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ORIGINAL ARTICLE

How to win the first Olympic medal? And the second?

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[Correction added on 17 October 2024, after first online publication: The copyright line was changed.]

Abstract

Objectives: We investigate the determinants of Olympic success. We distinguish between the probability of winning a medal and the overall Olympic success. Furthermore, we examine the impact of the three superpowers (China, Russia, and the United States). Beyond Olympic success as measured by medals, we also investigate the impact of other dependent variables considering additional rankings.
Methods: We use sport-level data for seven Summer Olympic Games (1996–2021), applying weighted market share as a performance indicator to differentiate types of medals and rankings. We employ zero-inflated beta regressions to estimate separately the probability of having zero market share at the Olympics and the determinants of Olympic success.
Results: Our estimations suggest that population positively influences Olympic success. Estimations highlight the role of superpower countries and sports-level effects in explaining Olympic success. Better economic status is associated with winning a medal at the Olympic Games, but not with the number of medals that have been won. When using different outcome variables for Olympic success, considering not only medal rankings, the determinants of success change significantly.
Conclusion: Countries without previous Olympic success should collect economic and human resources to obtain their first medal at the Games.

KEYWORDS

market share, Olympic Games, sport-level effect, superpower countries, zero-inflated beta regression

Economic development is a key factor for explaining success at the Olympics. Developed countries invest more resources into sport, especially into elite sports, than developing countries with fewer resources (Forrest, Sanz, and Tena 2010). Elite sport is a luxury good for developing nations, the demand for which increases with economic development (Manuel Luiz and Fadal 2011). More financial resources enable countries to build better-equipped facilities, create newer technologies, and develop better-educated coaches and staff for their athletes (Bernard and Busse 2004; Chambers 2020), while sport is more likely to be a part of schooling and the everyday lives of people in more developed countries (Bernard and Busse 2004).

There is a wealth of literature about the determinants of success at the Olympic Games that has used different outcome indicators and methodologies. However, not only have the format and the events changed over time but also countries' attitudes toward winning medals. In recent decades, many countries previously successful at the Games have allocated considerable resources to increase their Olympic success for different reasons (Grix and Carmichael 2012). As a result of the increased demand for Olympic medals, the "price of success" has also increased on the market (Shibli 2003). While the demand side of the Olympic Games market is flexible, the supply side is inelastic, as the number of medals that are obtainable is relatively constant. These tendencies have further widened the gap between successful and less successful countries at the Olympics. A transforming market affects not only the intensity of competition but may also influence the drivers of Olympic success (Kovács, Gulyás, and Sterbenz 2017).

It is worthwhile to re-examine the drivers of Olympic success in light of shifts in the market for the Olympic Games and advancements in methodology. We examine the factors that contribute to Olympic success, concentrating on six topics that have not been extensively explored. First, we examine separately the determinants of the likelihood of winning an Olympic medal and the quantity of Olympic medals. The literature has primarily focused on analyzing the success factors in terms of medal count. However, there is a growing disparity among countries' performance due to shifting market trends. Trivedi and Zimmer (2014) were the only ones who examined the question separately, focusing primarily on countries that did not win any medals. It is acknowledged that multiple studies have employed the two-step method (Rewilak 2021; Scelles et al. 2020). However, these studies have primarily concentrated on the factors influencing the number of medals won.

Second, articles usually apply aggregate indicators of success, yielding one observation for each country at each Olympic Games. However, the distribution of medals and changes of rules in sports may also influence Olympic success. In addition, the number of medals available for each sport changes over time (Figure 1), and the different number of medals that can be won in sports/disciplines distorts the ranking of countries (Globan and Rewilak 2024). To evaluate the sports-level heterogeneity of Olympic success, we employ sports-level data and sports-level effects in models to reduce the bias in the estimates. The use of this type of data set is still limited in the literature (Noland and Stahler 2017; Singleton et al. 2024), as macro-level indicators have previously been analyzed only per sports in this context (Csurilla et al. 2021; Forrest et al. 2017; Noland and Stahler 2016a, 2017; Otamendi and Doncel 2014).

Third, we control the number of athletes from a country participating in a sport at the Olympic Games. The more athletes a country has in an event, the more likely it is to win a medal. To the best of our knowledge, we are the first to account for the number of athletes representing a country in a specific sport when analyzing the relationship between a country's Olympic performance and that sport.

Fourth, we focus on the issue of the market concentration of medals. Although numerous nations fail to win any medals, three superpower countries—China, Russia, and the United States—hold a significant market share, particularly with regard to gold medals (see Figure 2). This is essentially the result of the weaponization of sport in the struggle for supremacy between the leading powers (Coates 2017). These countries possess abundant resources to allocate toward achieving Olympic success. The literature usually neglects the effects of superpower countries on Olympic success; thus, estimations may lead to biased results. Following Duráczky and Bozsonyi (2020), we control for the potential impacts of superpower nations on Olympic success.

Fifth, studies typically apply total medal count or a medal share indicator to measure Olympic performance without distinguishing between types of medals, which may lead to misleading results. To solve this

sport	1996	2000	2004	2008	2012	2016	2020
Archery	12	12	12	12	12	12	15
Artistic Swimming	3	6	6	6	6	6	6
Athletics	132	139	138	141	141	141	144
Badminton	15	15	15	15	15	15	15
Baseball	3	3	3	3	0	0	3
Basketball	6	6	6	6	6	6	6
Basketball 3x3	0	0	0	0	0	0	6
Beach Volleyball	6	6	6	6	6	6	6
BMX Freestyle	0	0	0	0	0	0	6
BMX Racing	0	0	0	6	6	6	6
Boxing	48	48	44	44	52	51	52
Canoe Slalom	12	12	12	12	12	12	12
Canoe Sprint	36	36	36	36	35	37	36
Cycling - Road	12	11	12	12	12	12	12
Cycling - Track	24	36	36	30	31	30	36
Diving	12	24	24	24	24	24	24
Equestrian - Dressage	6	6	6	6	6	6	6
Equestrian - Eventing	6	6	6	6	6	6	6
Equestrian - Jumping	6	6	6	6	6	6	6
Fencing	30	30	30	30	30	30	36
Football	6	6	6	6	6	6	6
Golf	0	0	0	0	0	6	6
Gymnastics - Artistic	45	42	42	42	42	42	43
Gymnastics - Rhythmic	6	6	6	6	6	6	6
Gymnastics - Trampolining	0	6	6	6	6	6	6
Handball	6	6	6	6	6	6	6
Hockey	6	6	6	6	6	6	6
Judo	56	56	56	56	56	56	60
Karate	0	0	0	0	0	0	32
Modern Pentathlon	3	6	6	6	6	6	6
Mountain Bike	6	6	6	6	6	6	6
Open Water Swimming	0	0	0	6	6	6	6
Rowing	42	42	42	42	42	42	42
Rugby Sevens	0	0	0	0	0	6	6
Sailing	30	33	33	33	30	30	30
Shooting	45	51	51	45	45	45	45
Skateboarding	0	0	0	0	0	0	12
Softball	3	3	3	3	0	0	3
Sport Climbing	0	0	0	0	0	0	6
Surfing	0	0	0	0	0	0	6
Swimming	96	97	97	98	96	98	105
Table Tennis	12	12	12	12	12	12	15
Taekwondo	0	24	24	32	32	32	32
Tennis	12	12	12	12	15	15	15
Triathlon	0	6	6	6	6	6	9
Volleyball	6	6	6	6	6	6	6
Water Polo	3	6	6	6	6	6	6
Weightlifting	30	45	45	45	45	45	42
Wrestling - Freestyle	30	24	33	44	44	48	48
Wrestling - Greco-Roman	30	24	21	27	28	24	24

FIGURE 1 Distribution of the number of medals available per sport at the Olympics.

