



# Economic Determinants of Success in Olympic Games

Seyed-nezamuddin MAKIYAN<sup>1A</sup>, Mojtaba ROSTAMI<sup>1B</sup>

<sup>1</sup> Yazd University, Faculty of Economics, Yazd, Iran

Address Correspondence to S. Makiyan : e-mail: nmakiyan@yazd.ac.ir

(Received): 11/08/2020/ (Accepted): 30.04.2021

A:Orcid ID: 0000-0001-2345-6789 B:Orcid ID: 0000-0001-2345-6789

## Abstract

Sport economics is defined as the application of economic theories for analyzing of sport activities in which Olympic Games are the most famous ones. Activities in such games are measured by the number of medals that a certain country obtains. One way to predict medals winning by countries is to consider economic strength of the country in addition to the abilities of athletics. In this study, the effect of the most important economic factors on medals winning, such as Population, GDP per capita, and also hosting and the experience from past times in Olympics as explanatory variables are considered, which have not been reflected so far in the related studies. These variables are appropriate for the assessment of the potential of countries' success in Olympics. The data which is used, is in form of discrete data. Accordingly, Poisson Regression model is suitable for the purpose of this study. The period of examination is from 1992-2016 for evaluating the availability of having more medals in Olympics. The results, indicate a positive and significant relationship between economic factors, hosting and experiences in Olympic progressing. Since, countries expect from Olympics Games to derive more medals after the use of their resources, which have been allocated for this purpose, the study suggests that success in the Olympic need to consider the importance of economic factors.

**Key Words:** Population, GDP Per-capita, Olympic Hosting, Experience in Olympic Games, Poisson Regression

## INTRODUCTION

The Olympic Games are not just a sporting event, but a broad social movement that contributes for the development of human harmony and the expansion of international relations among the countries promising peace in human society. The Olympic Games were initially a religious celebration held every four years and in the year of 776 BC in Olympia, the venue of the Zeus, to celebrate Zeus (the king of the Gods of Greece). The Olympics were of great importance among the Greeks, as ancient Greek historians used it as a unit for measuring time, and an "Olympiad" was a four-year-long one.

Centuries later, a German archaeologist and a scientist named "Pierre de Quentin" convened a meeting with their friends in Paris in 1889, in which the basis of the new Olympic Games was introduced. The games were officially launched in Athens in 1896, the capital of Greece, and since then, every four years (except for the three periods that

coincided with World War I and II), took place around the world.

A glimpse into the history of the Olympic Games proves that all participating countries do not have the same ability to win Olympic medals. So, the question that is posed is why some countries can enjoy the Olympic medal while some cannot? The answer to the relative power of countries in sport is returned. For example, the United States has a large number of professional basketball players, and it certainly has more medals in the Olympics than other countries of the world (2004). With a glimpse into the history of these games, we find that the participating countries do not have the same ability and opportunity for medals. One way to predict obtaining medals by countries is to consider the athletic ability of individuals. However, since the 1950s, the estimation of the importance of sport in societies as the yield of countries in raising medals in Olympics has attracted many experts. Success in Olympic Games both in terms of how it influences the host country and in terms of the issue of

mediation by participants can be examined from different cultural, economic and political aspects.

In the economics literature, one of the area which is formed and studied is "sport economics", which is defined as such; the sport of economics is the application of economic theories for the analysis of sport activities and, more precisely, the sport's economy, to assess the issues and patterns of optimal allocation of resources in three parts: sport performance, sport products, and sports development (1). In the sport economic research that have studied so far, limited variables have been defined as vital factors for predicting Olympic medals. These factors have been steady in almost all studies and have had interesting results. In some studies Gross National Product and population as independent economic variables are considered. In other studies, in the years 2000, 2004 and 2008, there are also other factors involved, including hosting, socio situation, whether and etc. of the participating country (2). This study aims to consider the main economic and semi-economic factors for estimating medals winning in Olympics. For this purpose consideration of a brief review of some studies which have done before is valuable.

