Olympic participation and performance since 1896

Gerard Kuper and Elmer Sterken[1]

Department of Economics
University of Groningen
The Netherlands

Abstract

We analyze the decision to participate and Olympic performance at the country level. We use an unbalanced panel of 118 countries over 24 editions of the Olympic Summer Games. The main focus of the paper is on economic, geographic and demographic explanations of Olympic participation and success. We estimate the impact of income per capita, population size, home advantage, and institutional variables on participation and success rates. We present separate results for events before the Second World War and after. These results show 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.

[1] Gerard Kuper: g.h.kuper@eco.rug.nl, Elmer Sterken: e.sterken@eco.rug.nl

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 boycotts the games survive political struggles and are generally 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 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. Gets a country it “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, a lot of the 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 national data and consider the portfolio of medals leading to lower forecast errors. On the other hand 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 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 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 relatively low success rate at the Games. Bangladesh is 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, etc 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. Each 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 homefield 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 was 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 homefield 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 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 the *Official Report of the Games* (International Olympic Committee, 1984, 1988, 1992, 1996, 2000). 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 Madisson (1995) for dollar weighed uniform priced GDP. Madisson gives estimates for about 15 countries in our sample back to 1870. Of the 289 country-event observations of the first ten editions of the games we are able to cover 209 using these GDP data. Madisson moreover provides estimates for Cuba for short time intervals of the 20th century.

Data on population are provided by Madisson (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, land area, landlocked indicator, 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 units, after that we use the countries as units to account for time-to-build effects.

4.1 Participation

The dependent variable is PS(it), which represents the percentage of athletes at game t (t=1,..,24) from country i (i=1,..,118). Modeling is shares avoids problems of nonstationary data. 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-the edition of the Summer Games POP(it).

There are several arguments valid why Olympic participation is not proportional to the absolute size of the population. Suppose we have a stochastic series X1,…, Xn which is identical independently standard normal distributed N(0,1). The expected value of the supremum Xsup 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, P(it) will be determined by the square root of the log of population share (POPS(it)).

Next we assume that income per capita (YS(it), in shares of total world income) will determine the training and health conditions of the potential athletes. Since it is likely that there are decreasing returns in income we have the following potential delegation share:

$$P(it) = a \sqrt{\log(POPS(it))} + b \log(YS(it)) + D(i)$$

Where D(i) represents country specific sports-cultural determinants. We represent this variable by the following indicators. We use the system of legal system indicators as proposed by La Porta *et al*. (1997). These authors analyze legal differences across the world in financial economics. They classify all legal systems into five classes:

- Common Law: the Anglosaxon countries and their former colonies;
- French Civil Law: southern Europa and Latin-America;
- German Civil Law: Germany, central Europe, Japan, and others;
- Scandinavian Civil Law;
- Socialist countries: Soviet countries, China, Cuba.

Lensink *et al.* (2000) cross analyze the legal systems with societal variables and show that societal norms and values are correlated with these legal indicators. Another country-specific determinant is female labor participation. Some countries do not allow women to work on religious grounds. These countries typically have a lower rate of female emancipation which reduces the potential set of athletes.

This potential share of athletes PS(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 to the Games. Especially in the first ten editions of the Games and shortly after the Second World War the costs of sending athletes could be high.

Table 2, 3, and 4 give the results for the participation regressions with event-specific fixed effects. In Table 2 we give estimates using all 24 events. In Table 3 presents sub-sample estimation results for pre- and post-World War II events. Table 4 gives estimates for a specific sub-sample, 1960-1992, where we are able to analyze the impact of media attention. Table 2 includes results with common parameters for income per capita, population and distance and with cross-section specific estimates. In the right-hand column we list indicative values for the 12th and 24th event. Table 2 shows that all variables are significant. It appears that the home country sends about 4 percent more athletes to the games. Table 3 shows that before World War II this percentage was even higher and reaches 16 percent. After World War II the home advantage drops to 3.5 percent. Income per capita and the order of the size of population determine participation. Especially after World War II the legal systems matter, as is emancipation relevant. Distance is more important before World War II. Table 4 gives the results with the same specification, but 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. Indeed it seems that countries with a large number of TV-sets send more athletes to the Summer Games.

