Going for Gold Medals: Factors affecting Olympic Performance

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Abstract- This particular study titled "Going for Gold Medals: Factors affecting Olympic Performance was carried out with special reference to 2000 Olympic Games. This study was thoroughly undertaken by the researchers by focusing on the problem that why countries show different performance in Olympics? There were three objectives set to be achieved by this study, which include a key objective namely 'To examine the influences of factors affecting the Olympic performance and two specific objectives such as (i) To produce a mathematical model facilitating to predict the Olympic tally (ii) To identify the degree of factors influenced on the Olympic performance. The researchers carried out an extensive literature review to provide a conceptual background of the study, to develop a conceptual model, and to formulate hypotheses for the study. Olympic Games in 2000, 80 countries and 921 medals were selected for the survey. Certain conclusions were made from the study after carrying out detailed scientific analysis of data using appropriate statistical tools. The conclusions are that the factors such as size of population of countries, GDP *per capita*, HDI, communist background and host city advantages of certain countries in the particular Olympic year. It showed significant relationship with some variations between these variables and Olympic performance. Based on the findings of the study, recommendations were made to the sport authorities and researchers in the field of sport to improve sport performance in their countries in future.

Index Terms- Olympic performance, Olympic Meal tally, Prediction, Host City, GDP Per Capita, HDI

I. Introduction

Why some countries win medals whilst others do not? Research conducted internationally to identify factors that affect sports performance focuses on resource endowments, a country's population and cultural and social resources (Kiviaho and Makela 1978; Bernard and Busse 2004; Andreff 2001; Johnson and Ali 2004). It can be argued that a country's success in sport should be evaluated relative to its economic resources and that medal achievement should therefore be weighted relative to a country's GDP *per capita.* Utilizing these criteria, countries including Mongolia, Jamaica, Zimbabwe, and Kenya topped the list of achievement at the Beijing Olympics, while some other less developed countries performed below the expectations. Under such an environment, this research was conducted to clarify the factors that affect the Olympic performance.

The development of the Olympic Movement and the Olympic Games is one of the great success stories of the 20th Century. The Olympic Games, particularly over the last 20 years, have experienced matchless growth and worldwide popularity. It is the largest and most successful sporting event in the world, and has become the pinnacle of most athletes' careers. More than 95% of countries participated in Olympic Games at present and athletes' participation is greater than the 10,000. However, the result convinces that the majority of countries have failed to show successful performance even at the lowest level. In last Olympic Games 2000, 112 countries obtained no medals. In addition, in the 2000 Olympic Game 9 countries obtained 52% of total medal tally. Olympic Game as one of the biggest businesses in the world it is important to make a close look in one side. Besides, it is also important to study the factors influencing on the Olympic performance since the Olympic performances reciprocally influence the nation's motivation on sport. Conversely sport leads to human health and then wealth of people at last in a country. On that ground, it is important to understand the factors affecting Olympic performance. Thus one nation can stimulate those factors to human wellbeing. So this study was completely planned to make a deeper study around this particular type of important sector regarding which more noticeable things discussed so far. In that sense it can be mentioned here that this study possesses a greater significance.

II. Literature Review

There are number of research done related to Olympic Game and other Olympic movements. Those researches can be divided into two categories as macro level studies and micro level studies. Out of those micro level studies, 93 research articles were reviewed in deferent categories under this study. Mainly the literature review was divided into two divisions as sport performance and Olympic performance. Under the category of sport performance, articles relating to individual sport performance were reviewed and under the category of Olympic performance articles related to Olympic successes were associated. Under the Olympic successes, there were mainly two sub categories as Olympic in 2000 and other Olympic Games. Related to the sport performance which is under the first category, 41 of previous studies done by scholars in different point of views, using different methodologies in different years to understand the factors affecting individual sport performance were also used. In the category of Olympic performance itself, 14 articles on 2000 Olympic Games were reviewed. Hence, five number of variables emerging from previous studies were used in

this study. Those commonly emerged variables are country midyear population, GNP *per capita* in a particular country in the Olympic year, Social Development of the particular country (HDI), the political system of the particular country, and finally being hosting the Olympic Game. Accordingly, 05, number of studies done related to 2000 Olympic Game and Some of those important studies are as follows;