Many studies have been dealing with this particular topic of dispersion over the years after the completion of each round of Olympic Games. In a study entitled "Who Takes Olympics: Economic Resources and Total Medals, used a Probit Regression model, in which the question examined which country wins the number of medals in a period of the Olympic Games? This study begins with a simple hypothesis that sports talent is randomly distributed and is proportional to population size. It also includes a function that covers distribution of resources, population, hosting, and other national features. In this study, the population power hypothesis explains, it is ineligible to describe the distribution of medals among countries. Significant evidence has been obtained that other resources, especially national income, are crucial for the training of an Olympic athlete. Interestingly, per capita and population income has also similar effects to cottage GDP as the best predictor of Olympic performance (3).

In a paper titled "Economics and the Olympic: A Productivity Analysis," assesses the importance of sport in the community by using technical measurements to ration the success of the Olympic Games. The results show that gross domestic

product is an appropriate indicator for predicting success for the output values of the model, namely, the medallion quota and the point of its contribution. The impact of population size is also positive for countries that are relatively wealthy. It has also been noted that the growing importance of sports among nations, races and laws is similarly increasing (4). In a paper titled "Why Do Some Countries Receive more Olympic Medals? Lessons for Social Mobility and Poverty Reduction," the study examined indicators such as health, education, and three variables of information and access (the size of the road in the country, the division of the population in villages and the amount of per capita output).

In relation to the ability of countries, given India's share of the world's total population, the country's Olympic medal is horribly low. For example, in the 2004 Olympics, India was the only winner of one medal (5). Meanwhile, Turkey, which has less than a tenth of India's population, has won ten times more than India. Thailand, which is hardly 6 percent of the population of India, won eight times more than that country. Indeed, what factors have caused a country with almost the sixth of the world's population to contribute very little to obtain Olympic medals? However, GDP per capita as an economic indicator has been shown to play a significant role in the success of the Olympic Games in obtaining a significant number of medals in various sports, but it cannot be said that GDP is a sufficient condition for this process (2). For example, countries such as Cuba, Ethiopia, Kazakhstan, Kenya and Uzbekistan do not seem to have higher per capita income than India, but their share of the Olympic medals is much higher than that for India.

In a study titled "Earning a Medal in the Olympics: Croatia Has a Chance?" examines variables such as population size, GDP and per capita GDP, hosting, political system, sports system, per capita health expenditure and the weather has paid attention. The results show that economic factors, especially GDP per capita and political system of the country, have a significant and positive effect on explaining the medallion of countries in these competitions. However, the impact of population size on the likelihood of the medal in Croatia has not been confirmed (6).

In a paper entitled "The Impact of the Economic and Social Factors Affecting the Sporting Success of Nations in the Olympics" during the period of 2012-

6, has studied for the countries participating in the Olympics. In this regard, the success of the sport of countries according to the medal received in these games is defined and function of the index of human development, per capita income, population, performance of previous courses, number of participants, trade balance, labor participation of 14-64 years and household expenses are considered. To investigate these factors, the regression model of panel data is used. The results of the estimation indicated that except for population variables, labor force participation rate and performance of the previous period, other variables were statistically significant. Also, except for the population variable, other variables have a positive impact on the sporting success of countries, so that the human development index was the most effective factor in the sport's success of the countries in the Olympic Games (1). The results indicate that many countries have been awarded medal in prediction by the aforementioned agents, that is, the number of predicted medals for them with the potential ability, which they were (with little difference) the same. Results mean that due to the political tensions and the type of economic situation in countries, may consider as factors which affects the success or failure in Olympics.