Table 5 presents the results for a reversed estimation using the countries as cross-section units instead of the events. Now we can use 104 countries and estimate for lagged effects in participation. Table 5 shows the results for the whole sample, the editions after World War II and the same sample without the cold-war games of Moscow and Los Angeles. Again we see a consistent estimate of the home advantage of about 6 percent over the whole sample and a little over 3 for the post-war data. Experimenting with more recent sub-samples shows that the home advantage falls to a little under 2% in the last editions of the games. For income per capita share we find typically lower elasticities (about 0.1). The impact of population size was bigger on the participation at the old games. The autoregressive term is about 0.2 to 0.3. We also estimated a model with a lead in participation. The lead coefficient is found to be around 0.1. We note that these results are just illustrative, since we did not correct for the dynamics in the panel regressions.

4.2 Success

In the previous section we modeled Olympic participation. Sending athletes to the Summer Games depends on the income level of a country, population size, legal regime, distance, emancipation, and media attention. Now we turn to Olympic success in terms of winning medals. 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 income. 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. Finally we include for the Rome 1960 to Barcelona 1992 Summer Games the public media variable, TV-sets per capita, to indicate public media pressure on athletic performance.

We have again two types of regressions: event-specific fixed effects, where we can include variables indicating differences between countries, and country-specific effects. 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 US and USSR probably won more medals than normal. Table 6 shows that a one-percentage point increase in participation leads almost to a homogeneous increase in medal success. The home advantage helps in earning more gold medals, but not for silver, while there is even a negative effect on bronze. One could argue that there is a shift from bronze to gold for the home teams. French legal countries typically have less success at the Summer Games.

Table 7 includes the same model for the events after World War II. Here we can observe that the participation effect is more important. The home advantage vanishes, apart from the disadvantage for winning bronze. The home advantage is fully due to sending more athletes to the games. 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 main conclusion is that the home advantage is less clear in winning medals, but runs via participation.

Table 8 gives the country-fixed effect results. We include 4 panels in Table 8. Panel A gives the results for the whole sample, Panel B for the Pre-World War II events, Panel C for the post-World War II events, and Panel D for the last 4 editions of the Summer Games. We include the home advantage, participation and GDP per capita shares as regressors in all models. We experimented with lags but did not find significant results. Across all panels participation is the single uniform significant determinant. Panel A shows that the home advantage counts if we include all events for all types of medals. Especially for the gold medals the home effect is strong. At the recent editions of the games there is no significant direct home effect. Only for the bronze medals the home effect matters at the last 4 editions (Panel D). Table 9 finally includes a model for the 1960-1992 editions of the Summer Games with TV-sets as a determinant. We observe that for winning gold and silver medals are sensitive for TV-attention. Again one has to note that TV-sets and GDP per capita are correlated, so one cannot be conclusive about the precise elasticities. From the sum of squared residuals one can conclude that adding TV-sets helps in improving the fit of the model.

5 Conclusion

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 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 country still is important for both participation and success. Secondly, the impact of population size on participation is less clear. We use a statistical approximation of the supremum of a population. It seems to be the case that the impact of population after the Second World War is less important than before. 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 old editions of the games. Probably transport costs caused a bias to home representation. The home advantage in success is less clear. For World War II the home advantage was strong via participation and success. At the recent games the home advantage shifted from gold to bronze. 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. Finally, media attention is important is explaining participation and success.

References

Ball, D.W. (1972), Olympic Games Competition: Structural Correlates of National Success, *International Journal of Comparative Sociology*, 15, 186-200

Bernard, A.B. and Busse, M.R. (2000), Who Wins the Olympic Games: Economic Development and Medal Totals, Yale School of Organization and Management, *mimeo*.

Grimes, A.R., Kelly, W.J., and Rubin, P.H. (1974), A Socioeconomic Model of National Olympic Performance, *Social Science Quarterly*, 55, 777-782.

Johnson, D.K.N., and Ali, A. (2000), Coming to Play or Coming to Win: Participation and Success at the Olympic Games, Wellesly College, *Mimeo*.