The first study to analyze the factors influencing on the success at the Olympic Games appeared after the 1952 Olympic Games in Helsinki. Accordingly to Rathke and Woitek (2007) Jokl and co-authors (1956) in the study sport in the cultural patterns of the world: A study of the Olympic Games in 1952 at Helsinki were the first to use gross Domestic Product index (GDP) or GDP *per capita* as a potential predictor of Olympic success. Using GPP is more justifiable since it can indicate the country's economic development and assumptions can be made about the resources for enabling athletes to be committed to sports preparation, building and maintaining training facilities, developing advanced educational system for coaches, supporting scientific research and consequently developing cutting edge training methods. Numbers recent studies used GDP or GDP *per capita* as a variable in Olympic Games success investigation (Bernard & Busse, 2000, 2004; Groot, 2007; Johnson & Ali, 2000,2004; Kuper & Sterken, 2001; Lui & Suen, 2008; Matros & Namoro, 2004; Rathke & Woitek, 2007; Roberts, 2006;Bernard 2008; Van 2010; Lozano, al et. 2002; Wade, 2006; Xun, 2004; Robert, 2002; anderw and Meghan, 2000;Custonja and Skoric, 2001;).

Johnson and Ali (2004) argued that countries with the single-party political system and communist regime send a similar number of athletes to the Olympic as the non-communist countries, but won more medals in both the summer and winter Olympics. A higher medals count for communist countries than expected was confirmed by Burnard and Busse (2000, 2004) and Kuper and Sterken (2001). Matros and Namoro (2004) argued that the change in the political system of communist countries to free market economy resulted in a lower medal count at the Olympics. Rathke and Woitek (2007) reported that the former communist countries used to outperform the other participants in absolute terms, given the same amount of available resources. These studies confirmed that in the past countries with the communist political system outperformed their counterparts. However, in the post cold war era, the effect of having the communist political system of being a former communist nation is no longer significant (Robert, 2006) Custonja al et (2001) was reviewed the importance of political system in winning Olympic medals was conformed especially in the case of the former communist countries. Hosting of the Olympic Games and certain climate conditions also significantly contribute to Olympic success.

According to Bernard and Busse (2000) 'host countries typically win an additional 1.8 percent of the medals beyond that would be predicted by their GDP alone. Similar results were reported by Johnson and Ali (2000) as well as by Rathke and Woitek (2007). They indicated undeniably large advantages of bringing the hosting nation, both in terms of participation and medal count. Lui and Suen (2008) predicted that 2008 Olympic Games held in China would win about 14% more medals than 2004 only on accounting of hosting the Games. Kuper and Sterken (2001) underlined that a host effect is strong, especially for participation, but it used to be more important at the older editions of the Games. Such a host effect was not confirmed by Roberts (2006)

III. Objectives

The key objective of the present study was to identify the factors that influences on Olympic performance and the Specific objectives were to produce a mathematical model facilitating to predict the Olympic tally, and to identify the degree of factors influence on the Olympic performance

IV. Hypotheses

This study conveys five hypotheses viz., 1) the size of population directly affects Olympic performance, 2). GDP *per capita* is positively correlated with Olympic performance; 3) Olympic performance depends on HDI. 4) the political system might have a relationship with Olympic performance and finally 5) host city advantage may positively influence on Olympic performance.

V. Material and Methods

As this study is exploratory in nature the researchers had to depend on secondary data. Therefore, as far as possible an attempt was made to collect secondary data from official publications and web sites. To maintain the validity and reliability of data well known cronbach's alpha was used. As it was more than 0.50 points it assured that there is a reliability and validity of data. Data of Olympic Medal count and information of hosting countries of Olympic Games were obtained from direct correspondence of international Olympic Committee (IOC). The data of population and per capita GDP (measured in PPP current international dollars) were extracted from World Development Report (World Bank Reports 2004 and 2010).