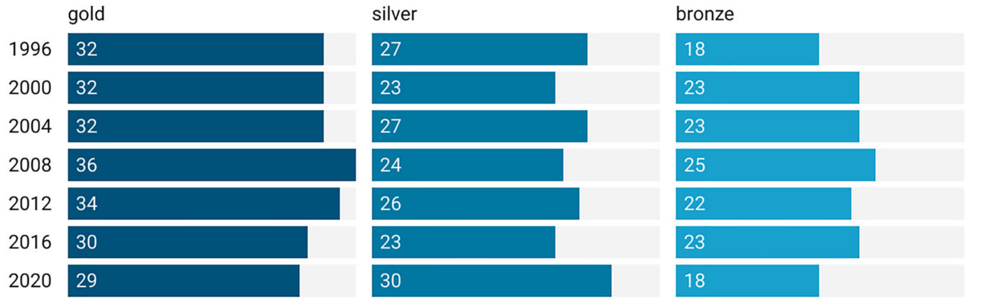

FIGURE 2 Olympic medal share of China, Russia, and the United States combined (1996–2021).

problem, we use countries' medal market share as the outcome variable. Determining market share, which involves applying different weights to medals, gives more precise information about a country's Olympic performance than the total medal count or the unweighted medal share (De Bosscher et al. 2008; Kovács, Gulyás, and Sterbenz 2017). In addition to the differences in performance, there are also discrepancies between the medals in terms of popularity and media visibility (Garcia-del-Barrio, Gomez-Gonzalez, and Sánchez-Santos 2020). Furthermore, the use of market share illustrates the pay-out system of a sports tournament much better than the sum of medals or the unweighted medal share (Lazear 2018).

Finally, we check the sensitivity of the results using different outcome indicators. In the majority of the literature, Olympic success is measured only in terms of the number of medals. However, other dependent variables have also been used (Rewilak 2021) while considering other rankings helps with understanding different sports strategies (De Bosscher et al. 2008). In addition to medal rankings, we also calculate market shares for the top 8 and 16 rankings and employ these as dependent variables in the models to check the robustness of the results. Such comparisons that use the same data set and methodology are still lacking, allowing us to better understand why previous studies have led to different findings.

LITERATURE REVIEW

Several studies that have investigated indicators of success at the Olympic Games are described in Table 1.

The key indicator for explaining Olympic success is economic development—including the total value of exported goods, number of airports, or total length of railroad track (Condon, Golden, and Wasil, 1999), gross national product (GNP) (Hoffmann, Ging, and Ramasamy 2002, 2004), gross domestic product (GDP) or GDP per capita (Andreff and Andreff 2010; Bernard and Busse 2004; Duráczky and Bozsonyi 2020; Forrest, Sanz, and Tena 2010; Forrest, Tena, and Varela-Quintana 2023; Johnson and Ali 2004; Kovács, Gulyás, and Sterbenz 2017; Lui and Suen 2008; Noland and Stahler 2016b, 2017; Rathke and Woitek 2008; Scelles et al. 2020; Trivedi and Zimmer 2014). Recently, Rewilak (2021) found evidence for the non-significance of GDP. In this study, it is important to highlight that not only podium finishes are considered. Moreover, the measurement of success was significantly different from previous studies, which presumably explains the role of GDP as having no influence on success.

Population size is also an important driver of winning Olympic medals. The assumption is that the distribution of talented athletes is random among the world's countries, and thus countries with a larger population have a larger selection pool in terms of talent (Bernard and Busse 2004; De Bosscher et al. 2006). Empirical evidence confirms the positive correlation between Olympic success and population (Andreff and Andreff 2010; Bernard and Busse 2004; Duráczky and Bozsonyi 2020; Forrest, Tena, and Varela-Quintana 2023; Johnson and Ali 2004; Kovács, Gulyás, and Sterbenz 2017; Lui and Suen 2008; Noland and Stahler 2016b, 2017; Rathke and Woitek 2008; Rewilak 2021; Scelles et al. 2020; Trivedi and Zimmer 2014; Vagenas and Vlachokyriakou 2012). Studies also support the claim of an inverted U-shaped relationship between population and Olympic success (Johnson and Ali 2004; Kovács, Gulyás, and

TABLE 1 Summary of studies about the determinants of Olympic success.

	Gross domestic product (GDP)/GDP per capita	Other economic indicators	Population	Host dummy	Socialist past dummy	USSR and Eastern Block dummy	Planned economy	Sports tradition and culture	Olympic team size
Condon, Golden, and Wasil (1999)		x							
Hoffmann, Ging, and Ramasamy (2002)		x	x	x	x			x	
Bernard and Busse (2004)	x		x	x		x	x		
Hoffmann, Ging, and Ramasamy (2004)		x	x	x	x			x	
Johnson and Ali (2004)	x		x	x					
Lui and Suen (2008)	x		x	x					
Rathke and Woitek (2008)	x		x	x		x	x		
Andreff and Andreff (2010)	x		x	x				x	
Forrest, Sanz, and Tena (2010)	x		x			x	x	x	
Vagenas and Vlachokyriakou (2012)	x		x						x
Trivedi and Zimmer (2014)	x		x	x					x
Sun, Wang, and Zhan (2015)	x		x		x				
Noland and Stahler (2016a)	x		x	x		x			
Noland and Stahler (2016b)	x		x	x		x			

(Continues)

TABLE 1 (Continued)

	Gross domestic product (GDP)/GDP per capita	Other economic indicators	Population	Host dummy	Socialist past dummy	USSR and Eastern Block dummy	Planned economy	Sports tradition and culture	Olympic team size
Noland and Stahler (2017)	x		x	x		x			
Forrest et al. (2017)	x		x	x		x	x		
Kovács, Gulyás, and Sterbenz (2017)	x		x	x				x	x
Duráczky and Bozsonyi (2020)	x		x	x	x			x	
Scelles et al. (2020)	x		x	x				x	x
Rewilak (2021)	x		x	x					
Csurilla and Fertő (2022)	x		x	x		x			
Schlembach et al. (2022)	x		x	x					x
Forrest, Tena, and Varela-Quintana (2023)	x		x	x	x	x			
Csurilla and Fertő (2023)	x		x	x		x			
Globan and Rewilak (2024)	x		x	x					

Sterbenz 2017; Lui and Suen 2008). Some populous countries have had little success at the Olympics, presumably explaining the significant negative squared effect. The reason for their lack of success at the Olympics is not population size but other factors.