Kluge, V. (1991), *Die Olympischen Spiele von 1896 bis 1980*, Sport Verlag, Berlin.

Levine, N. (1974), Why do Countries Win Olympic Medals? Some Structural Correlates of Olympic Games Success: 1972, *Sociology and Social Research*, 58, 353-360.

Reiss, R-D. (1989), *Approximate Distributions of Order Statistics*, Springer-Verlag, Berlin.

Shughart, W.F. and Tollison, R. (1993), Going for the Gold: Property Rights and Athletic Effort in Transitional Economies, *Kyklos*, 46, 263-272.

Wallechinsky, D. (2000), *The Complete Book of the Olympics*, 2000 edition, Little, Brown and Company, Boston.

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	8465	2189	159	237
1992	Barcelona	9370	2708	169	257
1996	Atlanta	10310	3513	197	271
2000	Sydney	11366		199	300

Source: D. Wallechinsky (2000), *The Complete Book of the Summer Olympics, Sydney 2000 Edition*, The Overlook Press.

Table 2 – Participation at the games – 24 editions

Dependent variable is the percentage participation share;
Home advantage = 1 if a country hosts the Olympic Games, else 0;
Socialist represents the social legal system, French the French Civil Law system, Scandinavian the Scandinavian Civil Law system, German the German Civil Law System;
Female labor participation is the percentage of female workers in the labor force in 1980;
GDP/POP is the share of GDP per capita of a country as a percentage of the total GDP/capita of the 118 sample countries;
POP is the country population share of the population of all 118 countries;
R^2 is the determination coefficient and SSR is the sum of squared residuals.
The White-corrected standard errors are in parentheses.
In the cross-section specific estimation results we list event 12/event 24 results.

	No cross-section specific terms	Cross-section specific terms
Home advantage	4.327	4.017
	(0.418)	(0.252)
Socialist	0.563	0.600
	(0.062)	(0.057)
French	-0.101	-0.257
	(0.042)	(0.038)
Scandinavian	-0.549	-0.457
	(0.086)	(0.070)
German	-0.128	-0.097
	(0.098)	(0.085)
Female labor participation	0.055	0.045
	(0.002)	(0.002)
Log(GDP/POP)	0.861	1.228/0.622
	(0.022)	(0.214)/(0.024)
√Log(100*POP)	2.057	2.396/1.721
	(0.050)	(0.619)/(0.085)
Distance	-0.002	-0.008/ 0.004
	(0.0004)	(0.002)/(0.001)
R^2	0.602	0.693
SSR	5291	3616
# countries	98	98
#country-event	1084	1084

Table 3 – Participation at the games – Subsample estimation results

Dependent variable is the percentage participation share;
Home advantage = 1 if a country hosts the Olympic Games, else 0;
Socialist represents the social legal system, French the French Civil Law system, Scandinavian the Scandinavian Civil Law system, German the German Civil Law System;
Female labor participation is the percentage of female workers in the labor force in 1980;
GDP/POP is the share of GDP per capita of a country as a percentage of the total GDP/capita of the 118 sample countries;
POP is the country population share of the population of all 118 countries;
R^2 is the determination coefficient and SSR is the sum of squared residuals.
The White-corrected standard errors are in parentheses.

	1896-1936	1948-2000
Home advantage	15.887	3.381
	(1.204)	(0.186)
Socialist	-1.763	0.727
	(1.276)	(0.105)
French	-0.663	-0.089
	(0.797)	(0.060)
Scandinavian	0.118	-0.576
	(1.147)	(0.111)
German	-1.845	-0.054
	(0.791)	(0.137)
Female labor participation	0.115	0.050
	(0.079)	(0.004)
Log(GDP/capita)	1.862	0.823
	(0.572)	(0.038)
$\sqrt{}$Log(100*POP)	5.901	2.832
	(1.082)	(0.128)
Distance	-0.016	-0.0013
	(0.005)	(0.0057)
R^2	0.688	0.699
SSR	4750	681
# countries	37	98
# country-events	206	878