Goals are being pursued today in leading sporting countries. Investigating the role of economic factors in the modeling of the Olympic Games winning can be started using economic function theories. Although, according to Bernard & Busse (2), which they assume that athletic talent to be randomly distributed across the world, the development and discovery of these talents, as they point out, requires spending on the individuals and facilities that they need. Wealthy countries are both more capable and more willing to spend such investments. As a result, it seems rational that one of the most important variables i.e. per capita GDP should be included in the modeling of Olympic medal gain. Bernard & Busse (2) define the following function as which (i) stands for country i at time (t):

$$Tit = F(Nit, Yit, Ait)$$

In the above case Nit represents the population, Yit represents the GDP and Ait stands for the ability of experience of country i. In this research, it seems that the above function can be a good description of the success of countries in the Olympics, while the experience of participating countries, which were in

the top Olympic winners, should be include in the function. This is because often the coaches or club advisors which are heroes or experienced people, that they can reflect their proficiency to involvement countries better. In addition, this paper have identified the experience of success in the Olympics as a variable which states the lack of Bernard and Busse's (2) work, then this experience as a variable is included in our study.

### Variables and Method

Considering the research background in order to evaluate the overall performance of countries in the Olympics in the period 1992 to 2016, four main explanatory variables were identified as follows:

**Domestic Production Per Capita:** The degree of economic strength of countries is measured by this variable. The data from this variable are prepared by the World Bank and used in the model of the study logarithmically (Abbreviation, lgdppc).

**Population:** The size and number of sports talents with the population. In this regard, the population includes one of the main variables of the research. The data from this variable are prepared by the World Bank and used in the model of the study logarithmically (abbreviation, lpop).

**Hosting as a virtual variable:** It is anticipated that hosting will affect the number of medals received by countries. According to the data of the International Olympic Committee, the countries hosting the Olympic Games during the period under consideration have been identified using the dummy variable and, thus we have investigated the hosting impact on the volume of received medals (Abbreviation, Host).

**Experience of attending the first 20 Olympic Games:** the experience of attending the top 20 Olympic Games in terms of the ranking that the International Olympic Committee has introduced as an important factor in the success of further medals. Using this variable is considered also as a dummy variable. It is expected that this variable will be effective on the number of medals won at the Olympics (Abbreviation Proage). This variable has not been introduced in any of the studies have been done so far.

The total number of medals won in each Olympics: The total number of medals won in each Olympics has been used as a dependent variable of the research and its data has been obtained from the

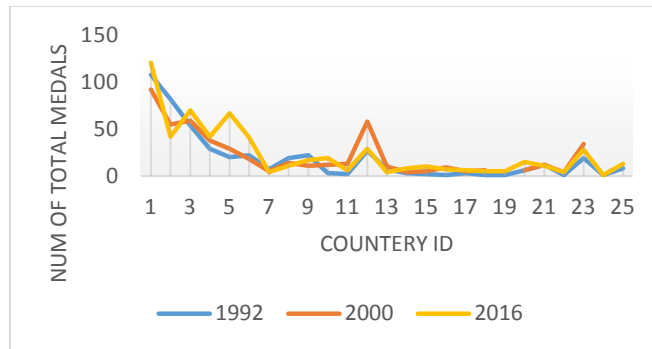
International Olympic Committee (Abbreviation, Mtotal).

According to the above mentioned and the studies which have done so far, dependent variable of this study (number of total medals) is a kind of discrete and a numerical variable. Therefore, the

assumption of the normalization of the function of the truth of this variable will result in incompatibility estimates of model coefficients. Therefore, the Poisson Model has been selected among different regression methods for these kinds of data, i.e. the discrete data.

**RESULTS**

Form 1 shows the total number of medals won by countries in different Olympic periods, which are represented by the abbreviation mtotal. Based on this form, it seems that during the period under consideration in the selected countries<sup>1</sup> the medal process is almost the same. It also shows the difference between countries in medal gain and the time stability of this kind of difference.



