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Research article

Market reaction to the announcement of the Summer Olympic Games host. Event study among the stock indices of winners and losers in the years 1984–2032

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Abstract: This paper used an event study to assess whether public information regarding the host of the Summer Olympic Games influenced the national host's stock market. We analysed all events for which the organiser was announced between the years 1978 and 2021, including events from the period 1984–2032. We confirm that the host announcement causes a statistically significant abnormal positive rate of return on the event day for future organisers. While this is true for blue-chip indices, we did not obtain statistically significant results for main market indices. On the markets of countries that did not obtain rights for the organisation of the analysed event, we found statistically significant abnormal negative (−0.8% on average) rates of return two days before the event and statistically significant abnormal positive (0.5% on average) rates of return one day before the event. Such results were obtained for both blue-chip indices and main indices.

Keywords: Summer Olympic Games; financial markets; stock markets; host selection; event study

JEL Codes: G11, G14, G15

1. Introduction

Mega sporting events are, in many ways, becoming larger and larger occasions, and therefore have an increasingly significant impact on the place where they are held. "Gigantism" primarily

concerns the Summer Olympic Games, which are by far the largest and, at the same time, difficult to compare to any other global sporting and non-sporting events (Chalkley and Essex, 1999; Müller, 2015). One of the most important attributes of the size of the Olympic Games is the financial resources, including public funds, necessary for their organisation (Zawadzki, 2017; Engelhardt et al., 2018). This enormous money boost, counted in billions of dollars, supplies the economy of the host and is intended for the implementation of infrastructural projects, including sporting arenas, transport infrastructure, the tourism sector, security, and telecommunications infrastructure (Hayduk III, 2022; Zawadzki, 2022). Therefore, according to the economic approach, the "new information" that comes with holding a mega event could cause stock price reactions, not least in selected branches of the national economy (Dollinger et al., 2010; Abuzayed, 2013).

However, prior research indicates that the announcement of a mega sporting event's host could influence a company's market value in both positive and negative ways. On the one hand, investors tend to rate such news positively when it enhances the company's brand recognition and cash flows due to possibly increasing revenues (Eshghi et al., 2022). Any engagement of the firm in the mega event's preparation process is then perceived as a way to the general development of the entity, which may be reflected in the share price (Langer et al., 2018). On the other hand, investors may react negatively to such information. The sale of company shares and declines in stock indices result from the belief that the huge costs of the event outweigh the benefits that can be achieved (Martinez and Janney, 2015). Negative market emotions have their source, among other things, in the disclosure of the so-called crowding-out effect related to the use of financial resources, notably public funds, for sports infrastructure that does not meet the real needs of the local community (Baade and Matheson, 2004; Barclay, 2009). Negative emotions on financial markets are not always associated with finance itself. Sometimes, they may be related to negative publicity resulting from violating human rights or from non-compliance with adopted environmental protection standards (Kwon and Cornwell, 2021).

Therefore, the research conducted so far provides very ambiguous results regarding the reaction of domestic financial markets to the selection process of the host of a mega sporting event (Ramdas et al., 2015; Fizel and McNeil, 2017; Abril et al., 2018; Harjito et al., 2021). Nevertheless, according to Zawadzki and Potrykus (2023), who conducted the most comprehensive analysis of the impact of large sporting events on stock indices, the organisation of the Summer Olympic Games contributes to achieving statistically significant abnormal and positive rates of return in the short term. These results have confirmed the previous outcomes achieved by Mirman and Sharma (2010), Dick and Wang (2010), and Floros (2010). Since the selection of the host of the Summer Olympic Games contributes to at least short-term positive reactions on the host's domestic capital markets, it seems reasonable to investigate the market reaction of the candidate countries that lose the race for the organisation. Few studies indicate that the loss of prospects related to the implementation of numerous infrastructure projects and the participation of domestic-listed companies in contracts is associated with missing an opportunity for development and will be perceived adversely by the market (Engelhardt et al., 2018; Hayduk III, 2022). This effect might be even more noticeable if the losing city has a high ex ante chance of being selected to host the mega event (Dick and Wang, 2010).