Though it is fruitful doing a macro study including all Olympic Games and all countries, this study was restricted to a selected sample due to the convenience of analysis. Accordingly one Olympic Game (one Olympiads) namely 2000 Sydney Olympic Game was selected for this study. There were two reasons not to include Olympic before 2000. The first as well as the basic one was that Olympic performances in many of those games were affected by non-socioeconomic factors. For example, due to Cold War, the United States did not participate in Moscow Olympics in 1980. Together with many other socialist countries, the Soviet Union boycotted the Los Angeles Olympics in 1984. The second reason was the Olympiad ranging from 1997-2000 recorded the highest national participation rate, which provided complete data set for analysis. Samples were selected from 2000 Olympic Games and sample was included represent nations who won least one medal at 2000 Olympic Games.

There are one dependent variable namely Medal count (M_t) and five independent variables namely size of population, GDP *per capita*, Human Development Index (HDI), the political system (whether communist or not), and whether the host city or

not which were considered in this study. The processing of data pertaining to the medal count was handled carefully. As mentioned under the Sources of Data Collection, data were collected from International Olympic Committee (IOC) official documents to maintain the validity of the data and were then weighted by assigning 0.5, 0.3 and 0.2 for gold, silver and browns medals respectively. Then calculated the weighted total for each country and prepared a weighted medal tallies for 2000 Olympic Games. Data connected to size of population in each country, were not needed to process and could employ them as it is in the *world population data sheet* of http://www/prb.org/pdf04/04_worldDataSheet_ENG.pdf. It was measured the mid-year population in millions of countries in the Olympic year that is of year 2000. GDP *per capita* was derived by dividing the country GDP by mid-year population of the particular country. The World Bank reports were referred for the calculated GDP. Considering the social development the Human Development Index (HDI), that was taken as it is from the Human Development Report 2010, was used. If the country is hosting the game then used 1 and otherwise 0 and the country has or had a communist system then used 1 and otherwise 0.

Here in this research both descriptive and inferential statistical tools were used to present and analyze the data. When presenting the data collected through various secondary sources the researchers used descriptive statistical tools such as mean, and standard deviation to analyze the data and inferential statistical tools viz., regression and p value were employed. Regression and p value provide basis to determine the acceptance or rejection of each hypothesis formulated.

Universality of the sample was discussed in two ways; vertically and horizontally. With the beginning of modern Olympic in 1896, there are 26 Olympic Games have been summoned so far. Though out of those 26 Olympic Games only one game was considered in this study, it can be justified since these games cover all nations, biggest NOC participation, biggest player participation, biggest spectator participation, and the biggest number of medals total. Number of countries included in the sample is 80 out of 199 participated countries in 2000 Olympic game. And finally, all medals totaling to 921, in 2000, were considered and included the sample. Therefore, the sample chosen for this study is much more adequate to generalize the ideas, suggestions and findings. As such this study bears a huge universal nature.

This study used linear functions to estimate the influence of population size, economic resources, political and economic structure and hosting advantage on nations' Olympic performance.

$$M_t = ß_0 + ß_1 (N_t) + ß_2 (Y_t/N_t) + ß_3 HDI_t + ß_4 (Pol) + ß_5 H_t + E$$

Each variable presented in this equation was conceptualized as follows.

M_t denotes the medal number for a country at a particular Olympic Game. In this study it was considered the Moosa and Smith's (2004) weighted system such as weights of 0.6, 0.3 and 0.1 for gold, silver and browns respectively. N_t is the population size of the country at the year t when the particular Olympic Game is held. Y_t/N_t denotes the GDP *per capita* and HDI_t denotes the Human development Index of the country at the same year. Pol., H_t, are dummy variables for political system of the particular country and hosting countries respectively. Pol. Takes the value 1 if the country has communist background, when means the country is or was a communist country and it takes 0 if otherwise. Similarly, if the country was hosting the Olympic in the year, H_t the value of 1, and 0 if otherwise were used. For the research hypothesis to be true, the coefficient of all independent variables needs to be positive.

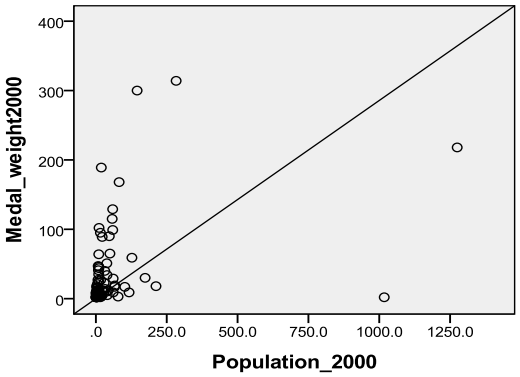
All variables mentioned above were operationalized with the aid of measurement criteria indicated in the table (Table 01) below.

