Olympic participation and performance since 1896

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Abstract

We analyze the decision to participate and performance at the Modern Olympic Summer Games at the country level. We use an unbalanced panel of 118 countries over all 24 editions of the Summer Games since 1896. The main focus of the paper is on economic, geographic and demographic determinants of Olympic participation and success. We estimate the impact of income per capita, population size, home advantage, and some fixed country factors on participation and success rates. We present separate results for events before and after the Second World War. These results indicate that income is an important determinant of Olympic participation and success. Socialist countries send more athletes to the games and have more success in medal counts. The home advantage has become less prominent.

(also downloadable) in electronic version: http://som.rug.nl/

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1 Introduction

In ancient times in the valley of Olympia in southwestern Greece the Olympic Games were held every four years. From 776 B.C. it took more than 1100 years until Emporer Theodosius of Rome considered them to be pagan and decided to forbid the games in 393 A.D. Baron Pierre de Coubertin proposed a revival of the games in 1892. He succeeded in his initiative and since 1896 the modern Olympics games have been organized. Despite wars and boycots the games survived political struggles and are currently considered to be the top sports event around the globe.

At the very first editions of the Summer Games competition was not fierce in most of the events. Participating was more important than winning. Especially the richer countries (sometimes represented by wealthy athletes) participated and collected medals. Gradually winning became more important and competition increased. In 1936 the Olympic Games were even politicized by Nazi Germany. Not the individual performance but the national performance was in the focal point of attention. After the Second World War the Olympic Games were even subordinated to the Cold War policies. But the most important change of the games is the globalization of participation and competition through improvement of economic conditions around the world. In this paper we analyze this economic development of the Olympic Summer Games.

The ultimate goal of our analysis is the construction of a model that forecasts future distributions of Olympic medals across nations. In that respect we analyze medal counts as a proxy of national performance. Does a country get a “fair” share of the medals? How can we define a fair share? Is there a home advantage? Is the home advantage decreasing because of the increase of competition? What’s the impact of different population growth figures across the world? Are political regimes relevant? Is emancipation important? How can we proxy for the effect of a societal positive attitude for sports? To that extent we analyze all the 24 versions of the modern Summer Olympic Games since 1896. We include 118 countries that were able to win a medal at least once at the games. We do not include the Winter Games, since these games have serious bias in the selection of competing countries. We also do not include countries that never won a medal. This creates a selectivity bias. So we are not able to analyze the issue of participating at the games or not, but we can analyze the problem of how many athletes a country should send to the games.

What is the relevance of a study like this? There are several things to be learned in our opinion. First, a lot of countries seem to consider the decision to organize a future edition of the games. Implicitly they assume that the net benefits of organizing the Olympic Games are bigger than the costs. The costs are mostly huge, and the benefits are not all that clear. In most cost-benefit analyses decision-makers include a net present value of future increases of economic activity through consumer optimism. The increase in consumer optimism is mostly related with success at the games. Being the host country an estimate of future medal potential is helpful. Secondly, many National Olympic Committees predict their medal tallies before the games. Their methodology is mostly based on summing the probabilities of winning medals in individual events. Based on those estimates and the final results of the games, decisions on government financing sports are based. We base our predictions on the aggregated national data and argue that we reduce the forecast error by considering a portfolio of events. We can estimate the “normal” medal returns, indicating outperformance of an individual NOC.

The remainder of this paper is organized as follows. In section 2 we review the literature on modeling national Olympic performance. In section 3 we introduce the data. In section 4 we present the models and the estimation results. We conclude with a summary and conclusions.

2 Olympic performance literature

There are two strands of literature on the analysis of Olympic performance at the national level. First there is an extensive literature on the analysis of medal tallies of individual events. Who did actually win the Olympic Games if we correct for variable A and variable B? Popular variables to deflate medal totals with are population size and national income. For each event the winner of the newly weighed results can be computed. The second strand of the literature is more interesting and tries to model Olympic performance based on multiple events. We review this type of literature more extensively.

For the post-World War II games sociologists and economist analyzed the impact of social and economic conditions on the results. Examples of these studies are Ball (1972), Grimes *et al.* (1974) and Levine (1974). Strange enough this literature did not develop further until the 1990’s. An explanation of this might be that in the 1970’s and 1980’s the Olympic Games were troubled by the Cold War. As known the USA did not participate at the Moscow 1980 Games, while the USSR did not show up at the Los Angeles 1984 Games. The first study that restarts the performance analysis is Slughart *et al* (1993), who analyze the problem for transitional economies. Recently two studies, by Johnson and Ali (2000) and Bernard and Busse (2000), relived the attention for this issue. Our paper is in line with those two studies. We give special attention to the approach taken by Johnson and Ali (2000) and Bernard and Busse (2000).