**Figure - Form 1.** The Mediation Process of the Selected Countries in the Olympic Games

**Table 1.** Transition Prob. Matrix for the No. of Medals in Countries (Von 10 or More)

No. of Medal Won in Time <sub>t</sub>	Prob. of Numbur of Medals Won in Time <sub>t+1</sub>											Total 100%	
	T	0	1	2	3	4	5	6	7	8	9		10
0	34.78	21.74	17.39	13.04	0.00	4.35	0.00	0.00	0.00	0.00	0.00	8.70	100.0
1	21.05	15.79	26.32	10.53	10.53	5.26	5.26	0.00	0.00	0.00	0.00	5.26	100.0
2	9.09	22.73	36.36	13.64	13.64	0.00	4.55	0.00	0.00	0.00	0.00	0.00	100.0
3	12.50	0.00	25.00	25.00	6.25	12.50	0.00	18.75	0.00	0.00	0.00	0.00	100.0
4	11.11	22.22	22.22	0.00	22.22	11.11	11.11	0.00	0.00	0.00	0.00	0.00	100.0
5	0.00	14.29	0.00	71.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.29	100.0
6	25.00	0.00	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.00	100.0
7	0.00	0.00	0.00	0.00	0.00	0.00	25.00	0.00	0.00	25.00	50.00	0.00	100.0
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	75.00	0.00	25.00	0.00	100.0
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.33	0.00	0.00	66.67	0.00	100.0
10	5.13	0.00	0.00	0.00	0.00	2.56	0.00	2.56	5.13	5.13	79.49	0.00	100.0
<b>Total</b>	13.33	10.67	16.00	12.00	5.33	4.00	2.67	3.33	3.33	2.00	27.33	0.00	100.0

<sup>1</sup> Among all participating countries (169) which were in Olympic Games, 25 countries that were in all Olympics periods was selected as a random sample.

According on the descriptive findings presented in Table 1, the paper examines the transition probabilities matrix for all countries that won 10 or more gold medals at different Olympic Games. Table 1 indicate a significant continuation in the medallion of countries that have 0-10 and more gold medals. The probabilities in this table show, 79.49 percent of countries that won 10 or more medals at the Ex-Olympic have won more than 10 gold medals, in fallowing periods also would happen 10 or more medals again. Countries that won 4 gold medals at the Ex-Olympic failed to win more than six gold medals in the next Olympics. According to the probabilities that show in the mentioned table, countries that won one gold medal at the Ex-Olympics, have a chance to win almost 48 percent (26.32 + 10.53+ 10.53) to achieve 2-4 gold medals in the next Olympic.

It is unrealistic to assume that medal rates in the selected countries can be the same. To show this, we use an over-dispersion test to investigate inferential relationships. For this purpose, the null hypothesis is considered as follows:

$$H_0 : Var(terror | X) = E(terror | X)$$

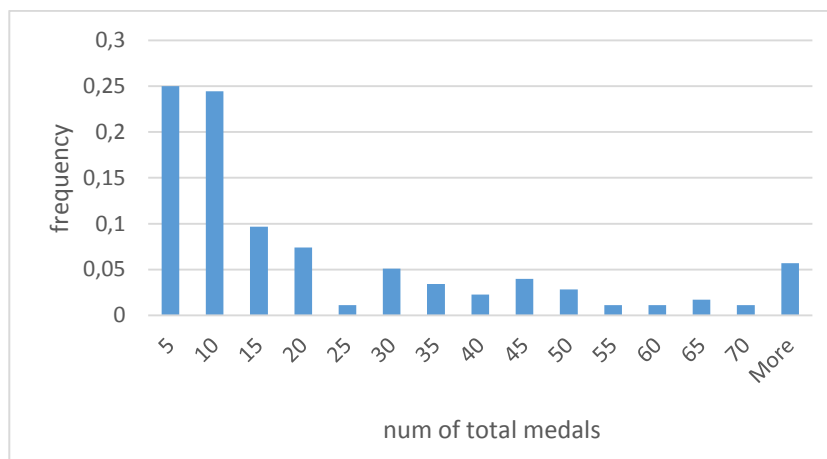
To perform the above test, two new variables, (ystar and muhat which only use for the test) have been made. The test method is based on a test that was introduced by Gröger and Carson in 1991. The results of this test in Table 2 indicate that the medal gain in the selected countries is not the same (rejection of the null hypothesis as shown in Table 2).