Another output of the production function of Olympic success, where the inputs are GDP and population, may also be the number of qualified athletes (Trivedi and Zimmer 2014; Vagenas and Vlachokyriakou 2012). Since at the country level, the number of medals won, the number of athletes participating, the economic power, and the population are highly correlated, in most cases, the number of athletes is not used in the model due to endogeneity issues. Therefore, Vagenas and Vlachokyriakou (2012) only used the number of athletes as a dependent variable, Trivedi and Zimmer (2014) did not include it in their dynamic model, and Scelles et al. (2020) and Schlembach et al. (2022) converted it into a category variable.

Articles usually employ a dummy variable to control for the medal surplus of the country that hosts the Olympic (Andreff and Andreff 2010; Bernard and Busse 2004; Duráczky and Bozsonyi 2020; Johnson and Ali 2004; Kovács, Gulyás, and Sterbenz 2017; Lui and Suen 2008; Noland and Stahler 2016b, 2017; Rathke and Woitek 2008; Rewilak 2021; Scelles et al. 2020; Schlembach et al. 2022; Trivedi and Zimmer 2014). On average, the host wins 1.8 percent more medals than might be predicted by its socioeconomic situation (Bernard and Busse 2004). Host countries tend to invest additional resources into elite sports before the event to ensure their athletes fully exploit a home-field advantage by preparing well. In addition to increased funding, many other factors influence why the host athletes win more medals. It should be added that the host effect is not detectable in all sports (Forrest et al. 2017; Noland and Stahler 2017), and the size of the effect is decreasing but still important (Singleton et al. 2024). However, a recent study highlights that when looking at host countries separately, neither the host country effect nor pre- and posteffects are as obvious as previous studies have suggested (Csurilla and Fertő 2023).

The former states of the Soviet Union and the Eastern Block were more successful (won more medals) at the Games than other countries before the 1990s and even afterward—which may be explained by their socioeconomic situation (Bernard and Busse 2004; Kovács, Gulyás, and Sterbenz 2017). Bernard and Busse (2004) claim that the medal share of Soviet countries was at least 6.1 percentage points higher from 1960 to 1996 than that of other countries. However, it has been argued in recent studies that the "Soviet effect" is no longer an essential determinant of countries' performance at the Olympics and that the latter effect had completely dissipated by the time of the Games in Sydney (Bernard 2008; Kovács, Gulyás, and Sterbenz 2017; Noland and Stahler 2017).

Many studies have made attempts to capture the cultural—and more specifically, the sports-related cultural—differences between countries (Andreff and Andreff 2010; Duráczky and Bozsonyi 2020; Hoffmann, Ging, and Ramasamy 2002, 2004; Kovács, Gulyás, and Sterbenz 2017; Scelles et al. 2020; Trivedi and Zimmer 2014). Nations in which sport has a prominent role in society tend to have a comparative advantage in specific sports that are traditionally considered important for the whole country (Duráczky and Bozsonyi 2020; Hoffmann, Ging, and Ramasamy 2002, 2004). Concerning the sports culture variable, results are presently contradictory since they are difficult to interpret and explain. The authors question what is measured by these variables and claim there is a need for further research to identify potential causal mechanisms. Presumably, this is why other studies have not used these variables in subsequent studies.

The literature identifies some other factors that may explain Olympic success, including the effect of a country's climate zone (Hoffmann, Ging, and Ramasamy 2002, 2004; Johnson and Ali 2004), spending on recreation (Forrest, Sanz, and Tena 2010), and political systems (Johnson and Ali 2004; Schlembach et al. 2022). However, several problems emerge with the application of these indicators. For example, data about recreation-related expenses are almost impossible to acquire, and climate zones and political variables are difficult to interpret without a solid theoretical basis.

Recent studies highlight the issue of the effect of the superpower countries (Csurilla and Fertő 2022; Duráczky and Bozsonyi 2020). The rivalry between the United States and the Soviet Union at the Olympics began during the Cold War, with the competition for medals between athletes from the two countries symbolizing the clash of ideologies (Coates 2017; Guttmann 1988). In recent decades, China has also joined the ranks of the superpowers in terms of Olympic medals, owing to its deliberate strategy of promoting elite sport (Zheng and Chen 2016). The Olympics of past decades have been a battle for position on the medal table between the three countries, whose status stands out from that of other nations. However, Duráczky and Bozsonyi (2020) find no empirical evidence to support the superpower hypothesis and Csurilla and Fertő (2022) only a little. The superpower variable is strongly correlated to the previously employed "communist" or "Soviet" variables, the effect of which is no longer detectable. Therefore, it may be worthwhile examining this variable on different data (from the 1990s) with an empirical strategy (without communist or Soviet variables).

Surprisingly, the sports-level heterogeneity of Olympic success is only partly elaborated in the literature. An Olympic fixed effect has been used in a number of studies to deal with the heterogeneity in events, medals won, and variation in the participant countries. Only five studies have applied sports-level data in the analysis of countries' Olympic performance using macro-level variables. However, these estimated models separately for sports or did not control changes in the events (Csurilla et al. 2021; Forrest et al. 2017; Noland and Stahler 2016a, 2017; Tcha and Pershin 2003). No research has used sports-level data to investigate country performance with Olympic and sports- or event-level fixed effects, providing the opportunity to control changes within the sport. The change in a country's medal tally in a given sport can be influenced by a number of sports-specific regulations, such as changes to the number of events, limits on the number of athletes from a country, or changes in the proportion of male and female events.

In short, the most common indicators for explaining Olympic success are GDP, population size, and the host effect. The use of these variables can be explained by their ready availability. Sports-related expenditure may have a larger impact on Olympic success, but it is almost impossible to acquire such data. There have been several attempts to capture the embeddedness of sport in society; however, the results proved to be contradictory because of the difficulty of interpretation (Andreff and Andreff 2010; Duráczky and Bozsonyi 2020; Hoffmann, Ging, and Ramasamy 2002, 2004; Kovács, Gulyás, and Sterbenz 2017). Furthermore, the literature also reveals the potential impacts of superpower countries (China, Russia, and the United States) and the importance of sports-level heterogeneity.