In general the literature shows that population size, income per capita, the home advantage, and a socialist/communist tradition have a major impact on the medal counts. Population size is the fundamental determinant of medal success. A larger population increases the group of potential athletes. There is a debate on the impact of a larger population on performance though. A country like India has a large population but a relatively low success rate at the Games. So is Bangladesh, the country with the largest population that never won a medal. Another issue in this respect is that countries with large groups of talented athletes are not allowed to send them all. For most events there are participation limits. So the relation between population and Olympic success is a complicated one.

The second determinant found is income per capita. A higher income allows a country to specialize in sports, to train athletes better, to provide better medical care, to send a larger group of athletes to the games, etc. In the Olympic history the richer countries have participated at many more events than developing countries. As we will show later on, income per capita was a crucial determinant at the first editions of the Games. There is evidence that the costs of transport and medical care, etcetera decreased over time, which enables even poor countries to send delegates.

The third determinant is the home advantage. It helps to send more athletes and to get more support during the games. The home country is allowed to participate in all events. Moreover, the crowd of home spectators will support the performing home athletes. Attention in the media puts further pressure on the home athletes. It seems that at the recent versions of the Games countries that will host the next version of the games perform better. Korea doubled its medal share at the 1984 games and hosted the Olympics in 1988. Australia performed significantly better at the Atlanta Games in 1996. And Greece doubled its medal normal share at the Sydney 2000 Games. This is a time-to-build argument: it takes long run planning to create a group of optimal performing athletes.

The fourth determinant is the political system. There is large evidence that communist countries perform better. Economies with central planning allowed more specialization in sports. More national resources were used for training and supporting athletes than in market-based economies. Moreover sports were considered to be an instrument the increase the national standing. Finally, there is the suspicion that socialist athletes used more drugs than others. There is no serious proof though. Wallechinsky (2000) reports the results of positive drug tests from 1968 up to and including the 1996 Games. Of the 48 positive drug tests at the Summer Games, only 15 cases involve athletes from communist countries.

Since the breakdown of the East-European communist systems things changed a little. In the last decade economic development allowed also market-based economies to specialize further in sports. The other issue is that professional sports are more integrated with the Games since 1988. But the former socialist countries are able to perform at a very high standard despite the liberalization process. Examples are Russia, Romania, Poland and Bulgaria.

A fifth determinant is the national sports culture. Is sport really a societal activity? If so, a country is probably better able to use resources for training, etc. If performance is accepted and appreciated by the public, athletes will be stimulated more. This variable is hard to measure though and has not been used by previous studies.

How is Olympic performance modeled? Johnson and Ali (2000) present two types of models. First they estimate an equation for the number of participants per country. They assume participation to be a quadratic function of GDP per capita, population, the home advantage, a dummy variable indicating immediate geographical proximity to the hosting nation, a dummy variable indicating the political system, and variables indicating former colonial links. Johnson and Ali present results for total participation and female participation. They conclude on a data set that includes 138 countries and 1095 country-event observations since 1952 that a home country almost doubles its participation and a neighbor country sends about 25% more athletes. A monarchy sends fewer athletes to the Games, and rather surprisingly, communist countries do not send more competitors. Next Johnson and Ali estimate performance. First the estimate the probability of individual success using a similar specification as the model that explains participation. Based on more than 60 thousand observations they find that the home advantage adds twelve percent change of success. On the national level (using again a model in absolute medals and quadratic in GDP per capita and population, etc) the home advantage is estimated to be an additional 25 medals, of which 12 are gold medals. Communist countries outperform the others by 12 medals (5 gold medals).

Bernard and Busse (2000) estimate probit models for medal shares (note that Johnson and Ali use absolute medal counts) using data for the events since 1960. First they use population shares. If a country had been able to double its population it would increase its medal share by 1.5% percentage point. Next they specify a Cobb-Douglas production function for medal shares, using population share and GDP-capita as production factors. Moreover they include a dummy variable for the home advantage, a soviet-dummy and a non-Soviet but planned economy dummy. The home advantage is estimated to be 1.2 percentage point medal share. The soviet dummy varies between 3 and 6 percentage points. Bernard and Busse also estimate time-to-build effects. These are found to be significant.

3 Data

We include data for all modern Olympic Summer games since 1896. This implies that we include all 24 events in our sample. On the one hand this increases the number of observations compared to Johnson and Ali (2000) and Bernard and Busse (2000). On the other hand this leads to more problems in data collection (see below). Including the older versions of the games might also bias the true current parameters. Therefore we use split-samples to analyze differences through time. We collected the medal data from Wallechinsky (2000) with the Yahoo Sports reports on the

Sydney 200 Games. We included the 118 countries that won at least one medal at one of the 24 events (we consider Bohemia to be the Czech Republic). A full listing of the countries included is given in the Appendix.