In this paper, the event study method was used to assess the reaction of national stock exchanges' indices to the selection of the host of the Summer Olympic Games, which is not an innovative approach, as it has already been used a number of times in worldwide literature (Floros, 2010; Asteriou et al., 2013; Refai and Eissa, 2017; Zawadzki and Potrykus, 2023). However, what distinguishes the present

study is its time, objective, and subjective scope. The analysis concerns the Summer Olympic Games in the years 1984–2032, in which case the moment of announcing the result of the host selection covers the years 1978–2021. To be more explicit, only the market's reaction to the announcement date is considered, since there are Olympic Games in the sample that have not yet occurred. At the same time, an impact assessment was carried out on the financial markets of the host countries and countries that turned out to be losers on the day of the announcement. Finally, the analysis refers each time to two types of stock exchange indices, i.e., broad market indices and indices covering the largest and most liquid companies, known as blue-chips. The latter, according to the authors, has greater potential to react to the "news" of either a win or a loss in the Summer Olympic Games organisation race.

To achieve the proposed objectives, the following hypotheses are proposed:

H1a) National blue-chip indices of a given country react positively to the announcement of winning the bid as the host of the Summer Olympic Games.

H1b) National broad market indices of a given country react positively to the announcement of winning the bid as the host of the Summer Olympic Games.

H2a) National blue-chip indices of a given country react negatively to the announcement of losing the bid as the host of the Summer Olympic Games.

H2b) National broad market indices of a given country react negatively to the announcement of losing the bid as the host of the Summer Olympic Games.

The justification of the abovementioned hypotheses on the basis of existing theory will be provided in the next sections of this paper.

The study contributes to enhancing the state of knowledge and strengthens the discourse on the impact of mega sporting events, notably the Summer Olympic Games, on the economy in general and financial markets in particular. On the basis of related theoretical approaches such as the efficient-market hypothesis, the obtained results aim to shed light on the so far unrecognised mechanisms behind the financial effects of the Summer Olympics and thereby to bridge a research gap in the literature of mega sporting event impacts.

2. Economic and non-economic theories of the stock market reaction to the announcement of the host of a mega sporting event

In general, in the literature to date, two theoretical pillars appear for assessing the reaction of domestic capital markets to the "news" of the selection of the host of a mega sporting event. The first one stems from the economic area and the second from non-economic fields (Zawadzki and Potrykus, 2023). The former approach results from injecting the economy with significant financial resources necessary to conduct a sporting event properly and in accordance with the requirements of sports organisations such as the International Olympic Committee (Baade and Matheson, 2004; Zawadzki, 2017). Autonomous expenditures on the organisation of the Summer Olympic Games are increasing and, in the case of events organised in the 21st century, range from USD 5.9 billion in Sydney in 2000 to USD 44 billion in Beijing in 2008. The involvement of considerable funds causes primary and secondary effects in the host economy (Crompton, 1995; Kasimati, 2003; Essex, 2011; Zawadzki, 2022). The appearance of "new money" creates favourable conditions for local companies involved in the preparatory process, including additional demand impulses (Sterken, 2006; Cornelissen et al.,

2011). This "new money" can influence supply and demand forces in financial markets, leading to new valuations of listed companies.

The latter, non-economic approach involves, first and foremost, the marketing area. Sports sponsorship has developed over the last decades and is now perceived as a significant tool of the marketing communication mix in an increasing number of companies (Reiser et al., 2012). A company's involvement in sports sponsorship aims at generating positive commercial benefits, such as increased sales, brand awareness, and corporate image (Chen and Chen, 2012; Eshghi, 2022; Gao et al., 2023). The target market, which might be consumers, the general public, or financial markets, plays a significant role in determining how effective sports sponsorship is (Cornwell and Kwon, 2020; Kwon and Cornwell, 2021). Accordingly, investments in sports sponsorship are seen as a reliable indicator of a company's financial health and, as such, they enhance shareholder value and have a favourable effect on a company's position on the stock market (Eshghi et al., 2022). That kind of beneficial relationship is not always evident, though. Stock market investors may occasionally view sports sponsorship expenditures as redundant if linked to significant and not always justified expenses (Mazodier and Rezaee, 2013). According to Martinez and Janney (2015) and Fizel and McNeil (2017), they would lower the activity's value, which would have a detrimental effect on the stock valuation, caused by such announcements.