DATA AND EMPIRICAL STRATEGY

Data

Data about the results and the number of athletes of the Olympic Games were obtained from the Gracenote database. Gracenote is an entertainment data company that collects data about the Olympic Games, among other areas.

We collected data about seven Summer Olympic Games (1996–2021) for all sports to obtain detailed information about countries' Olympic performance. During this period, there were no major political boycotts or changes that could have had a major distorting effect on the results. The period of analysis was deliberately chosen, as there are several issues with the pre-1990s data. The first and foremost is the lack of macro-level data, especially for the Soviet Union and its member states. The large amount of missing data would also have distorted the reliability of the estimates and the results. Second, the break-up of the Soviet Union led to the creation of several new states. It is therefore almost impossible to link past Olympic results to the successor countries, causing another problem for the panel data structure. Nevertheless, we still had to deal with country changes.

The breakup of Yugoslavia (1996 Atlanta and 2000 Sydney) and Serbia and Montenegro (2004 Athens) was the only problematic issue during the period of analysis. However, both countries performed remarkably well at the Olympics, and thus we decided to keep the data and assign it to the countries where the athlete performed later. Most of the observations were attributed to Serbia and Montenegro, but we also identified athletes from Slovenia, Croatia, Bulgaria, Hungary, and the United States. To create a panel structure, countries were grouped with the sports events. In the data set, the individual units are countries associated with specific sports (e.g., Australia—archery), and the time dimension was the year of the Olympic Games.

For the socioeconomic indicators, we employ data from the database of the World Bank. The Olympic Games is a 4-yearly event, and thus to obtain more detailed information about countries' economic and social situation, we calculated 4-yearly geometric means for the year of the Olympic Games and the previous 3 years. This method eliminates bias due to data fluctuations or erroneous data. Similarly to previous studies (Forrest, Sanz, and Tena 2010; Trivedi and Zimmer 2014), we calculated shares of GDP and population (relative to all other countries in the sample) to ensure consistency across the equation. The descriptive statistics for the variables employed in the analysis are presented in Appendix Table A in the Supporting Information.

Measuring Olympic success

The key issue is how to measure Olympic success. Studies usually employ the sum of medals (Andreff and Andreff 2010; Duráczky and Bozsonyi 2020; Hoffmann, Ging, and Ramasamy 2002, 2004; Johnson and Ali 2004; Sun, Wang, and Zhan 2015; Vagenas and Vlachokyriakou 2012) or the share of medals (Bernard and Busse 2004; Forrest, Sanz, and Tena 2010; Rathke and Woitek 2008; Sun, Wang, and Zhan 2015; Trivedi and Zimmer 2014) to measure Olympic performance. However, both approaches may yield misleading results.

The main problem with using the sum of medals and the share of medals is the lack of distinction concerning their "color." Good examples of this are the cases of Croatia and the Czech Republic at the 2016 Summer Olympics in Rio de Janeiro. Both countries won 10 medals, but while the Croats got five gold medals, the Czechs had only one; consequently, the countries were ranked 17th and 43rd on the medal table, respectively. Therefore, it is rather difficult to argue that the performances were equivalent.

Interestingly, only a few studies distinguish between (or at least indicate) types of medals. Lui and Suen (2008) applied weights to medals (3, 2, 1), Condon, Golden, and Wasil (1999) and Rewilak (2021) employed a Fibonacci sequence (5, 3, 2) and assigned one point for rankings of between four and six. Csurilla et al. (2021) and Kovács, Gulyás, and Sterbenz (2017) used market share for medals, which is a standardized measure of performance at the Olympic Games. Using market share has several advantages. First, the market share illustrates the payout system of a sporting competition (exponential payout) much better than the amount of medals or the unweighted medal share (Lazear 2018). Second, using market share allows for more accurate time-series analysis, as the number of medals that can be won varies according to event and Olympics (Kovács, Gulyás, and Sterbenz 2017; Trivedi and Zimmer 2014). Third, in contrast to total medals, the approach indirectly accounts for interdependence across countries; at the Olympic Games, one athlete's win implies another's loss (Trivedi and Zimmer 2014).

We calculate the market shares for the medal places using the following formula (Csurilla et al. 2021):

$$MS_{i,j,t} = \frac{P_{i,j,t}}{\sum P_{j,t}}, \tag{1}$$

where $MS_{i,j,t}$ is the share of "Olympic performance" of country i in sport j at the Olympic Games t. $P_{i,j,t}$ is the points achieved by country i in sport j at Olympic Games t. We use six points for a gold medal and a proportion of six points and the ranking for other medals (i.e., six for gold, three for silver, two for bronze). The ranking value was always defined as the product of the value of six divided by the ranking—for example, for rank six, the value is one.

Similarly to previous studies (Csurilla et al. 2021; Kovács, Gulyás, and Sterbenz 2017; Lui and Suen 2008; Rewilak 2021), we also consider the quality of medals. Note that the different types of variables (weighted, unweighted) are significantly correlated (De Bosscher et al. 2008). To confirm this, we also conducted a correlation analysis with different types of Olympic performance variables. In addition to the dependent variables calculated based on medals, we calculated dependent variables for other rankings following previous studies (De Bosscher et al. 2008; Rewilak 2021). We also calculate market shares for the top 8 and 16 rankings. More detailed performance data reduce the number of zero observations, so we obtain more comprehensive information on countries' performance and Olympic strategy, as the goal is not always to win but to increase the number of finalists (Rewilak 2021). The correlation matrix of different Olympic performance indicators is presented in Table 2.

TABLE 2 Correlation matrix of indicators of Olympic success.

	(1)	(2)	(3)	(4)	(5)
(1) Market share for medal places (Market Share 3)	1.000				
(2) Market share for top 8 places (Market Share 8)	0.961	1.000			
(3) Market share for top 16 places (Market Share 16)	0.946	0.990	1.000		
(4) Unweighted medal share (Medal Share)	0.943	0.916	0.905	1.000	
(5) Total number of medals	0.541	0.553	0.543	0.563	1.000

The market shares are strongly correlated with unweighted medal share. There is only a moderate correlation between the share variables and total medals. The correlation table and the literature suggest two conclusions. First, compared to previous studies that did not use weights to distinguish the quality of medals, we may obtain slightly different results. Second, the more detailed performance indicator may reveal different relationships with the determinants of success. Since such a comparison is not available, we check the robustness of the results with different outcome indicators.

Empirical model

As shown in the literature review, Olympic success depends mainly on two factors: the economic background of the country in terms of spending on elite sport and the number of talented athletes who are available. For most of the participating nations, no information can be found on direct investment in elite sport and the number of athletes in the country. Therefore, following the literature, these effects are captured using the country's GDP and population. Both indicators are indirect measures, but they are at least available for most countries, making the analysis reliable.

