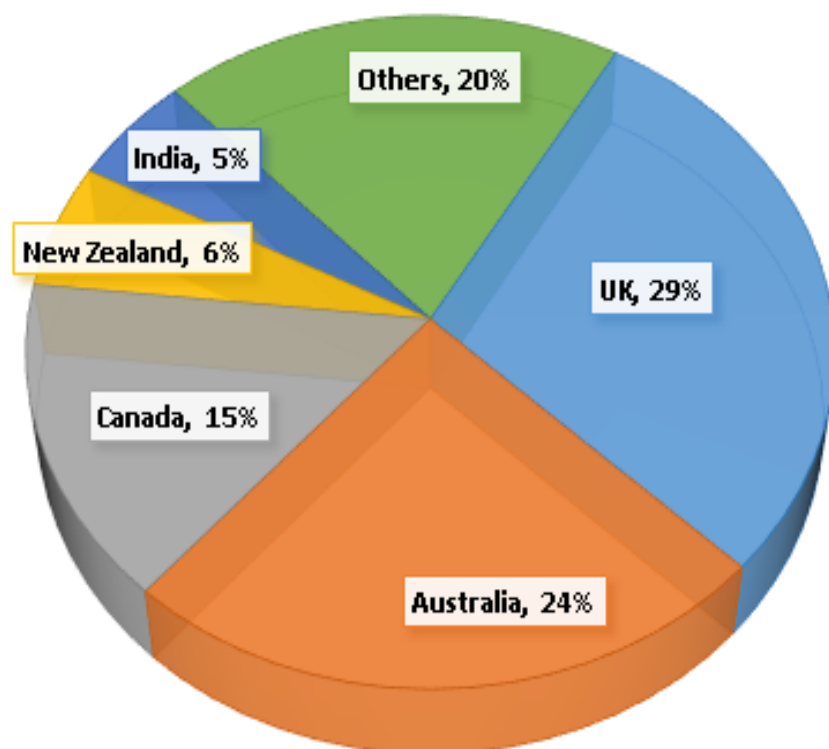
Figure 2. Medal share of top five countries during 1962–2014 (Percentage of total medals).

Note. United Kingdom (UK) includes England, Wales, Northern Ireland, and Scotland.

Source. Author's estimation.

Figure 2 reveals that the United Kingdom, Australia, and Canada combined have won 68% of the medals during the 1962–2014 period. It shows the dominance of these permanent participants in the Games.

From these studies and statistics, it is found that the studies carried out by scholars focused on determinants of medal achievements in the Olympic Games. There are no studies focused on Commonwealth Games about socioeconomic factors and their contribution to the medal achievements in Commonwealth Games. Moreover, the existing studies have not considered a larger time period to get a complete picture of the impact of socioeconomic factors on medal achievements in Commonwealth Games. Therefore, the study is aimed at fulfilling the research gap by considering panel data for 15 Commonwealth Games editions during the period 1962–2014.

The next section deals with the data collection and research methods employed to conduct the study. In Section 3, the results have been discussed, and the determinants of medal achievements in Commonwealth Games have been critically analysed. The last section gives the conclusion of the study.

2. DATA COLLECTION AND RESEARCH METHODS

The present section deals with the data collection, variables used in the study, and the methodology that has been employed for the analysis in the study. The variables with their time period and the respective data sources have been mentioned. Also, the methodology used to carry out the analysis has been discussed in detail in this section.

2.1. Data Sources and Variables Used

The present study is based on secondary panel data to explore the relationship amongst the variables. The study uses the total number of medals won, host advantage, per capita GDP, life expectancy, and the adult literacy rate for the analysis of the connection between the performance of a country in Commonwealth games and the socioeconomic progress level in that country. The study takes into account the data for the 15 editions of Commonwealth Games from the year 1962 to the year 2014. The data on the total number of medals won have been taken from the official Commonwealth Games Federation database. The total number of medals won includes gold, silver, and bronze medals won by a country, and it is referred as the medal achievements of the country. Life expectancy, adult literacy rate, and GDP per capita (at constant USD prices of 2010) have been collected from World Bank Open Data. Adult literacy rate refers to the percentage of people above the age of 15 years who can read and write with understanding a short and simple statement in their everyday life (UNESCO). From the pool of 35 countries that participated in the 1962 edition to 71 countries that participated in the 2014 edition, ten countries have been selected, which have at least participated in 11 editions out of the 15 that have been considered for the analysis. The selected countries are Australia, Canada, Ghana, India, Jamaica, Kenya, Malaysia, New Zealand, Uganda, and the United Kingdom. All the selected countries have won at least a medal in each of the editions in which they have participated. The selected countries represent about 88% of the total medals won (7011 medals won by the selected countries out of the total 7968 medals during the period of the study) during the selected Commonwealth Games editions. The variables used in the study include the dependent variable, i.e., medal achievements (*MED*) and the independent variables, i.e., host advantage (*HOST*), GDP per capita (*GDPPC*), life expectancy (*LEX*) and literacy rate (*LITR*).