**Table 2.** Test of Excessive Dispersal

ystar	Coef.	Std. Err.	t	p>  t	[95%Conf. Interval]	
muhat	-.0231989	.0023699	-9.79	0.000	-.027878	-.0185198

The distribution of medals earned per year for selected countries (Form 2) shows that 25% of countries in different periods of the Olympic Games, from 1992-2016, won 5 medals and almost 6% of the selected countries earned up-to 70 medals or more. This indicates that the distribution of medals among countries is not homogenous which shows a huge gap between the lowest and highest frequency of

earned medals. Thus, accordingly, on the basis of the different power of countries in acquiring medals is a real thing that should be considered in modeling.



**Figure - Form 2.** The Distribution of Total Medals Won by the Selected Countries in the Period of 1992-2016

When the process generating data is over-dispersive, Laplace Regression Model (Negative Binomial) or Modified Poisson method can be used to estimate. Therefore, in this study, as explained in the methodology, the mentioned model is applied.

Due to the fact that the number of medals won in each Olympic is a variable from zero to any possible value, in this case as demonstrated, the Poisson Regression Method will be used to examine the relationship between economic indicators and

the success of countries in the Olympics. Modified Poisson estimator reveals the coefficients of explanatory variables are as follows:

**Table 4.** Model Estimation by Modified Poisson Method

Method	Robust			
	Coef.	Std. Err.	Z	p> z
Mtotal	.3416885	.0838611	4.07	0.000
Lpop	.2409657	.0779747	3.09	0.002
Host	.4226885	.1381906	3.06	0.002
Proage	.2198691	.0383763	5.73	0.000
_cons	-6.352633	2.092824	-3.04	0.002

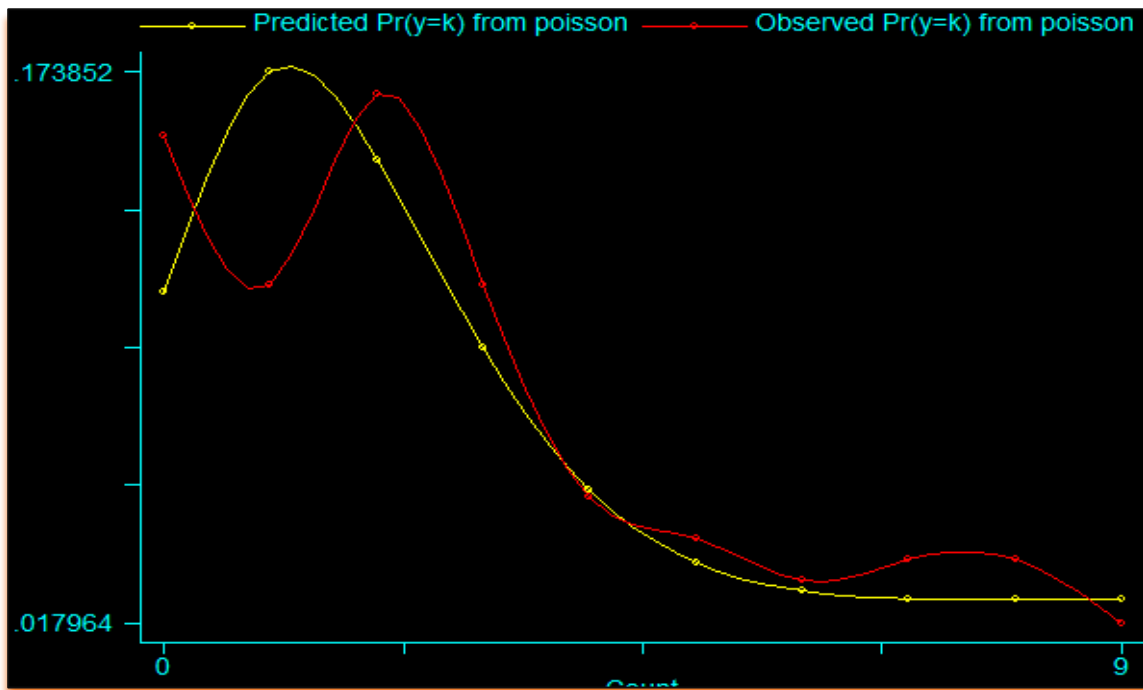
The results of the estimation indicate that the number of medals obtained by selected countries are positively and significantly related with population (lpop), domestic production (lgdppc) and hosting (Host). Also, the number of times that a country was in the first 20 winner has a positive impact on the mediation potential of countries. The change in the earning medals (mtotal0 conditionality as a result of