The key control variable to be included in the models is the number of athletes from a country participating in the Olympic Games in a sport. Since the majority of nations cannot qualify athletes in most sports, this is an important constraint to Olympic success. At the level of aggregate data, the number of athletes participating in an Olympics from a country is closely related to the country's economic situation and population size. Due to endogeneity, it needs to be addressed for consistent estimates (Trivedi and Zimmer 2014). However, in the context of sport-level data, endogeneity is not a concern since the number of athletes eligible to participate in each sport is determined by the sport regulations, which can be controlled by the sport effects. A dummy variable is used to capture the outlier medal-winning of the host country. The home-field advantage is due to several factors (knowledge of home track and climate, targeted financial support, judging bias, etc.) but varies from sport to sport (Forrest et al. 2017; Noland and Stahler 2017). Hence, it is not always detectable for each host but remains important in aggregate (Csurilla and Fertő 2023) but with decreasing explanatory power (Singleton et al. 2024).

The number of events, participating nations, and medals vary from Olympics to Olympics. Of these parameters, we can control for the number of medals by using market share as a dependent variable. Previous studies have controlled for changes in the number of participating nations and medals using an Olympic fixed effect (Bernard 2008; Forrest et al. 2017; Kovács, Gulyás, and Sterbenz 2017; Noland and Stahler 2017; Rewilak 2021). However, for country-sport level data, such as that which we use in our study, changes in sporting disciplines can and should be taken into consideration. A change in rules can significantly affect a country's medal variation in a sport—for example, by limiting the number of athletes from a country who can compete in an event. One earlier study used a sport fixed effect, but without an Olympic fixed effect (Csurilla and Fertő 2022). A two-way fixed effect has also already been used in one study, but instead of a sport fixed effect, country fixed effects were used in the model in addition to the Olympic effect (Singleton et al. 2024). Using a combination of Olympic and sport fixed effects allows for a more reliable estimate than previous studies, as we can also identify the impact of country-level changes within sports on medal-winning.

To identify a country's success at the Olympic Games, our baseline models are grounded on previous studies (Bernard and Busse 2004; Forrest, Sanz, and Tena 2010; Forrest et al. 2017; Trivedi and Zimmer 2014):

$$MS_{ijt} = f\left(GDPsh_{it},\ POPsh_{it},\ ATHLETE_{ijt},\ HOST_{it}, d_t, v_j, \varepsilon_{ijt}\right). \tag{2}$$

The dependent variable is $MS_{i,j,t}$, the medal market share of i country in j sport at t Olympic Games. $GDPsh_{i,t}$ and $POPsh_{i,t}$ refer to the share of total GDP and population of i country at t time. $ATHLETE_{ijt}$ is the number of participating athletes from i country in j sport at t Olympic Games. $HOST_{i,t}$ is also a dummy variable used to control the host effect. d_t is the Games fixed effect that captures changes in the number of countries participating. v_j is the sport-level effect, and $\varepsilon_{i,j,t}$ is the error term.

China, Russia, and the United States have won significantly more Olympic medals than other countries in recent decades. This Olympic rivalry between Russia and the United States dates back to the Cold War (Guttmann 1988) and was symbolic of the supremacy and rivalry of the two ideological systems. The competitive advantage that the countries gained at this time persisted after the Cold War, as did the rivalry to a certain extent. These two countries were joined in competition by China, which also perceives sporting success as proof of its superpower status (Zheng and Chen 2016). Chinese sports strategy has been successful, with Chinese athletes winning the most gold medals at the 2008 Beijing Olympics. Previous studies have failed to address the outlier performance of the superpowers, while the political rivalry between the three countries is clearly visible at the Olympics. So far, two studies have used a separate dummy variable for superpowers (Csurilla and Fertő 2022; Duráczky and Bozsonyi 2020), but the results did not have significant explanatory power. However, we assume that with a different model specification, the outperformance of superpowers may be significant.

In the next step, we extend the baseline model with the superpower effect:

$$MS_{ijt} = f\left(GDPsh_{it},\ POPsh_{it},\ ATHLETE_{ijt}, HOST_{it}, SUPER_i,\ d_t,\ v_j,\ \varepsilon_{ijt}\right), \tag{3}$$

where $SUPER_i$ is a dummy variable if country i is China, Russia, or the United States.

Estimator for Olympic data

The empirical methodology depends on the nature of the outcome variables. Studies that apply count-type indicators—like total medals or points—employ different types of regressions—these include ordinary least squares (OLS) (Vagenas and Vlachokyriakou 2012), Hurdle (Rewilak 2021; Scelles et al. 2020; Trivedi and Zimmer 2014), and Poisson (Duráczky and Bozsonyi 2020; Lui and Suen 2008) models. Articles that describe research using medal or market shares as the dependent variable have mainly used Tobit estimators (Andreff and Andreff 2010; Bernard 2008; Forrest, Sanz, and Tena 2010; Forrest et al. 2017; Kovács, Gulyás, and Sterbenz 2017) or the panel Tobit estimator with Mundlak transformation (Rewilak 2021). As elite sport is a zero-sum game—one participant's win is another's loss, and only a proportion of participating countries can win at least one medal at the Olympics—a censored model, like the Tobit, seems to be a good choice for the data. However, the share data are bounded between 0 and 1, which makes the use of Tobit regression problematic. Also, as Trivedi and Zimmer (2014) emphasize, Tobit is not suitable for estimating non-linear relationships, such as in the case of the Olympic Games. For proportion-type data with a limited range as the outcome variable, the normal linear or nonlinear regression models are not suitable. The beta distribution is suitable for our purpose since its density takes different shapes. Furthermore, proportions data often include a non-negligible number of zeros and/or ones (Ospina and Ferrari 2012). Ospina and Ferrari (2012) suggest zero-or-one inflated beta regression models for handling the latter problem. For the Olympics, the zero-inflated beta regression (ZIB) is the appropriate one, as most countries obtain zero medals, and no country can obtain all the points and have a market share of "1" (Csurilla et al. 2021). There are two principal reasons for the presence of these excess zero numbers. Firstly, a country may fail to qualify or choose not to participate in an event or sport, or to send a delegation to the Games. For example, many Middle Eastern athletes did not send female athletes during the sample period. Second, even if a country does participate, it may fail to achieve a medal due to the lack of abilities or skills of the athlete in the particular event or sport. As the precise cause of the zero value is unknown, to reduce potential bias, only countries and sports where the country in question had an athlete participating in the given sport at any Olympics within the specified sample period were included.