Table 4 – Participation at the games – TV-sets

Dependent variable is the percentage participation share;
Home advantage = 1 if a country hosts the Olympic Games, else 0;
Socialist represents the social legal system, French the French Civil Law system, Scandinavian the Scandinavian Civil Law system, German the German Civil Law System;
Female labor participation is the percentage of female workers in the labor force in 1980;
GDP/POP is the share of GDP per capita of a country as a percentage of the total GDP/capita of the 118 sample countries;
POP is the country population share of the population of all 118 countries;
TV-sets is the number of TV-sets per capita
R^2 is the determination coefficient and SSR is the sum of squared residuals.
The White-corrected standard errors are in parentheses.

	1960-1992
Home advantage	2.777
	(0.199)
Socialist	0.787
	(0.124)
French	-0.063
	(0.064)
Scandinavian	-0.896
	(0.113)
German	-0.008
	(0.160)
Female labor participation	0.026
	(0.004)
Log(GDP/capita)	0.228
	(0.061)
$\sqrt{}$Log(100*POP)	1.622
	(0.085)
Distance	-0.002
	(0.0005)
TV-sets	6.627
	(0.545)
R^2	0.807
SSR	267
# countries	79
# country-events	567

Table 5 – Participation at the games – Time-to-build

Dependent variable is the percentage participation share;
Home advantage = 1 if a country hosts the Olympic Games, else 0;
GDP/POP is the share of GDP per capita of a country as a percentage of the total GDP/capita of the 118 sample countries;
POP is the country population share of the population of all 118 countries;
R^2 is the determination coefficient and SSR is the sum of squared residuals;
The White-corrected standard errors are in parentheses.

	1900-2000	1948-2000	1948-1976/ 1992-2000
Home advantage	6.454	3.293	3.250
	(1.251)	(0.342)	(0.386)
log(GDP/POP)	0.067	0.112	0.116
	(0.004)	(0.007)	(0.006)
$\sqrt{}$log(100*POP)	0.999	0.444	0.270
	(0.061)	(0.025)	(0.019)
Participation(-1)	0.196	0.192	0.277
	(0.047)	(0.035)	(0.038)
R^2	0.312	0.552	0.585
SSR	7059	618	469
# countries	108	108	108
# country-events	1455	1151	964

Table 6 – Medal counts with event-specific intercepts

Dependent variable is the percentage medal share (gold, silver, and bronze);
Home advantage = 1 if a country hosts the Olympic Games, else 0;
Socialist represents the social legal system, French the French Civil Law system, Scandinavian the Scandinavian Civil Law system, German the German Civil Law System;
USA = dummy-variable representing the USA;
USSR = dummy-variable representing the Soviet Union;
Participation = percentage athletes sent by a country;
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
Home advantage	2.339	0.154	-1.448
	(0.849)	(0.816)	(0.656)
Socialist	0.875	0.759	0.619
	(0.123)	(0.121)	(0.126)
Scandinavian	0.523	0.312	0.298
	(0.126)	(0.124)	(0.143)
French	0.007	-0.150	-0.097
	(0.040)	(0.040)	(0.041)
German	0.389	0.574	0.528
	(0.188)	(0.186)	(0.220)
USA	16.043	9.387	6.432
	(1.144)	(0.897)	(0.994)
USSR	16.474	11.983	9.010
	(1.124)	(0.794)	(1.023)
Participation	0.754	0.900	0.989
	(0.101)	(0.097)	(0.126)
R^2	0.855	0.850	0.808
SSR	6518	3868	3850
# countries	118	118	118
# country-events	1408	1408	1408