2.2 Count Data Models

In the present study, medal achievements is used as a dependent variable that has non-negative integer values. In the literature, the variables, which constitute of non-negative integer values are called as count variables. For estimating the count data, there are two models, i.e., Poisson regression and Negative Binomial regression model (Chimka & Talafuse, 2016; Leeds & Leeds, 2009). There are some statistical conditions through which the Poisson and Negative Binomial regression model are

used. If the mean and variance of the count variable are equal, then Poisson regression is used. On the other hand, if the mean and variance of the count variable are not equal, the Negative Binomial regression model is used (Leeds & Leeds, 2009). In other words, the Poisson regression model assumes equal dispersion in the count data (Trombley, 2016). In the present study, the mean and variance of the dependent variable, i.e., medal achievements, are not equal. So, Negative Binomial regression is an appropriate model for the current analysis. The following equation is used to estimate the impact of socioeconomic factors on medal achievements.

$$E(MED) = \exp(\beta_0 + \beta_1 HOST + \beta_2 GDPPC + \beta_3 LEX + \beta_4 LITR) + \varepsilon$$

where,

E(MED): the expected value of medal achievements for a country,

HOST: dummy variable for hosting advantage,

GDPPC: real GDP per capita,

LEX: life expectancy,

LITR: literacy rate,

β_0: intercept,

β_1, β_2, β_3, and β_4: respective coefficients of the independent variables, and

ε: Error term

3. RESULTS AND DISCUSSION

The count data panel regression techniques have been applied to empirically investigate the relationship between medal achievements in Commonwealth Games and socioeconomic progress level of a country. Count data models have been used since the dependent variable, i.e., medal achievements, is a non-negative integer. In the first step, the panel Poisson regression model has been applied. The results of the model are shown in Table 2.

Table 2. Results of Poisson Regression

Independent Variable	Dependent Variable: Total Number of Medals		
	Log Coefficient	**Standard Error**	***p*-value**
HOST	0.2918	0.0284	0.00
GDPPC	-2.25e-06	3.31e-06	0.49
LEX	0.0739	0.0085	0.00
LITR	0.0054	0.4539	0.09
Likelihood-ratio test statistic	Coefficient	Standard Error	*p*-value
α	0.5659	0.2352	0.00

For applying the Poisson model, the mean of the dependent variable must be equal or approximately equal to the variance of the dependent variable. To check the

suitability of the Poisson model, a likelihood-ratio test is applied, and α gives the output of the test. In Table 2, α is a measure used to test whether the mean of the medal achievements is equal or approximately equal to the variance of the medal achievements (Colin & Trivedi, 2005, p. 671). The null hypothesis of the test is that the mean of the medal achievements is equal or approximately equal to the variance of the medal achievements. In this case, α has a value of 0.5659, and the *p*-value of α is less than 0.01, indicating that the null hypothesis is rejected. Therefore, the likelihood-ratio test suggests that the Poisson regression model is not suitable for the analysis.

Table 3. Results of negative binomial regression with fixed effects

Independent Variable	Dependent Variable: Total Number of Medals		
	Log Coefficient	Standard Error	*p*-value
HOST	0.3503	0.0712	0.0000
GDPPC	9.49e-06	6.91e-06	0.1700
LEX	0.0432	0.0167	0.1000
LITR	0.0082	0.0050	0.0900

In the second step, Panel Negative Binomial Regression is applied with fixed effects and random effects. Table 3 gives the results of Negative Binomial Regression with fixed effects. Table 4 presents the results of Negative Binomial Regression with random effects.