Dimension	**Dependent Variable:**	**Indicator**	**Hypothesized Sign**
Olympic Performance	Medal Count (M_t)	The number of medal won by a country in a particular Olympics	N/A
	Independent Variables:		
Demographic Environment	Population (N_t)	The population size of a country at a particular Olympic year	+
Economic Development	GDP per capita (Y_t/ N_t)	The per capita GDP (measured in PPP current international dollars) of a country at a particular Olympic year	+
Social Development	Human Development Index HDI_t	The Human Deployment Index of a country at a particular Olympic year	+
Political Environment	Political System (Pol)	1 if the country is or used to be a socialist country or 0 otherwise	+
Geographic Environment	Hosting country (H_t)	1 if the country is the hosting country of the year or 0 otherwise	+

VI. Results

Size of population and Medal Talley

The below scatter diagram was drawn from the data collected with respect to population size of countries with at least one Olympic medal taken in 2000 Olympic games.



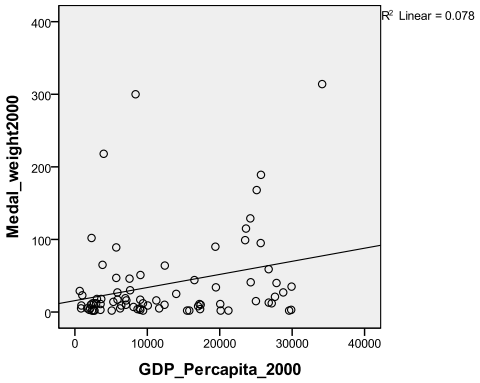
Source: Survey data

The line shows the trend of relationship Olympic performance and country population size. Accordingly, the scatter diagram shows very poor positive relationship between the size of population and the Olympic performance. However, it doesn't numerically show the strength of relationship between these variables and therefore, the statistical calculations such as correlation co-efficient; regression and p –value were calculated by using statistical software (SPSS 19.0).

There is a positive significant relationship between the size of population and the medal tally in 2000 Olympic Games. The correlation co-efficient between size of country populations and Olympic performances in the Olympic Games 2000, is 0.354^{**}, and the regression equations is M_t = -1.665+0.419(pop), and the p values is 0.000. It is seen a good correlations (0.354^{**}). However, the regression analysis supports the argument obtaining +0.419 (pop), with the p value taking 0.0000, and therefore the hypothesis can be accepted with respected to 2000 Olympic Games.

GDP *per capita* and Medal Talley

The below scatter diagram was drawn from the data collected with respect to GDP *per capita* of countries with at least one Olympic medal taken in 2000 Olympic games.



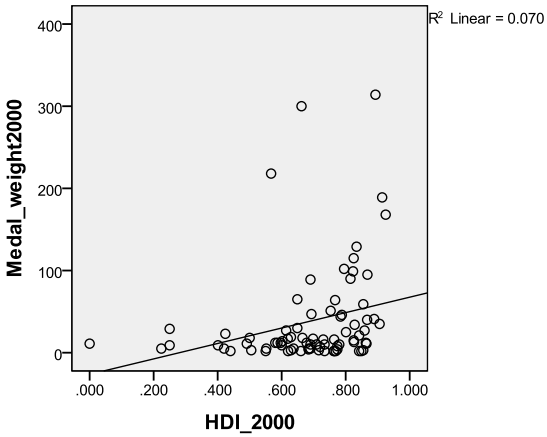
Source: survey data

The line shows the trend of relationship Olympic performance and country GDP *per capita*. Accordingly, the scatter diagram shows very poor positive relationship between the GDP *per capita* and the Olympic performance. However, it doesn't numerically show the strength of relationship between these variables and therefore, the statistical calculations such as correlation co-efficient; regression and p –value were calculated by using statistical software (SPSS 19.0).