Table 1 gives an overview of the modern Olympic Summer Games. The Table includes information on the number of athletes, female participation, number of countries represented at the games and the number of events held. The Table shows that in the first ten editions of the games before the Second World War 289 country-event observations are present.

Data on participation by country are given by Kluge (1981) for the Olympic Games up to and including the Moscow 1980 games. For later editions of the Games we used data from Statistical Annexes of the *Official Report of the Games* (kindly provided by the International Society of Olympic Historians). We do not analyze female participation and success separately.

Next we collected data on GDP. GDP data are typically hard to find for some countries, especially for those not included in the sets of the International Monetary Fund or World Bank. In our sample this typically holds for Cuba, Monaco, and the Peoples Republic of Korea. The other problem is the provision of consistent estimates of GDP before the Second World War. We used Maddison (1995) for dollar weighed uniform priced GDP. Maddison gives estimates for about 15 countries in our sample back to 1870. This group of countries includes a majority of the countries that participated in the first ten editions of the Summer Games. Of the 289 country-event observations of the first ten editions of the games we are able to cover 209 using these GDP data. Maddison moreover provides estimates for Cuba for short time intervals of the 20th century.

Data on population are provided by Maddison (1995) and by the World Bank. The World Bank provides moreover a data set on development indicators (see Easterly, 2000). We use this set for other geographical and demographic data, such as longitude and latitude, female labor participation (in 1980), legal system dummies etc.

4 Model and estimation results

We estimate two models, as suggested by Johnson and Ali. First we estimate participation. Next we model Olympic performance in terms of medal shares for gold, silver and bronze, conditional on participation. We estimate the model in a combined time-series cross-section form. First we use the events as cross-section, after that we use the countries as units to account for time-to-build effects. Throughout this section we estimate the models with the fixed-effects estimator. Alternative estimators would be the random coefficients model or instrumented panel estimators.

The first estimator allows for stochastic differences between cross-section units. Experimenting with this estimator led to inferior results for our models though. The second estimator could be used to correct for endogeneity of the regressors. For instance if one includes a lagged dependent variable. We will use an IV-estimator in the model that explains the success rates. In those models we estimate the shares of e.g. gold medals on the endogenous participation rate. In our dynamic models we don't correct for endogeneity, because our observation matrix is rather sparse.

4.1 Participation

The dependent variable is PSH_{it}, which represents the fraction in percentages of athletes at game t (t=1,..,24) from country i (i=1,..,118) from the total number of participating athletes. Modeling in shares avoids problems of nonstationarity. Let P_{it} be the absolute potential number of athletes delegated by country i. Suppose now that each world citizen has an equal probability to become a top athlete. In that case P_{it} will be dependent on the size of the total population of a country at the time of the t^{th} edition of the Summer Games POP_{it}. There are several valid arguments why Olympic participation is not proportional to the absolute size of the population. Suppose we have a stochastic series $X_1,\ldots, X_n$ which is identical independently standard normal distributed $N(0,1)$. The expected value of the supremum X_{sup} of all possible outcomes is of order $\sqrt{\log(n)}$ (see Reiss, 1989). So it is likely that the maximum performing individual of a population of size POP_{it} will be of the order $\sqrt{\log(POP_{it})}$. Since this result also holds at the world level, PSH_{it} will be determined by the square root of the log of population share ($POPSH_{it}$).

Next we assume that income per capita (YSH_{it}, in shares of total world income) will determine the training and health conditions of the potential athletes. We measure income by the 1990 Geary Khamis dollar denominated GDP per capita figures as presented by Maddison (1995). We average to Olympic GDP per capita series by taking the arithmetic averages over the last 4 years. We restrict the participation share to be positive (the upper bound of 100 per cent is not binding in any case) by taking the natural logarithm of the participation share:

$$\log PSH_{it} = a \sqrt{\log(POPSH_{it})} + b \log(YSH_{it}) + C_i \quad (1)$$

where C_i represents a country specific determinant. We expect both parameters to be positive. The potential share of athletes PSH_{it} is disturbed by two effects. First we have the home advantage $HOME_{it}$ (=1 if country i hosts Games t, = 0 in other cases). Home countries are allowed to send more athletes. Secondly, we have the distance $DIST_{it}$ to the Games. We measure the distance by taking the square root of the cubic terms that denote the differences in coordinates of latitude and longitude between the hosting and the visiting country. Note that we correct for taking the shortest route. This leads to the following specification:

$$\log PSH_{it} = a \sqrt{\log(POPSH_{it})} + b \log(YSH_{it}) + c^* HOME_{it} + d^* DIST_{it} + C_i + e_{it} \qquad (2)$$

where e_{it} is a white noise residual. Finally, we can model the country specific effects C_i. In previous studies, the socialist origin of countries has been found to be relevant to Olympic participation and success. Another determinant is emancipation, which we measure by female labor participation. Especially for the more recent editions of the Games the number of women events increases.