Table 4. Results of negative binomial regression with random effects

Independent Variable	Dependent Variable: Total Number of Medals			
	Log Coefficient	Actual Coefficient (Exponential of Log Coefficient)	Standard Error	*p*-value
HOST	0.35330	1.42380	0.07100	0.0000
GDPPC	0.00001	1.00001	6.69e-06	0.0900
LEX	0.04130	1.04210	0.01600	0.0100
LITR	0.00900	1.00900	0.00500	0.0700

After applying Panel Negative Binomial Regression with both fixed and random effects, the Hausman test is employed to check which model is suitable for the analysis. The results of the Hausman test are shown in Table 5.

Table 5. Results of the Hausman test

Chi-square value	*p*-value
4.20	0.38

The Chi-square value of the test is 4.20, with a *p*-value of 0.38, meaning that the model with random effects is more suitable for the analysis. The results of the model with random effects in Table 4 reveal that all the four variables, i.e., *HOST*, *GDPPC*, *LEX*, and *LITR,* have a positive and significant impact on the medal achievements of a country.

Firstly, the results quantify that when a country hosts Commonwealth Games, its medal achievements, on average, increases by 42%. It is much higher than the hosting advantage in the Olympic Games. The difference could be because the number of hosting countries in the Commonwealth Games is less when compared with the Olympic Games. The dominant countries are repeatedly hosting the Commonwealth Games and increasing their dominance in their home conditions. On the contrary, the hosting countries in the Olympic Games are more in number. The study by Bernard and Busse (2004) reveals that hosting advantage brings 1.8% more medals for a country in the Olympic Games. It is because a host country enjoys certain advantages when compared to its peers. The advantages include, but not limited to, better adjustment to home weather conditions, playing with motivation in front of the home crowd, tailored facilities for home athletes, and knowing the field conditions well. Secondly, when it comes to financial wellness, a higher GDP per capita indicates that more people can afford the cost of becoming a trained athlete. So, a USD 1,000 increase in real GDP per capita of a country can increase the medal achievements by 1.1% on an average for that country. Thirdly, life expectancy measures the longevity of the population of a nation. It also captures the health standards and facilities of a country. A higher life expectancy of a country indicates that the population is less susceptible to diseases, which results in better athletic performance. A higher life expectancy also means a lower infant mortality rate as both are highly negatively correlated. From the analysis, it is inferred that, on an average, a one-year increase in life expectancy can result in a 4.2% increase in the medal achievements for a country. Lastly, a literate population can understand the importance of sports as a means of wellness in life and the career opportunities that sports can open for the masses in the country. On average, a 1% increase in literacy rate can bring 0.9% more medals for a country in the Commonwealth Games during the study period. It indicates that when more people are literate, they contribute more to the sports achievements of their country. Hence, all the variables taken in the study contribute positively to the medal achievements of a country.

4. CONCLUSION

The existing literature on the relationship between the medal achievements and socioeconomic progress level has been focused on the Olympic Games only. The previous studies have not investigated the relationship between the total number of medals won in Commonwealth Games and the socioeconomic progress level of a country. Therefore, the present study has empirically examined the socioeconomic factors affecting the performance of a country in the Commonwealth Games. The factors include hosting advantage, GDP per capita, life expectancy, and literacy rate.

Kumar, S., Sahu, N. C., & Kumar, P. (2019). Do socioeconomic factors of a country affect its sports achievements in commonwealth games? *Journal of Sports Economics & Management, 9*(3), 174-184.

The study reveals a positive relationship between the medal achievements and socioeconomic progress of a country. The connection amongst the variables has been examined based on the Panel Negative Binomial regression. The model exhibits a positive contribution of all the socioeconomic factors taken in the study in enhancing the performance of a country in the Commonwealth Games. It suggests that a better socioeconomic performance of a country significantly contributes to the sports achievements of a country. By taking into account the panel data during the period 1962–2014, the time period makes the study comprehensive. The results of the study could help policymakers to focus on higher socioeconomic progress capturing better financial, health, and educational infrastructure since it plays a significant role in enhancing sports achievements and bring laurels to a country. A key result of the study is that the hosting advantage is very dominant in the case of Commonwealth Games. Therefore, the policymakers could also focus on providing an opportunity to the other Commonwealth Countries that have not hosted the games yet. It will also boost the socioeconomic progress of those countries and make the games more competitive.

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