The beta distribution with parameters μ and ϕ ($0 < \mu < 1$ and $\phi > 0$) has the following density function, where $\Gamma(\cdot)$ denotes the gamma function (Ferrari and Cribari-Neto 2004):

$$f(y; \mu, \phi) = \frac{\Gamma(\phi)}{\Gamma(\mu\phi)\,\Gamma((1-\mu)\phi)} y^{\mu\phi-1}(1-y)^{(1-\mu)\phi-1}, \; y \in (0,1). \tag{4}$$

To deal with the zero-inflated problem, and to obtain a zero-inflated beta distribution, a new parameter α should be added for the probability of observations having a zero value:

$$bi_0(y; \alpha, \mu, \phi) = \begin{cases} \alpha, & \text{if} y = 0, \\ (1-\alpha) f(y; \mu, \phi), & \text{if} y \in (0,1), \end{cases} \tag{5}$$

where $f(y; \mu, \phi)$ is the beta density, and α is the probability of observing zero (Ospina and Ferrari 2012). To estimate the three distribution parameters (α, μ, ϕ), link functions need to be defined. For α and μ logit link and for ϕ log link are generally used (Ospina and Ferrari 2012).

Our model is following:

$$\text{logit}(\alpha) = \rho_0 + \rho_1\, MS_{ijt-4} + \rho_2\, GDPsh_{it} + \rho_3 POPsh_{it} + \varepsilon_{ijt},$$

$$\text{logit}(\mu) = \gamma_0 + \gamma_1\, GDPsh_{it} + \gamma_2\, POPsh_{it} + \gamma_3\, ATHLETE_{ijt} + \gamma_4\, HOST_{it} + \gamma_5\, SUPER_i + d_t + v_j + \varepsilon_{ijt}, \tag{6}$$

$$\log(\phi) = \phi_0.$$

The α parameter indicates the probability of having zero market share in the outcome variable. Three of the explanatory variables could influence this directly: a country's previous Olympic performance, economic situation, and size of population. The beta distribution's μ parameter indicates the mean of the outcome variable. ϕ is a precision parameter that is assumed to be constant for all observations (Csurilla et al. 2021).

There is also a theoretical basis for the use of the two-step estimator. As Manuel Luiz and Fadal (2011) noted, for African countries, only GDP matters for Olympic success, while all other variables used in previous studies do not. It is therefore reasonable to assume that other factors are driving the differences in success. However, previous studies have not examined the barriers to success—that is, what determines whether a country can win an Olympic medal. Based on the system that generates the Olympic success of countries (Rewilak 2021), we estimated the ZIB α parameter by considering the three basic factors: past Olympic success (as a proxy for the cultural embeddedness of sport), GDP, and population.

Based on earlier studies, we assume that GDP, population, and host effect are positively associated with Olympic medals. We expect that being a superpower country will have a positive impact on Olympic success. For the α parameter logit model, all the independent variables will decrease the probability of having zero medals at the Olympics. The ZIB regressions were estimated using Stata and with the user-written *zoib* code by Buis (2010).

RESULTS

Superpowers and sport-level effect

Results are presented in Table 3, and the estimations of sport-specific effects are available in Appendix Table B in the Supporting Information. First, the ZIB regressions are displayed with unweighted medal share (1-4), then with weighted market share as the dependent variable (5–8). The superpower dummy variable is added to the (2,4,6,8) estimations, and the sport-specific effect was applied in four cases (3,4,7,8).

The first striking finding is that the results are robust to alternative outcome variables. All independent variables have positive and significant impacts on Olympic success (1,5). Note that the superpower dummy has a remarkable effect on the magnitude of coefficients alone without employing a sport-level effect (2,6). The impact of GDP share on Olympic success almost halves with both dependent variables, while the significance of population share diminishes. When adding only the sport-specific effect into the models (3,8), the magnitude of coefficients for GDP share decreases, and for the host dummy, the significances diminish in the case of using medal share as a dependent variable (3), while the effect of the number of athletes participating changes to a positive sign. In the models without sport fixed effects (1,2,5,6), as the number of athletes increases, ceteris paribus, the countries' performance decreases significantly. This phenomenon is presumably due to different sport regulations. Without considering sport differences, the number of participating athletes would therefore lead to biased results, and it is important to control for these with sport fixed effects. In the fully augmented models (4,8) with the superpower dummy and the sport-level effect, the coefficients of population share, host effect, participating athletes, and superpower remain statistically significant, while the explanatory power of GDP share on Olympic success ceases. Our estimations reinforce the importance of population, as highlighted by previous studies (Rewilak 2021; Scelles et al. 2020). However, in the fully specified models, GDP share is no longer significant when the superpower variables are added to the estimations, and sport-specific effects are used.

The estimations with the different outcome variables are slightly different. Except for the coefficients of the host effect and the superpower variable, the magnitudes of the others are lower in the case of the weighted market share. While the magnitude of the host effect is significant for both dependent variables, notable differences are still apparent. The size of the host effect is almost double for the weighted market share, compared to the unweighted medal share, which is a remarkable difference. This indicates that for the host countries, in addition to the medal surplus, there is an even greater impact in terms of quality (type of medal). Results using the market share are more precise than those that use the unweighted medal share variable.

The lower part of Table 3 shows the zeroinflate results of the ZIB regression. The coefficients of all the variables have negative signs and are significant. The estimations suggest that the lagged outcome variable, GDP share, and population share decrease the probability of having zero medals at the Olympic Games. In other words, weaker economic and social development and no previous Olympic success indicate that a country's chance of winning a medal at the Olympics is very small.

In the case of the sport-specific effect, badminton, canoe slalom, and road cycling did not have significant explanatory power in any model, compared to the base variable (archery; Appendix Table B in the Supporting Information). Eighteen sports had coefficients of a negative and significant sign, while signs for the other 28 sports were positive and significant.

Medals and finalist rankings

Using the full extended model (with superpower dummy and sport effects), we also examined how Olympic performance variables of different levels are differently impacted by the factors that influence

TABLE 3 Estimation of the ZIB regressions with unweighted (medal share) and weighted (market share) dependent variables for medal rankings.

	(1) Medal share	(2) Medal share + Super	(3) Medal share +Sport	(4) Medal share + Super + Sport	(5) Market share	(6) Market share + Super	(7) Market share + Sport	(8) Market share + Super + Sport
Proportion								
GDP share	145.5***	88.60***	24.90***	−5.555	148.2***	83.28***	42.22***	−5.026
	(10.01)	(13.61)	(7.409)	(9.062)	(10.99)	(14.61)	(9.789)	(11.80)
Population share	27.97***	−7.812	56.93***	35.84***	32.23***	−8.274	57.71***	25.35***
	(9.339)	(11.24)	(6.205)	(7.284)	(10.12)	(12.06)	(8.232)	(9.574)
Host	0.367***	0.399***	0.0618	0.0856*	0.402***	0.437***	0.142**	0.178***
	(0.0725)	(0.0730)	(0.0480)	(0.0482)	(0.0784)	(0.0790)	(0.0632)	(0.0634)
Athlete	−0.0127***	−0.0125***	0.0246***	0.0239***	−0.0105***	−0.0105***	0.0201***	0.0191***
	(0.00139)	(0.00138)	(0.00126)	(0.00125)	(0.00141)	(0.00140)	(0.00155)	(0.00153)
Super		0.422***		0.240***		0.484***		0.373***
		(0.0702)		(0.0426)		(0.0741)		(0.0550)
OG FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sport effect	No	No	Yes	Yes	No	No	Yes	Yes