We present the results of this model in Table 2. Table 2 contains the estimation results of this model for the whole sample, the pre-WWII and the post-WWII editions. Table 2 shows that all the determinants are important contributors in the explanation of participation in the Olympic Games. The population share contributes importantly to participation shares, although its impact is decreasing. The same holds for the impact of the share in income per capita. If country *i* increases its income share by 1 percentage point, participation is increased by about 0.8 percentage points. The home advantage is substantial, especially before WWII. Note that the two pre-WWII US editions of the Games contributed to a large extent to this result. The countries with high female labor participation tend to send more athletes to the Games. After WWII the socialist countries are found to send about 1 percentage-point more athletes.

Table 3 presents the results for the same model, but with countries as cross-section units. Through that we skip the fixed factors, female labor participation and the dummy variable for socialist countries. The parameter estimates are in the same order of magnitude. From this angle the income share elasticity seems to be lower though. More interesting is Table 4, where we present the results for the time-to build effect. After WWII it seems relevant to include the lagged participation information. The partial adjustment coefficient is about 0.2. Note that we don't treat lagged participation as an endogenous variable for reasons set out above. The quality of the model using a lag is better though, so we proceed to include lagged participation in the model version.

Table 5 gives the results for the same specification of the model, but now including TV-sets per capita as an additional variable. Although this variable is correlated with GDP per capita it might explain a little more of the variance of participation via media attention. Media attention is increasingly important. We are able to analyze the impact of the media for the games from Rome up to and including Barcelona. This is the main argument to present the results separately from the previous ones. The model including TV-sets typically has less observations. Again we estimate the model two ways: with the editions and the countries as cross-section units. From the first regression (with events as cross-section units) indeed it seems that countries with a large number of TV-sets per capita send more athletes to the Summer Games. The country-specific results seem to object to this argument, since we find no evidence of TV-sets.

Summing up, using information over more than a century we find that national Olympic participation depends on:

- The share of world income per capita;
- The growth of relative population;
- The home advantage;
- The distance to the hosting country;
- The legal status of the country, more specifically whether a country has a socialist background;
- The degree of female labor participation;
- Historical participation (time-to-build an Olympic team).

If we compare the pre- and post-World War II periods we observe that the home-advantage decreased and the distance to the games has a lower elasticity in the recent editions. The impact of income and population is important in the event-specific model, but typically less relevant in country-specific regressions. Finally, there is some evidence that media attention might be relevant in explaining a higher participation rate in recent editions of the Summer Games.

4.2 Success

In the previous subsection we modeled national Olympic participation as a function of income per capita, population, distance to the games and some country specific factors. Now we turn to Olympic success in terms of winning medals. We model the national shares in medal totals MSH. We distinguish the medals by type: gold, silver, and bronze. Our main innovation is that we model medal shares as a function of participation shares. Since participation is endogenous we use the estimated participation results from the previous section. As we illustrate below, the data clearly reveal that national medal success is dependent on participation. The notion that participating is more important than winning is proven to be untrue: participation is nowadays the crucial determinant of Olympic success. Of course this is due to selection and qualification regulation. In modeling Olympic success we therefore concentrate on determinants of success given participation.

We model the share of medals (gold, silver, and bronze) as a function of the participation share, the home advantage, the legal systems and again income per capita. The home advantage relates to the home crowd that supports the home team. The legal system relates to the fact that some countries might be more restrictive and selective to sending athletes, leading to a higher average quality of the team. In the country-specific regressions we include GDP per capita again as an additional determinant to indicate a higher average quality of a national team.

We have again two types of regressions: event-specific fixed effects, where we can include variables indicating differences between countries, and country-specific effects, where we focus on the dynamics of medal winning. Analyzing the data both ways so reveals the importance of cross-sectional variation and time dynamics. Table 5 starts with the basic event-specific regressions. The model includes the home advantage, participation, legal systems and two dummy-variables for the USA and USSR. Since we include all the events in these regressions we need to correct for the fact that due to boycotts the USA and USSR probably won more medals than normal. In 1980 for instance the USA did not participate in the Moscow Games, leading to a very high percentage of medal winning by the USSR. The opposite effect holds for the 1984 Los Angeles Games, where the USSR was absent and the USA won more medals than they would normally do.