Both approaches are based on theories that are often mutually exclusive, which may explain the inconsistency of stock valuation results (positive, negative, and neutral) in connection with the appearance of information regarding the selection of a mega sporting event host. Investor responses, when taking an economic approach, are influenced by either behavioural finance theory or the efficient-market hypothesis. Whereas the former is centred on investor emotions that explain the occurrence of asset price distortions from their fundamental values (Akerlof and Shiller, 2009; Oprean and Tanasescu, 2014), the latter makes the assumption that currently available information has been included in the price of financial instruments (Fama, 1970; Hasan and Al-Najjal, 2024). Moreover, in the case of the marketing approach, the resource-based view is to be mentioned, referring to "marketing capability". This term was then used by Eshghi et al. (2022) to describe the efficiency with which a business converts its "marketing resources" into "desired performance objectives" such as market share or the level of sales. If businesses with stronger "marketing capabilities" are able to gain more from sports sponsorship, then there may be a true correlation between the two, and this could be seen in the share price of the company. According to Joshi and Hanssens (2010), investors may view sports sponsorship announcements as signs of sound managerial practices that increase shareholder value because they are easily and quickly observable through media coverage.

The literature overview provides the basis for the statement that the theory itself is a source of diversified results on how financial markets react to the announcement of the host of a mega sporting event. Only within the economic approach are there two concepts with completely different assumptions. While the effective-market hypothesis presupposes that investors are rational, behavioural finance theory holds that investors lack rationality (Abuzayed, 2013). While the former is based on the market's efficiency, the latter is based on the inefficiency explained mostly by psychology and other related sciences linked to human sentiment, notably either optimism or pessimism (Edmans et al., 2007; Quaye et al., 2016). As mentioned by Supino et al. (2024), sports in general have a strong impact on both the optimism and pessimism of investors on financial markets.

3. Conceptual framework on the study of winners and losers markets' reaction to the announcement of the host

The most commonly used method to assist in measuring the response of investors when large sporting events are announced is the event study (Dick and Wang, 2010; Eshghi, 2022; Hasan and Al-Najjal, 2024; Hayduk III, 2022; Ramdas et al., 2015; Samitas et al., 2008). When it comes to the announcement of a sporting event, the event study highlights the significance of fresh information emerging among financial market participants and affecting the prices of financial instruments listed on stock exchanges. For this reason, the fundamental condition for applying the event study in research is the assumption of the financial market's efficiency (McWilliams and Siegel, 1997). With this in mind, the following hypotheses are proposed:

H1a) National blue-chip indices of a given country react positively to the announcement of winning the bid as the host of the Summer Olympic Games.

H1b) National broad market indices of a given country react positively to the announcement of winning the bid as the host of the Summer Olympic Games.

If market efficiency holds true, then stock prices will automatically adjust to any new information that becomes available to investors. This means that the application of the event study is based on an economic approach, including the efficient market hypothesis, despite some weaknesses related to this concept. In the case of an event study, the researcher should be aware of the possibility of distortions occurring in the form of other information impulses reaching the market. According to the confounding effect, the valuation of the shares of listed companies may be influenced by information not related to the selection of the host of a sporting event, but to concurrent or overlapping events, for example, the decision of the management board regarding the payment of a dividend, an invitation to existing shareholders to purchase additional new shares according to rights issue rules, or the periodic publication of financial data (Sorescu et al., 2017). One way to avoid the confounding effect is thus to resign from the use of long windows in the event study methodology (Tipton et al., 2009).

Though sports are frequently the subject of the event study methodology (Becker-Olsen, 2003; Danylchuk et al., 2016; Drivdal et al., 2018; Gannon et al., 2006; Hood, 2012; Hundt and Horsch, 2019; Scholtens and Peenstra, 2009), research on the effect of mega sporting event announcements on stock markets is not so frequent, even in relation to the Olympic Games. Nevertheless, previous studies point to certain regularities.

First, winning the bid is perceived positively by the markets of Summer Olympic Games hosts, while for Winter Olympics, the reaction is either neutral or even negative. Mirman and Sharma (2010) confirmed that the markets' reaction is reflected around the days of the host announcement. The findings suggest that financial markets respond favourably to the awarding of the hosts of the Summer Games and unfavourably to that of the Winter Games. Dick and Wang (2010) considered 15 different Olympic Games from 1988 to 2014. The findings of their analysis indicate that the stock markets of the Summer Games and Winter Games winners, when combined, generally experienced notably positive average returns in the days that followed the announcement. In contrast, if only the Winter Olympic Games were taken into account, no discernible impact was found. In the most comprehensive study of Zawadzki and Potrykus (2023), the authors included Olympic Games announcements either held or to be held in the period of 1980–2032. According to results in the case of the Summer Olympic Games, the reaction of the markets became statistically significant and positive on the announcement

day and the day after the announcement. On the day of the event's announcement, the hosts' stock exchanges saw abnormally negative rates for the Winter Olympic Games. Despite the abovementioned examples, there is a research gap when it comes to the distinction between national blue-chip indices and broad market indices.