The correlation co-efficient between GDP *per capita* and Olympic performances of the Olympic Games in 2000 is valued 0.280^{**}. The regression equation is M_t = -1.665+0.315 (GDP per capita) and p value is valued 0.000 level. The value statistically shows a good correlation (0.280^{**}) in 2000 Sydney Olympic Games between GDP per capita and Olympic performance. Furthermore, regression analysis supports this through obtaining 0.315(GDP per capita) and since the p value is 0.0000, and therefore the hypothesis is accepted.

HDI and Medal Talley

The below scatter diagram is drawn from the data collected with respect to HDI of countries with at least one Olympic medal taken in particular Olympic games. The following diagram shows the relationship between HDI and Medal Talley in 2000 Olympic Games



Source: Survey Data

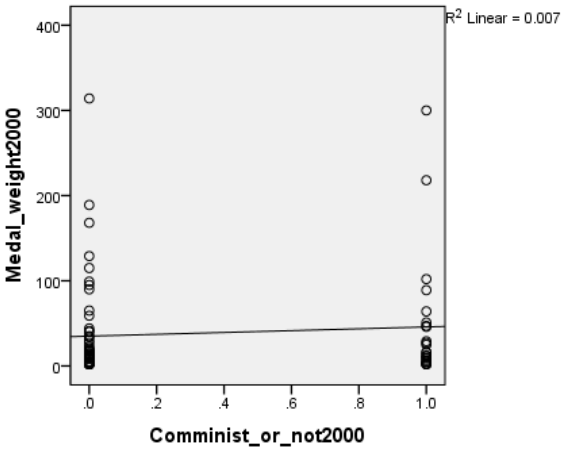
The line shows the trend of relationship Olympic performance and country HDI. Accordingly, the scatter diagram shows very poor positive relationship between the HDI and the Olympic performance. However, it doesn't numerically show the strength of relationship between these variables and therefore, the statistical calculations such as correlation co-efficient; regression and p –value were calculated by using statistical software (SPSS 19.0).

The correlation co-efficient between HDI and Olympic performances in the Olympic Games in 2000 is 0.265^{**}. The regression equation is M_t = -1.665+0.152(HDI) and p values are 0.000. There is weak correlations (0.265^{**}) between Olympic medal tally and HDI. Furthermore, regression analysis supports this through obtaining 0.152 (HDI) in 2000. Since the p value is also 0.0000, the hypothesis is accepted with respect to 2000 Sydney Olympic Games.

Whether it is a communist country or not and Medal Talley

The below scatter diagram was drawn from the data collected with respect to Political system of countries with at least one Olympic medal taken in particular Olympic games. The

following diagram shows the relationship between Political system and Medal Talley in 2000 Olympic Games



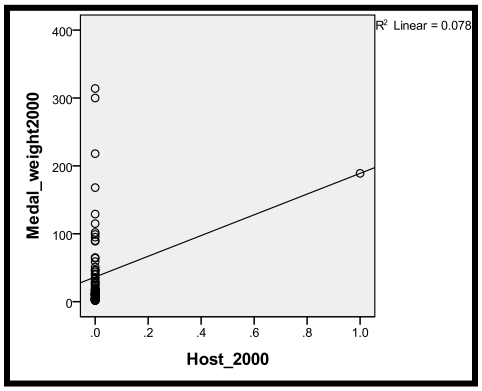
Source: Survey Data

The line shows the trend of relationship Olympic performance and country communist system. Accordingly, the scatter diagram shows very poor positive relationship between the communist system and the Olympic performance. However, it doesn't numerically show the strength of relationship between these variables and therefore, the statistical calculations such as correlation co-efficient; regression and p –value were calculated by using statistical software (SPSS 19.0).

The correlation co-efficient between communist system and Olympic performances of the Olympic Games 2000 is 0.081. The regression equation is M_t = -1.665+0.259(pol) and p value is 0.000. it shows a weak correlations (0.081) between medal tally in Olympic Games and communist system. Furthermore, regression analysis supports this through obtaining 0.259 (pol), values and since the p value is 0.0000, the hypothesis is accepted.

Host city and Medal Talley

The below scatter diagram was drawn from the data collected with respect to Host city of countries with at least one Olympic medal taken in particular Olympic games. The following diagram shows the relationship between host city and Medal Talley in 2000 Olympic Games



3Source: Survey Data

The line shows the trend of relationship Olympic performance and country Host city. Accordingly, the all scatter diagrams shows very poor positive relationship between the Host city and the Olympic performance. However, it doesn't numerically show the strength of relationship between these variables and therefore, the statistical calculations such as correlation co-efficient; regression and p –value were calculated by using statistical software (SPSS 19.0).