Table 6 presents the results for event-specific regressions for both the whole sample and the post-WWII period (with a fixed effect for each edition of the Games). Panel A highlights that a one-percentage point increase in participation leads almost to an increase in medal success by 0.35 to 0.40 for all medal types. The home advantage helps in earning more medals. The impact on winning gold medals is the strongest. Legal origin matters in winning medals. Socialist countries not only sent more athletes to the Games, but also won more medals. Scandinavian countries also have a strong reputation in winning medals. On the other hand countries with a French legal origin typically have less success at the Summer Games. All Latin-American countries for instance are relatively unsuccessful in winning medals. Panel B includes the event-specific model for the events after World War II. Here we can observe that the participation effect is about as important as it is in the model that includes all editions of the Games. The home advantage is typically less after WWII, and for winning bronze medals it is even insignificant. Socialist countries keep their advantage in winning medals, since their participation starts after the Second World War. Scandinavian countries still win more gold medals. The USA and USSR-impact is strong as we can see from the significance of the dummy-variables.

Table 7 presents the results for the model with country-specific fixed effects for both the whole sample and the post-WWII period. From Panel A we again observe that the home advantage is the strongest in winning gold medals. Again we find that estimated participation helps in explaining medal success. The long-run participation elasticities are about 0.5 to 0.6. Income is found to be a relevant variable in this model. The partial adjustment coefficients are the largest in winning gold medals. This illustrates that there is some hysteresis in winning gold medals. From Panel B we can observe that the home advantage has decreased in the more modern editions of the Games. Moreover, the impact of GDP per capita is typically less significant.

Table 8 finally describes the transition or persistence from one quality of medal to the other. We use the post-WWII sample and estimate *e.g.* gold medal performance on past gold-, silver-, and bronze medal winning success. If a country was successful at the last edition of the Games it is more likely to win a medal (no matter what kind) this time. Here we observe that winning gold medals is typically a determinant of winning medals at the next edition of the Games. The persistence in winning silver or bronze medals is much lower. The implied long-run own elasticities of the gold, silver, and bronze persistence are about 1.5, 1.2, and 1.3 respectively. The cross long-run elasticities of gold to silver and bronze are about twice bigger than viceversa (0.4 to 0.5 versus 0.2 to 0.3 respectively). Winning gold medals therefore has important spin-offs for future Olympic success.

5 Conclusions

This paper analyzes Olympic participation and success at all the modern editions of the Summer Games. Using a large data set including Olympic statistics and income per capita and demographic information we are able to explain participation shares and medal success at the country level. First we model participation, after that we show that conditional on participation we can model success in the medal standings.

The following can be concluded. First, the economic condition of a country still is important for both participation and to a lesser extent for success. The impact of income per capita has diminsihed though. The same holds for the impact of population size and distance to the Games. The home effect is important, especially for participation. Here we have a regulated effect, the home team is allowed to send more athletes. This effect is still strong, but used to be more important at the older editions of the games. Probably transport costs caused a bias to home representation. The home advantage in success is less clear. Before World War II the home advantage was strong via participation and success. At the recent games the home advantage has shown to be relevant in e.g winning gold medals. The legal tradition of a country, as a proxy of the sports culture is relevant for modeling participation and success. Especially socialist countries send more athletes and earn more medals. French legal system countries perform less impressive. Emancipation is found to be important. Media attention is important is explaining participation. Winning gold medals, finally, has important consequences for future Olympic success.

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Appendix – Countries included

Country Name
Algeria
Argentina
Armenia
Australia
Austria
Azerbaijan
Bahamas, The
Barbados
Belarus
Belgium
Bermuda
Brazil
Bulgaria
Burundi
Cameroon
Canada
Chile
China
Colombia
Costa Rica
Cote d'Ivoire
Croatia
Cuba
Czech Republic
Denmark
Djibouti
Dominican Republic
Ecuador
Egypt, Arab Rep.
Estonia
Ethiopia
Finland
France
Georgia
Germany
Germany, Fed. Rep. (former)
Ghana
Greece
Guyana
Haiti
Hong Kong, China
Hungary
Iceland
India
Indonesia
Iran, Islamic Rep.
Iraq