(Continues)

TABLE 3 (Continued)

	(1) Medal share	(2) Medal share + Super	(3) Medal share +Sport	(4) Medal share + Super + Sport	(5) Market share	(6) Market share + Super	(7) Market share + Sport	(8) Market share + Super + Sport
Constant	−2.277***	−2.273***	−2.121***	−2.119***	−2.275***	−2.268***	−2.177***	−2.179***
	(0.0437)	(0.0434)	(0.0783)	(0.0781)	(0.0471)	(0.0467)	(0.107)	(0.107)
zeroinflate								
Medal share $_{t-4}$	−16.38***	−16.38***	−16.38***	−16.38***				
	(0.536)	(0.536)	(0.536)	(0.536)				
Market share $_{t-4}$					−16.55***	−16.55***	−16.55***	−16.55***
					(0.592)	(0.592)	(0.592)	(0.592)
GDP share	−205.1***	−205.1***	−205.1***	−205.1***	−213.7***	−213.7***	−213.7***	−213.7***
	(23.46)	(23.46)	(23.46)	(23.46)	(23.23)	(23.23)	(23.23)	(23.23)
Population share	−57.62***	−57.62***	−57.62***	−57.62***	−54.56***	−54.56***	−54.56***	−54.56***
	(18.43)	(18.43)	(18.43)	(18.43)	(18.45)	(18.45)	(18.45)	(18.45)
Constant	1.918***	1.918***	1.918***	1.918***	1.899***	1.899***	1.899***	1.899***
	(0.0285)	(0.0285)	(0.0285)	(0.0285)	(0.0283)	(0.0283)	(0.0283)	(0.0283)
Observations	13,374	13,374	13,374	13,374	13,374	13,374	13,374	13,374

Note: OG FE refers to the Olympic Games fixed effects. The sport-level effects of the estimations are presented in Appendix Table B in the Supporting Information. Standard errors are in parentheses.
Abbreviation: ZIB, zero-inflated beta regression.
$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

TABLE 4 Estimation of the market shares for the three different rankings (top 3, 8, 16).

	(1) Market share top 3	(2) Market share top 8	(3) Market share top 16
Proportion			
GDP share	−5.026	24.48**	66.01***
	(11.80)	(9.940)	(9.357)
Population share	25.35***	−8.147	−6.503
	(9.574)	(8.196)	(7.631)
Host	0.178***	0.184***	0.226***
	(0.0634)	(0.0517)	(0.0461)
Athlete	0.0191***	0.0280***	0.0330***
	(0.00153)	(0.00111)	(0.000940)
Super	0.373***	0.438***	0.347***
	(0.0550)	(0.0494)	(0.0486)
OG FE	Yes	Yes	Yes
Sport effect	Yes	Yes	Yes
Constant	−2.179***	−3.042***	−3.422***
	(0.107)	(0.0820)	(0.0693)
zeroinflate			
Market share $_{t-4}$	−16.55***	−45.61***	−64.74***
	(0.592)	(1.295)	(1.949)
GDP share	−213.7***	−167.7***	−76.54***
	(23.23)	(25.44)	(27.47)
Population share	−54.56***	−27.41	−21.61
	(18.45)	(18.49)	(19.15)
Constant	1.899***	1.179***	0.446***
	(0.0283)	(0.0244)	(0.0230)
Observations	13,374	13,374	13,374

Note: OG FE refers to the Olympic Games fixed effects.The sport-level effects of the estimations are presented in Appendix Table C in the Supporting Information. Standard errors are in parentheses.
$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

success. The results of estimating the market shares for the three different rankings (top 3, 8, 16) are presented in Table 4 (the sport-specific effects are listed in Table C of the Appendix in the Supporting Information).

Among the three dependent variables, the market shares calculated for medals differ significantly from the others, while the market shares calculated based on additional rankings produce similar results. Although not for medals, the market shares calculated for the other rankings are significantly explained by the economic situation of a country measured in GDP. The economic situation is therefore an important determinant of how many athletes from a country can qualify for the finals (top 8 and 16 rankings) in a sport at the Olympic Games. In contrast, the population has no significant effect on the performance of a country in terms of further rankings. In the zeroinflate model, the pattern is the same. The population does not have significant explanatory power for the probability of achieving the top 8 and 16 rankings. As with GDP, the host effect is also positive and significant when rankings are considered in addition to medals. The host country may not only win more medals, but it will have more athletes than usual among the best. The superpower variable is almost unchanged. It also leads to a robust result for all dependent variables considering additional rankings. And as expected, more qualified athletes mean more top 8 to 16 finishes for a country.

Robustness test

To ensure the reliability of the results, we conducted a series of robustness tests (see Appendix Table D in the Supporting Information). First, we examined the impact of another economic variable, namely, GDP per capita share, on our results (2). Second, we created a variable for the former Soviet bloc countries (excluding Russia, as it is already included in the Super variable) and included it in our model (3). Third, we employed a different empirical strategy, and an estimation was performed with standard errors clustered by country but without Olympic fixed effects (4).

In all three cases, the economic variables (GDP and GDP per capita) proved to be statistically insignificant. The population coefficient exhibited minimal variation in models (2) and (3), yet it demonstrated a notable decline in explanatory power in model (4). The coefficients of Host, Athlete and Super remained unaltered to one decimal place. However, the standard error of Host increased in Model (4) and the level of its significance decreased. On that basis, we demonstrated that the results remain largely consistent when different model specifications are employed.

DISCUSSION

Our main finding is the different importance of determinants of Olympic success in terms of first and subsequent medals. GDP and population, as well as lagged Olympic performance, are still found to determine the likelihood of a country winning a medal at the Olympics. The results indicate that economic status is an entry barrier to the Olympic medal market, but it does not affect the further improvement of a country's Olympic performance. A sound economic situation—which is essentially a proxy for spending on elite sport or sports—and sufficient population—which is a proxy for talent—are essential for winning Olympic medals. But when it comes to winning more medals, only the number of talented individuals and other factors matter. The lack of the effect of economic strength here is presumably because those countries that have been successful in the past already have the sporting infrastructure and organizational structure (coaching knowledge, competitive advantage in sport, etc.) that are essential for achieving Olympic success. Among other factors, the effectiveness of sports governance may play an important role (De Bosscher et al. 2006, 2008), but there is no comprehensive measure to empirically demonstrate this. In the future, it may be worth exploring the relationship between sport governance and broader government effectiveness as a better proxy for sport expenditure, compared to the current variables.