The correlation co-efficient between Host city and Olympic performance of the Olympic Games in 2000 is 0.279^{**}.The regression equation is M_t = -1.665+0.237(Host) and p value is 0.000.. There is a weak correlation (0.279^{**}) in 2000 between Host city and Olympic performance. Furthermore, regression analysis supports this through obtaining 0.237(Host) values and since the p value is 0.0000, the hypothesis is accepted with respected 2000 Sydney Olympic Games.

VII. Discussion

As this study is exploratory in nature, it was intended to collect secondary data. Country population, Olympic medal tally, HDI that are the standard figures used in UN reports and IOC official reports to collect relevant data. Cluster sample method was used because this tool helps to select the countries which at least one Olympic medal. In addition, athletes' events continuously appear from the very first Olympic Games to date. Besides that, it is a common sport for every nation. Sample taken from the Summer Olympic Games only since the winter Games are still bias to specific countries.

The researchers have endeavored throughout the study to bring at a realistic report, which reflects some of the key factors affecting Olympic performance. As the researchers reviewed the comprehensively a larger number of literature, designed and employed data collection methods, interacted with people in order to collect data for this study, it was found that the undertaken task is not only challenging but also highly complex. Under the discussion part research findings and conclusion were made with the help of data analysis and hypotheses testing. In addition to this, it also provides several recommendations to improve Olympic performance and generally sport performance. Later part of this paper attempts to point out certain suggestions for future studies.

The regression formula derived by data analysis made above based on 2000 Olympic Game performance and matched with the regression model mentioned above is as follows;

The regression formula No 01: The regression formula for 2000

M_t = -1.665+0.419(pop) +0.315(GDP per capita) +0.152(HDI) +0.259(pol.) +0.237(Host)

Based on findings of the study following are recommended towards the authorities of sport industry in order to improve the performance of sport and to show their proud to the rest of the world.

Only 2000 Sydney Olympic Games were chosen for this study. The findings based on the discussions made so far pertaining to size of population, GDP *per capita*, HDI, political system (whether communist or not), and finally Host country advantages are stated below in short. As far as the relationships between size of population, GDP *per capita*, HDI, political system (whether communist or not), as far as Host country advantages and Olympic performance are concerned it has been proved by this study that there is a considerable relationship.

When it comes to conclusions with the consideration of generated formula it can be said that the size of population, GDP *per capita*, HDI, political system (whether communist or not), Host country advantages considerably influence on Olympic performance.

Based on the conclusions of the study the researchers would recommend the followings to the authorities of sport industry in order to improve the performance of sport and to show their strength to the rest of the world.

- As this study revealed, five variables, size of population, GDP *per capita*, HDI, political system (whether communist or not), Host country advantages that greatly much influenced on Olympic performance, it is recommended to look for suitable sports factors and encourage them as much as possible.
- It is also recommended to identify inherited factors and identify how factors encourage the sports
- Further, national policies should be to encourage the national inherited factors.
- The sport authorities in every nation should make an attempt to identify the sportsmen with genetic capabilities on such sports.
- It is also recommended to identify sports match with the countrymen capabilities rather than going for popular sports.
- The researchers further recommend encouraging rural level sport clubs and events that is lead to fourth come the genetic capabilities.
- The present study thoroughly studied about five factors namely size of population, GDP *per capita*, HDI, political system (whether communist or not), Host country advantages that influence on Olympic performance and this study was strictly limited to macro level investigation. It was not investigated breakdowns of medal tally. Therefore, it is needed to go for more micro level study to identify the factors that influence on sport performance. The events that countries more score and country geographical and other generic factors should be investigated.

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We highly appreciate all the scholars who have initiated several researches related to this study. Their findings and methodologies directed us to complete another research gap in the athletic sport management field. Last but not least, we convey our sincere thanks to all our colleagues at University of Kelaniya who helped a lot, by sharing their views on our research work, "Going for Gold Medals: Factors Affecting Olympic Performance".

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