Ireland
Israel
Italy
Jamaica
Japan
Kazakhstan
Kenya
Korea, Dem. Rep.
Korea, Rep.
Kuwait
Kyrgyz Republic
Latvia
Lebanon
Lithuania
Luxembourg
Malaysia
Mexico
Moldova
Monaco
Mongolia
Morocco
Mozambique
Namibia
Netherlands
Netherlands Antilles
New Zealand
Niger
Nigeria
Norway
Pakistan
Panama
Peru
Philippines
Poland
Portugal
Puerto Rico
Qatar
Romania
Russian Federation
Senegal
Singapore
Slovak Republic
Slovenia
South Africa
Sovjet Union
Spain
Sri Lanka
Suriname
Sweden
Switzerland
Syrian Arab Republic
Taiwan, China

Tanzania
Thailand
Tonga
Trinidad and Tobago
Tunisia
Turkey
Uganda
Ukraine
United Arab Emirates
United Kingdom
United States
Uruguay
Uzbekistan
Venezuela
Vietnam
Virgin Islands (U.S.)
Yugoslavia, FR (Serbia/Montenegro)
Zambia
Zimbabwe

Table 1 – Modern Olympic Summer Games

Year	City	Athletes	Female	Countries	Events
1896	Athens	245	0	14	43
1900	Paris	1118	21	28	75
1904	St Louis	627	6	12	84
1908	London	2023	44	22	109
1912	Stockholm	2490	55	28	102
1920	Antwerp	2668	77	29	154
1924	Paris	3070	125	44	126
1928	Amsterdam	3014	290	46	109
1932	Los Angeles	1328	127	37	116
1936	Berlin	3956	328	49	129
1948	London	4064	355	59	136
1952	Helsinki	4879	518	69	149
1956	Melbourne	3258	384	72	151
1960	Rome	5348	610	83	150
1964	Tokyo	5081	683	93	163
1968	Mexico City	5423	768	112	172
1972	Munich	7173	1058	121	195
1976	Montreal	6024	1246	92	198
1980	Moscow	5217	1124	80	203
1984	Los Angeles	6797	1567	140	221
1988	Seoul	8439	2197	159	237
1992	Barcelona	9365	2707	169	257
1996	Atlanta	10310	3513	197	271
2000	Sydney	10650	4069	199	300

Source: Up to and including 1984: D. Wallechinsky (2000), *The Complete Book of the Summer Olympics, Sydney 2000 Edition*, The Overlook Press, After 1984: *Statistical Annexes of the Official Report of the Olympic Games.*

Table 2 – Participation at the Games - Fixed effects for events

Dependent variable is the log of the percentage participation share log(*PSH*);
Home = 1 if a country hosts the Olympic Games, else 0;
Female labor = the percentage of female workers in the labor force in 1980;
YSH is the share of GDP per capita of a country as a percentage of the total GDP/capita of the 118 sample countries;
POPSH is the country population share of the population of all 118 countries;
Distance = distance in kilometers from the capital of the host country to the capital of the participating country;
Socialist = 1 if a country has a socialist legal system;
R^2 is the adjusted determination coefficient and *SSR* is the sum of squared residuals;
The White-corrected standard errors are in parentheses.
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	All Games 1896-2000	Pre-WWII 1896-1936	Post-WWII 1948-2000
log(*Home*+1)	1.417	1.599	1.016
	(0.282)	(0.513)	(0.260)
log(*Female labor*)	1.342	2.347	1.212
	(0.103)	(0.509)	(0.104)
log(*YSH*)	0.766	0.889	0.753
	(0.027)	(0.141)	(0.027)
√log(100**POPSH*)	1.703	1.850	1.700
	(0.073)	(0.222)	(0.075)
log(*Distance*/1000+1)	-3.892	-9.975	-2.399
	(0.565)	(1.461)	(0.563)
log(*Socialist*+1)	0.973	-0.892	1.271
	(0.115)	(0.359)	(0.115)
R^2	0.648	0.532	0.678
SSR	732	177	496
# countries	98	37	98
# country-events	1111	206	905

Table 3 – Participation at the Games - Fixed effects for countries

Dependent variable is the log of the percentage participation share log(*PSH*);
Home = 1 if a country hosts the Olympic Games, else 0;
YSH is the share of GDP per capita of a country as a percentage of the total GDP/capita of the 118 sample countries;
POPSH is the country population share of the population of all 118 countries;
Distance = distance in kilometers from the capital of the host country to the capital of the participating country;
R^2 is the adjusted determination coefficient and *SSR* is the sum of squared residuals;
The White-corrected standard errors are in parentheses.