Our estimations confirm the importance of the use of a sport-specific effect in models, which considerably affects the coefficients of the standard explanatory variables. Using sport effects along with the superpower variable, GDP cannot explain the number of medals. Only one previous study has shown a similar result for GDP (Rewilak 2021), but the host effect has so far been significant in all cases. Presumably, wealthier countries have responded more effectively to the rule changes in certain sports. This could account for the positive correlation with success shown in the literature previously.

Another key finding is the importance of the outcome indicator. The results of models that use weighted market share slightly differ from those that apply unweighted medal share. Winning a gold medal is usually associated with the highest prestige at the Olympic Games. The unweighted medal share does not consider this fact, which distorts assessments of the Olympic performance of countries. The use of weights better illustrates the dynamics of a tournament-type payment system and competition in a sporting contest. The coefficients of superpower countries highlight the importance of this problem. The rivalry between the three superpowers and the symbolic, ideological struggle at the Olympics is about winning as many medals as possible. In terms of bronze medals, this is empirically proven (Csurilla and Fertő 2022). Models with market share as the outcome variable show that the superpower dummies have a stronger effect on Olympic performance than models with an unweighted medal share. The weights thus make the different coefficients more visible, and there is a clear difference at the significance level. Also due to the unweighted dependent variables, it is plausible that recent studies found a decrease (Singleton et al. 2024) and strong heterogeneity (Csurilla and Fertő 2023) in the size of the host effect.

We have an important finding by being the first to consider the number of athletes per country in a given sport who have qualified to the Olympics. Previous studies have emphasized that the quantity of athletes is a crucial determinant of success in Olympic sports. In the absence of athletes from a particular country in a given sport, the likelihood of that country winning a medal is zero. However, as the number of athletes increases, the probability of winning a medal also increases—only up to a point, of course, as the number of athletes from each country who can qualify for an event is limited. Nevertheless, it is important to note that analyzing the number of athletes without accounting for sport differences, specifically sport fixed effects, can lead to bias results since certain sports only allow one athlete per country to qualify. Future studies on Olympic success should follow this kind of empirical strategy for more reliable results.

Finally, we also tested the different effects of the determinants of success on the dependent variables calculated for different Olympic rankings. In all cases, superpowers have robust explanatory power, suggesting they can consistently field large numbers of athletes at the Olympics. The host effect is also significant in all cases meaning that athletes from the host country achieve better than usual in terms of rankings, not only in terms of medals. For the top 8 and 16 rankings, GDP is significant. The effect of population is perhaps the most significant difference, compared to a model that only considers medals. The likelihood of being ranked in the top 8 or 16 is not at all affected by the population size of a country. Moreover, the population also does not have impact on the number of such rankings. Presumably, this is due to the restricted number of athletes from each country in each sport, creating a kind of ceiling phenomenon. Even for medals, it is the number of talented individuals that counts, but for further placings, a country's economic situation and efficiency are more relevant. Differences may even be attributed to differences in the sports strategies of countries, as it may not be the case that winning a medal is the primary target everywhere. Controlling for the heterogeneity of country objectives cannot be implemented, even with such a large database, so this remains to be addressed.

CONCLUSION

We investigate the drivers of countries' performance at the Olympic Games. The article contributes to the literature in six areas. First, we highlight the difference between the determinants of Olympic success when the probability of winning a medal and the number of medals are analyzed separately. Second, we add sport-level effects to our models, considering the heterogeneity in sports. Changes in sports can have a significant impact on a country's success, so it is essential to eliminate this distortion. Third, we demonstrate the clear dominance of superpower countries at the Olympics, namely, China, Russia, and the United States, and the importance of controlling their "outperformance." Fourth, we employ a weighted outcome variable to distinguish differences in countries' success, compared to the total medal count or unweighted medal shares. Fifth, we control the number of athletes from a country who qualify per sport. Previously, the importance of this has been addressed only at the aggregate country level. Finally, we examine how different performance indicators may affect the determinants of Olympic success.

In contrast to earlier studies, our estimations suggest the declining importance of GDP. Better economic status is associated only with winning a medal at the Olympic Games, not with the number of medals that have been won. We argue that GDP is a barrier to entry, and the host effect on medals is not as significant as previously suggested. China, Russia, and the United States have a competitive advantage in terms of winning Olympic medals, but for other countries, the level of economic development does not influence Olympic success. Further studies are needed to identify any additional channels that explain successful Olympic performances among countries.

Although the weighted market share better illustrates the difference in medals, our results are robust to alternative outcome variables. We do not expect significant differences between the weighted and the unweighted indicators. However, we identify a significant difference in the dependent variables calculated for the other rankings. In further studies, it would be important to measure not only medal ranking but also additional performance indicators for comparison.

Our research has some limitations. Macroeconomic indicators do not represent the attitude of countries toward a sport. Expenditure on sport, especially on elite sport, may show the embeddedness of sport in culture. Similarly, the resources available through a country's sport governance system and the effectiveness of sport governance systems could be further subjects of analysis.

The findings of the article suggest the following implications, not exclusively for practitioners of sport. First, we make recommendations for countries where Olympic success is an important objective of sports governance. Countries without previous Olympic success should first collect economic and human resources to increase the chance of obtaining a first medal at the Games. As the macro variables employed as proxies are nearly impossible to influence, even over extended periods, it may be necessary to consider alternative strategies, such as increased expenditure on sport and leisure activities and more effective talent management, to achieve this desired outcome. Based on the literature, it may be worth selecting sports for which a country has a comparative advantage (Tcha and Pershin 2003), the market potential for new nations to win an Olympic title is relatively high (Weber et al. 2019), or the competition is balanced (with no one country dominating the sport; Knuepling and Broekel 2020; Zheng et al. 2019). Countries that have previously achieved podium places should also focus on building sport-specific knowledge. Nations with prior Olympic success can diversify their funding more and attempt to win medals in more sports (De Bosscher, Shibli, and Weber 2019). Diversification requires an adequate pool of talented individuals, and this need can only be met by more effective talent management.

Second, our study raises important issues for the International Olympic Committee (IOC). We present empirical evidence of the overwhelming Olympic superiority of the three superpowers, compared to other countries. Moreover, this dominance seems to be increasing. In addition, it is evident that winning medals is still primarily a function of economic situation and population size. However, to promote the Olympic ideals as widely as possible, it is important that the Olympics do not become a playground for the privileged but that as many nations as possible can participate. The IOC has made efforts in recent decades to achieve this, but work remains to be done. Further action is also needed with the organization of the Olympics. If it is proven that hosting is not associated with economic benefit (Kobierecki and Pierzgalski 2022) or additional medals (Csurilla and Fertő 2023), it will become increasingly difficult to persuade nations to bid for the Olympics—while, of course, other aspects (e.g., personal gains for organizers and politicians or soft power considerations) may still make a mega sporting event like the Olympic Games attractive for certain countries.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to commercial restrictions.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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