Table 7 – Medal counts after World War II – Event-specific intercepts

Dependent variable is the percentage medal share (gold, silver, and bronze);
Home advantage = 1 if a country hosts the Olympic Games, else 0;
Socialist represents the social legal system, French the French Civil Law system, Scandinavian the Scandinavian Civil Law system, German the German Civil Law System;
USA = dummy-variable representing the USA;
USSR = dummy-variable representing the Soviet Union;
Participation = percentage athletes sent by a country;
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
Home advantage	1.143	-0.671	-2.247
	(1.065)	(1.102)	(0.642)
Socialist	0.817	0.707	0.507
	(0.127)	(0.125)	(0.109)
Scandinavian	0.276	0.042	-0.011
	(0.120)	(0.117)	(0.127)
French	0.059	-0.115	-0.044
	(0.046)	(0.049)	(0.048)
German	0.192	0.394	0.210
	(0.162)	(0.161)	(0.166)
USA	14.124	8.584	4.883
	(1.242)	(0.933)	(0.746)
USSR	16.902	11.825	8.768
	(1.360)	(0.836)	(1.131)
Participation	0.925	1.032	1.192
	(0.058)	(0.052)	(0.051)
R^2	0.859	0.848	0.817
SSR	2607	1605	1529
# countries	118	118	118
# country-events	1114	1114	1114

Table 8 – Medal counts - Country-specific effects

Dependent variable is the percentage medal share (gold, silver, and bronze);
Home advantage = 1 if a country hosts the Olympic Games, else 0;
Participation = percentage athletes sent by a country;
Log(GDP/POP) = log of GDP per capita share (percentages of total GDP per capita);
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
Home advantage	4.881	3.211	2.318
	(1.078)	(1.482)	(0.940)
Participation	0.488	0.735	0.615
	(0.082)	(0.092)	(0.188)
Log(GDP/POP)	0.527	0.203	0.173
	(0.092)	(0.070)	(0.053)
R^2	0.677	0.910	0.853
SSR	4424	2564	3855
# countries	72	72	72
# country-events	613	613	613

Panel B – Games 1896-1936

	Gold	Silver	Bronze
Home advantage	8.037	5.833	2.728
	(2.627)	(2.301)	(1.758)
Participation	0.464	0.722	0.607
	(0.117)	(0.092)	(0.166)
Log(GDP/POP)	1.341	0.355	0.508
	(0.140)	(0.128)	(0.110)
R^2	0.704	0.815	0.849
SSR	1574	1093	1643
# countries	72	38	38
# country-events	613	209	209

Panel C – Games 1948-2000

	Gold	Silver	Bronze
Home advantage	3.965	2.525	2.322
	(1.073)	(1.849)	(1.184)
Participation	0.493	0.737	0.603
	(0.113)	(0.133)	(0.173)
Log(GDP/POP)	0.513	0.214	0.123
	(0.107)	(0.088)	(0.070)
R^2	0.718	0.899	0.823
SSR	2051	1549	2202
# countries	72	72	72
# country-events	404	404	404

Panel D – Games 1988-2000

	Gold	Silver	Bronze
Home advantage	0.857	0.369	2.585
	(0.779)	(1.675)	(0.543)
Participation	0.553	0.382	0.409
	(0.027)	(0.053)	(0.045)
Log(GDP/POP)	0.995	1.115	0.004
	(0.158)	(0.237)	(0.057)
R^2	0.731	0.889	0.767
SSR	302	175	309
# countries	72	72	72
# country-events	195	195	195

Table 9 – Medal counts and TV-sets - Country-specific effects

Dependent variable is the percentage medal share (gold, silver, and bronze);
Home advantage = 1 if a country hosts the Olympic Games, else 0;
Participation = percentage athletes sent by a country;
Log(GDP/POP) = log of GDP per capita share (percentages of total GDP per capita);
TV-sets = number of TV-sets per capita;
R^2 is the determination coefficient and SSR is the sum of squared residuals;
The White-corrected standard errors are in parentheses.

Games 1960-1992

	Gold	Silver	Bronze
Home advantage	3.928	1.827	-0.529
	(0.481)	(0.463)	(0.432)
Participation	0.124	0.285	0.485
	(0.018)	(0.031)	(0.055)
Log(GDP/POP)	0.031	0.010	0.057
	(0.002)	(0.002)	(0.005)
TV-sets	0.266	0.530	0.062
	(0.025)	(0.034)	(0.038)
R^2	0.800	0.866	0.841
SSR	1122	535	541
SSR (without TV-sets)	1556	699	600
# countries	92	92	92
# country-events	625	625	625