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	All Games 1896-2000	Pre-WWII 1896-1936	Post-WWII 1948-2000
log(*Home*+1)	1.363	1.522	0.721
	(0.226)	(0.367)	(0.154)
log(*YSH*)	-0.176	-0.970	0.084
	(0.072)	(0.608)	(0.075)
√log(100**POPSH*)	0.617	-0.879	1.020
	(0.361)	(1.404)	(0.412)
log(*Distance*/1000+1)	-2.592	-7.301	-2.153
	(0.349)	(1.695)	(0.319)
R^2	0.745	0.540	0.806
SSR	536	158	296
# countries	108	37	108
# country-events	1190	206	981

Table 4 – Time-to-build in participation at the games

Dependent variable is the log of the percentage participation share log(*PSH*);
Home = 1 if a country hosts the Olympic Games, else 0;
YSH is the share of GDP per capita of a country as a percentage of the total GDP/capita of the 118 sample countries;
POPSH is the country population share of the population of all 118 countries;
Distance = distance in kilometers from the capital of the host country to the capital of the participating country;
R^2 is the adjusted determination coefficient and *SSR* is the sum of squared residuals;
The White-corrected standard errors are in parentheses.
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	All Games 1896-2000	Pre-WWII 1896-1936	Post-WWII 1948-2000
log(*PSH*(-1))	0.271	0.111	0.252
	(0.042)	(0.081)	(0.047)
log(*Home*+1)	1.182	1.503	0.709
	(0.223)	(0.437)	(0.153)
log(*YSH*)	0.044	-0.572	0.182
	(0.069)	(0.606)	(0.075)
√log(100**POPSH*)	0.116	-5.549	0.084
	(0.357)	(4.052)	(0.376)
log(*Distance*/1000+1)	-2.804	-8.096	-2.238
	(0.341)	(1.530)	(0.307)
R^2	0.796	0.612	0.834
SSR	343	88	207
# countries	108	36	108
# country-events	1019	163	856

Table 5– Participation at the games – TV-sets

Dependent variable is the log of the percentage participation share log(*PSH*);
Home = 1 if a country hosts the Olympic Games, else 0;
Female labor = the percentage of female workers in the labor force in 1980;
YSH is the share of GDP per capita of a country as a percentage of the total GDP/capita of the 118 sample countries;
POPSH is the country population share of the population of all 118 countries;
Distance = distance in kilometers from the capital of the host country to the capital of the participating country;
Socialist = 1 if a country has a socialist legal system;
TV-sets = number of TV-sets per capita;
R^2 is the adjusted determination coefficient and *SSR* is the sum of squared residuals;
The White-corrected standard errors are in parentheses.

	Events: 1960-1992	Countries: 1960-1992
log(*PSH*(-1))		0.163
		(0.050)
log(*Home*+1)	0.878	0.968
	(0.370)	(0.177)
log(*Female labor*)	0.842	
	(0.124)	
log(*YSH*)	0.455	0.163
	(0.055)	(0.137)
√log(100**POPSH*)	1.687	1.079
	(0.084)	(0.786)
log(*Distance*/1000+1)	-2.192	-1.363
	(0.651)	(0.361)
log(*Socialist*+1)	1.273	
	(0.110)	
log(*TV-sets*+1)	3.923	-0.131
	(0.481)	0.305
R^2	0.736	0.863
SSR	245	91
# countries	81	87
# country-events	580	530

Table 6 – Medal counts with event-specific intercepts

Dependent variable: log of the percentage medal share log(*MSH*+1);
Home = 1 if a country hosts the Olympic Games, else 0;
Socialist = 1 if the country is ruled under the socialist legal system;
Scandinavian = 1 if the country is ruled under the Scandinavian Civil Law system;
French =1 if the country is ruled under the French legal system;
German = 1 if the country is ruled under the German legal system;
USA = dummy-variable representing the USA;
USSR = dummy-variable representing the Soviet Union;
PSH^e = estimated participation share of athletes (results of Table 2, first and last column);
R^2 is the determination coefficient and *SSR* is the sum of squared residuals;
The White-corrected standard errors are in parentheses.

Panel A: All Games – 1896-2000

	Gold	Silver	Bronze
log(*Home*+1)	0.991	0.842	0.671
	(0.248)	(0.227)	(0.224)
log(*Socialist*+1)	0.358	0.372	0.316
	(0.101)	(0.101)	(0.101)
log(*Scandinavian*+1)	0.327	0.317	0.352
	(0.111)	(0.107)	(0.114)
log(*French*+1)	-0.043	-0.084	-0.095
	(0.048)	(0.048)	(0.048)
log(*German*+1)	0.124	0.282	0.255
	(0.114)	(0.111)	(0.112)
log(*USA*+1)	2.512	1.978	1.676
	(0.148)	(0.141)	(0.166)
log(*USSR*+1)	2.240	1.752	1.482
	(0.159)	(0.134)	(0.167)
log(PSH^e)	0.352	0.385	0.391
	(0.020)	(0.019)	(0.019)
R^2	0.604	0.608	0.580
SSR	300	282	297
# countries	98	98	98
# country-events	1111	1111	1111