the change in the explanatory variables should be supported by the factor interpretation method which is shown in Table 5.

**Table 5.** Factor Interpretation of the Model Coefficients

Mtotal	B	Z	p> z
Lpop	0.34169	4.074	0.000
Lgdppc	0.24097	3.090	0.002
Host	.42269	3.06	0.002
Proage	.21991	. 5.73	0.000

Table 5 shows the explanation of four explanatory variables that the study applied are the most important economic factors of winning medals. Based on these results, a one unit increase in the logarithm of population affect equal to .0.34 increases the number of medals. Also, increasing one unit in the logarithm of domestic production increases the number of medications as 0.24 and the rest of variables as such.



**Figure - Form 3.** Poisson Distribution Estimation of the Total Number of Gold Models versus Actual Data

The graph of the prediction distribution obtained from the findings of the model shows in Form 3 and with a comparison with the actual observation distribution chart shows that the model correctly adapts the actual data.

**DISCUSSION**

In this study, the relationship between economic indicators and Olympic medals in the period of 1992-2016 was investigated. The dependent variable in the research is the number of medals won by each country in the Olympics. The

data which is used, was in form of discrete data. Accordingly, Modified Poisson Regression form was suitable for the purpose of the study.

The results of model show a positive relationship between number of medals with population, per capita production, hosting and the experience of participating in the previous games. Using the prediction of the sample of this model, it can be seen that many countries have relatively large distances with their rating, which could be due to the inappropriate allocation of resources in athletes' activities. Many countries expect the Olympics to derive more from the use of resources, which have been allocated. The variable of accumulation of experiences, which is based on the number of times that a country is situated at the first 20 Olympic ranking (this variable has not been introduced in any of the studies presented in the field study provided in this area), reflects the relatively importance of this variable for the success of countries for medal gain. In other words, the experience from previous periods can enhance the possibility of improvement for the next time games. Results, indicates positive significant effects between

the dependent and the explanatory variables for having more medals in Olympics. Therefore, it is suggested that to achieve a better rank in Olympic Games must take into account the importance of economic variables which have been done in this study.

#### REFERENCES.

1. Karimnia A. Investigating the Impact of Economic and Social Factors on the Sporting Success of Nations in Olympics (1996-1992). Master's Thesis, Peyame Noor University of Tehran, (in Persian), 2013.
2. Bernard AB., Meghan RB. Who Wins the Olympic Games: Economic Development and Medal Totals? National Bureau of Economic Research, 2000; (Working Paper): 7998.
3. Bernard AB., Meghan RB. Who Wins the Olympic Games: Economic Resources and Medals? Review of Economics and Statistics, 2004; 86(1): 413-417.
4. Ratchet A, Ulrich W. Economics and the Summer Olympics: An Efficiency Analysis. Journal of Sports Economics, 2008; 9(5): 520-537.
5. Krishna A, Eric H. Why Do Some Countries Win More Olympic Medals? Lessons for Social Mobility and Poverty Reduction. Economic and Political Weekly, 2008: 143-151.
6. Čustonja, Zrinko, Sanela Škorić. Winning Medals at the Olympic Games—does Croatia Have any Chance? Kinesiology, 2011; 43(1).