H2a) National blue-chip indices of a given country react negatively to the announcement of losing the bid as the host of the Summer Olympic Games.

H2b) National broad market indices of a given country react negatively to the announcement of losing the bid as the host of the Summer Olympic Games.

Some researchers draw attention to the importance of announcing the results of selecting the host of the Olympic Games for countries that lost the bids. Gopane and Mmotla (2019) claimed that stock market reactions are significantly negative when bids to host the sporting mega events are rejected. Considering how costly and resource-intensive it is to submit a bid, this conclusion seems reasonable. Market participants perceive certain constraints in future economic activity following the Olympic bid's defeat, which is supposed to be valued out of stocks (Hayduk III, 2022). In previous research, the importance was attributed to the reaction of the shares of companies assigned to particular sectors of the economy. This can be considered as a justification for the division of national indices into blue chips and broad market indices. Verraros et al. (2004) observed an industry-specific differentiation during the 2004 Summer Olympic Games. Their research revealed a generally favourable effect of the mega sporting event's announcement on construction indices of the Athens Stock Exchange. Similar conclusions were revealed by Asteriou et al. (2013), who proved that even though the FTSE 100 increased by 0.87% following the announcement of the 2012 Olympic Games in London, not all industry stock returns mirrored this increase. For example, the reaction of the oil and gas sector was negative. Zawadzki (2017) notes that selected economic sectors, in particular those related to construction and tourism, are responsible for the occurrence of the so-called primary economic effects, which affect the growth of selected enterprises whose business profiles are related to these sectors. Only the secondary effects, caused by the circulation of money and depending on the size of the multipliers, affect all sectors and, consequently, the broad market of stock companies.

4. Data and methodology

For the purposes of the study, we collected information on the process of selecting the host of the Summer Olympic Games from 1984 to 2032. At that time, the organisers of 13 Summer Olympic Games had been selected. The date of selection of the host for each of the analysed Olympic Games is presented in Table 1.

Table 1, apart from the year of the Olympic Games and the date of announcement, also presents the host country that was selected as the organiser of the mega event. The penultimate column of Table 1 contains information about the main national stock index (MI), which, according to the authors, is the best reflection of the broad capital market. The last column contains information regarding the blue-chip index (BC), which groups the largest stock companies on a host country's stock exchange. As blue-chip indices, we chose indices that group the narrowest available index of the largest companies. If, for example, there were indices available of the 30th and 50th largest companies on a given stock exchange, the one with the smallest number of companies was chosen for analysis. The idea to utilise blue-chip indices results from the belief that larger companies have a greater chance of

winning contracts, especially since in some countries this narrow index includes state-owned enterprises. Therefore, the reaction among the companies making up this index seems to be more impulsive compared to the group, including all listed companies.

Table 1. Information about the winners of the Summer Olympic Games in the years 1984–2032.

No.	SOG year	Date of host announcement	Host country	Main index (abbreviation)	Blue-chip index (abbreviation)
1	1984	18.05.1978	United States of America	S&P 500 (GSPC)	Dow Jones (DJI)
2	1988	30.09.1981	South Korea	KOSPI (KOSPI)	**KOSPI 50 (Not available)**
3	1992	17.10.1986	Spain	General Madrid (SMSI)	**IBEX 35 (Not available)**
4	1996	18.09.1990	United States of America	S&P 500 (GSPC)	Dow Jones (DJI)
5	2000	24.09.1993	Australia	ASX All Ordinaries (AORD)	**S&P/ASX 20 (Not available)**
6	2004	05.09.1997	Greece	Athens General Composite (AT)	**FTSE/Athex 20 (Not available)**
7	2008	13.07.2001	China	Shanghai Composite (SC)	Shanghai SE 180 (SE180)
8	2012	06.07.2005	Great Britain	FTSE All-Share (FTAS)	FTSE100 (FTSE100)
9	2016	02.10.2009	Brasil	Sao Paulo SE IGCX (IGCX)	Bovespa (BVSP)
10	2020	08.09.2013	Japan	TOPIX (TOPIX)	NIKKEI 225 (N225)
11	2024	13.09.2017	France	CAC All Shares (SBF250)	CAC40 (FCHI)
12	2028	13.09.2017	United States of America	S&P 500 (GSPC)	Dow Jones (DJI)
13	2032	21.07.2021	Australia	ASX All Ordinaries (AORD)	S&P/ASX 20 (ATLI)