Panel B: Post- World War II Games: 1948-2000

	Gold	Silver	Bronze
log(*Home*+1)	0.735	0.540	0.393
	(0.258)	(0.170)	(0.225)
log(*Socialist*+1)	0.502	0.482	0.404
	(0.105)	(0.105)	(0.105)
log(*Scandinavian*+1)	0.266	0.087	0.072
	(0.100)	(0.101)	(0.113)
log(*French*+1)	-0.031	-0.094	-0.101
	(0.044)	(0.046)	(0.046)
log(*German*+1)	0.196	0.360	0.277
	(0.124)	(0.118)	(0.121)
log(*USA*+1)	2.661	2.043	1.626
	(0.164)	(0.142)	(0.167)
log(*USSR*+1)	2.194	1.716	1.392
	(0.141)	(0.117)	(0.145)
log(PSH^e)	0.329	0.361	0.384
	(0.021)	(0.020)	(0.020)
R^2	0.624	0.635	0.602
SSR	183	171	185
# countries	98	98	98
# country-events	905	905	905

Table 7 – Medal counts with country-specific intercepts

Dependent variable is the log of the percentage medal share log(*MSH*+1);
Home = 1 if a country hosts the Olympic Games, else 0;
YSH is the share of GDP per capita of a country as a percentage of the total GDP/capita of the 118 sample countries;
PSH^e = estimated participation share of athletes sent by a country (results of Table 4);
R^2 is the determination coefficient and *SSR* is the sum of squared residuals;
The White-corrected standard errors are in parentheses.

Panel A: All Games – 1896-2000

	Gold	Silver	Bronze
log(*Home*+1)	0.867	0.795	0.513
	(0.146)	(0.147)	(0.154)
log(*MSH(-1)*+1)	0.408	0.345	0.292
	(0.028)	(0.030)	(0.031)
log(*YSH*)	0.131	0.079	0.123
	(0.035)	(0.035)	(0.036)
log(PSH^e)	0.205	0.216	0.284
	(0.051)	(0.053)	(0.054)
R^2	0.806	0.795	0.769
SSR	118	120	132
# countries	108	108	108
# country-events	1091	1019	1019

The countries *not* included in this model are: Netherlands Antilles, Bahama's, Barbados, Iceland, Virgin Islands, Monaco, North Korea, Quatar, Suriname and Tonga.

Panel B: Post-World War II Games – 1948-2000

	Gold	Silver	Bronze
log(*Home*+1)	0.643	0.491	0.380
	(0.144)	(0.143)	(0.153)
log(*MSH(-1)*+1)	0.384	0.247	0.268
	(0.031)	(0.033)	(0.035)
log(*YSH*)	0.076	0.051	0.073
	(0.038)	(0.038)	(0.041)
log(PSH^e)	0.167	0.188	0.208
	(0.059)	(0.059)	(0.063)
R^2	0.826	0.822	0.795
SSR	69	68	78
# countries	108	108	108
# country-events	856	856	856

Table 8 – Medal persistence with country-specific intercepts

Dependent variable is the log of the percentage medal share log(*MSH*+1);
Home = 1 if a country hosts the Olympic Games, else 0;
YSH is the share of GDP per capita of a country as a percentage of the total GDP/capita of the 118 sample countries;
Goldsh = share of gold medals;
Silversh = share of silver medals;
Bronzesh = share of bronze medals;
PSH^e = estimated participation share of athletes sent by a country (results of Table 4);
R^2 is the determination coefficient and *SSR* is the sum of squared residuals;
The White-corrected standard errors are in parentheses.

	Gold	Silver	Bronze
log(*Home*+1)	0.687	0.542	0.455
	(0.142)	(0.138)	(0.145)
log(*Goldsh(-1)*+1)	0.267	0.192	0.248
	(0.037)	(0.036)	(0.038)
log(*Silversh*(-1)+1)	0.118	0.073	0.151
	(0.039)	(0.038)	(0.040)
log(*Bronzesh*(-1)+1)	0.140	0.153	0.080
	(0.037)	(0.036)	(0.038)
log(*YSH*)	0.077	0.038	0.068
	(0.038)	(0.036)	(0.038)
log(PSH^e)	0.102	0.115	0.111
	(0.059)	(0.057)	(0.061)
R^2	0.832	0.836	0.816
SSR	66	62	69
# countries	108	108	108
# country-events	856	856	856