The beginning of the analysis period was determined by the availability of data for the benchmark, which is necessary to conduct the event analysis. The MSCI World Index was used as a benchmark[1], and the first quotation of that index took place on January 1, 1972 (*MSCI World Index*, 2023). Importantly, we use and present results for both the blue-chip and main indices on each national stock exchange. Data for individual main market indices and blue-chip indices were downloaded from the following websites: Investing.com, finance.yahoo.com, and stooq.com. Ultimately, in each case, the portal that offered the longest time horizon for a specific national index was selected. Unfortunately, despite searching the given websites, it was not possible to find all the required indices, and those for which no data was obtained are marked in bold with the note "Not available" in Tables 1 and 2.

Table 2 presents data for countries that lost the competition to host the Summer Olympic Games in individual years. If only one participant applied to organise a given Olympics, the description "No losers" appears.

[1] MSCI data contained herein are used under license and may not be further used, distributed, or disseminated without the express written consent of MSCI.

Table 2. Information about losers in the host selection process for 1984–2032 Summer Olympic Games.

No.	SOG year (host country)	Date of announcement	Country	Main index (abbreviation)	Blue-chip index (abbreviation)
1	1984 (USA)	18.05.1978	No losers		
2	1988 (South Korea)	30.09.1981	Japan	**TOPIX (n.a.)**	NIKKEI 225 (N225)
3	1992 (Spain)	17.10.1986	Australia	ASX All Ordinaries (AORD)	**S&P/ASX 20 (n.a.)**
4	1992 (Spain)	17.10.1986	France	**CAC All Shares (n.a.)**	**CAC40 (n.a.)**
5	1992 (Spain)	17.10.1986	Great Britain	FTSE All-Share (FTAS)	FTSE100 (FTSE100)
6	1992 (Spain)	17.10.1986	Netherlands	**AEX All Share (n.a.)**	AEX 25 (AEX25)
7	1992 (Spain)	17.10.1986	Yougoslavia	**(n.a.)**	**(n.a.)**
8	1996 (USA)	18.09.1990	Australia	ASX All Ordinaries (AORD)	**S&P/ASX 20 (n.a.)**
9	1996 (USA)	18.09.1990	Canada	S&P/TSX (GSPTSE)	**S&P/TSX 60 (n.a.)**
10	1996 (USA)	18.09.1990	Great Britain	FTSE All-Share (FTAS)	FTSE100 (FTSE100)
11	1996 (USA)	18.09.1990	Greece	**Athens General Composite (n.a.)**	**FTSE/Athex 20 (n.a.)**
12	1996 (USA)	18.09.1990	Yougoslavia	**(n.a.)**	**(n.a.)**
13	2000 (Australia)	24.09.1993	China	Shanghai Composite (SC)	**Shanghai SE 180 (Not available)**
14	2000 (Australia)	24.09.1993	Germany	**HDAX (n.a.)**	DAX (GDAXI)
15	2000 (Australia)	24.09.1993	Great Britain	FTSE All-Share (FTAS)	FTSE100 (FTSE100)
16	2000 (Australia)	24.09.1993	Turkey	BIST ALL SHARES **(n.a.)**	**BIST 30 (n.a.)**
17	2004 (Greece)	05.09.1997	Argentina	**S&P/BYMA Argentina General (n.a.)**	S&P Merval (MERVAL)
18	2004 (Greece)	05.09.1997	Italy	**FTSE Italia All Share (n.a.)**	**FTSE MIB (n.a.)**
19	2004 (Greece)	05.09.1997	South Africa	FTSE/JSE All Share (FTSEJSE)	South Africa Top 40 (J200)
20	2004 (Greece)	05.09.1997	Sweden	OMX Stockholm (OMXSPI)	OMXS30 (OMX30)
21	2008 (China)	13.07.2001	Canada	S&P/TSX (GSPTSE)	**S&P/TSX 60 (n.a.)**
22	2008 (China)	13.07.2001	France	CAC All Shares (SBF250)	CAC40 (FCHI)
23	2008 (China)	13.07.2001	Japan	TOPIX (TOPIX)	NIKKEI 225 (N225)
24	2008 (China)	13.07.2001	Turkey	BIST ALL SHARES (BAS)	BIST 30 (XU030)
25	2012 (Great Britain)	06.07.2005	France	CAC All Shares (SBF250)	CAC40 (FCHI)
26	2012 (Great Britain)	06.07.2005	Russia	MOEX (MOEX)	MOEX Blue Chip (MOEXBC)
27	2012 (Great Britain)	06.07.2005	Spain	General Madrid (SMSI)	IBEX 35 (IBEX)
28	2012 (Great Britain)	06.07.2005	USA	S&P 500 (GSPC)	Dow Jones (DJI)
29	2016 (Brasil)	02.10.2009	Japan	TOPIX (TOPIX)	NIKKEI 225 (N225)
30	2016 (Brasil)	02.10.2009	Spain	General Madrid (SMSI)	IBEX 35 (IBEX)
31	2016 (Brasil)	02.10.2009	USA	S&P 500 (GSPC)	Dow Jones (DJI)
32	2020 (Japan)	07.09.2013	Spain	General Madrid (SMSI)	IBEX 35 (IBEX)
33	2020 (Japan)	07.09.2013	Turkey	BIST ALL SHARES (BAS)	BIST 30 (XU030)
34	2024 (France)	13.09.2017	No losers		
35	2028 (USA)	13.09.2017	No losers		
36	2032 (Australia)	21.07.2021	No losers		

n.a. – not available

Table 2, which contains data on the countries that lost the competition to organise the analysed sports events, also includes information on the names of the main stock exchange indices in these countries and the indices grouping the largest companies. What should be emphasised is that in the case of 4 of the 13 Olympic Games analysed, the organising country did not have a single competitor. These were the games of 1984, 2024, 2028, and 2032. Based on the data in Table 2, it can be seen that the later the date of the event, the fewer potential candidates for its organisation. This is related to the organisation of the method of selecting the host of this event, which has changed radically in recent years.

In order to verify the research hypotheses defined in the introduction, an event analysis was used as the research method. A market model was used to calculate above-average rates of return. Ultimately, the formula for an above-average rate of return can be written as follows (Prusak and Potrykus, 2021b):

$$AR_{i,t} = R_{i,t} - (\alpha_i + \beta_i * R_{m,t}) \quad (1)$$

where:
$AR_{i,t}$ – abnormal return,
$R_{i,t}$ – the rate of return for stock index "i" on day "t" (MI or BC index), the "real" rate of return recorded on the market with the event,
$R_{m,t}$ – the rate of return for the MSCI World Index on day "t",
α_i, β_i – the estimated market-based model parameters.

The study used a market model (Sharpe, 1963) because it has been proven that the use of more sophisticated models (e.g., GARCH class models) does not affect the obtained results (Castro-Iragorri, 2019). To estimate the parameters α and β, as suggested in (Corrado, 2011), we used 250 observations from the past, with the most recent observation coming from seven days before the event. Selecting the estimation window in this way allows avoiding a situation in which disturbing events that may occur immediately before the event date are included in the estimation (Gurgul, 2019). To perform all the calculations related to the application of the event analysis, the "EventStudy" package from the R program was used (Wolf et al., 2014). The study used logarithmic rates of return, and if the day of the event fell on a day when no quotations were available, then the next business day was considered as the day of the event. The abnormal average rates of return and their cumulative equivalents used to verify the research hypotheses were calculated according to the formulas given, for example, in (Prusak and Potrykus, 2021a):

$$AAR = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t} \quad (2)$$

$$CAAR = \frac{1}{N}\sum_{i=1}^{N} CAR(t_1, t_2) \quad (3)$$

$$CAR(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_{i,t} \quad (4)$$

where,
AAR - average abnormal return,
N - number of analysed events,
CAAR - cumulative average abnormal return,

CAR - cumulative abnormal return,
t_1 - the beginning of the event window,
t_2 - the ending of the event window.

To assess the statistical significance of the obtained results, we used the Patell test (Patell Z) (Patell, 1976) and the adjusted Patell Z test (Kolari and Pynnönen, 2010). Neither test is sensitive to the way in which abnormal returns are distributed on an event window. The main difference between these two tests is the fact that the adjusted version is not sensitive to cross-sectional correlation (Wolf et al., 2014). The main equations for these tests are given below in Table 3.

Table 3. Details on event study statistical tests.

		Patell Z	Adjusted Patell Z
AAR	Null hypothesis	H_0: E(AAR)=0	
	Test statistic	$z_{AAR} = \frac{\mathrm{ASAR}_0}{S_{ASAR}}$	$z_{adjARR} = z_{AAR} * \sqrt{\frac{1-\bar{r}}{1+(N-1)*\bar{r}}}$
CAAR	Null hypothesis	H_0: E(CAAR)=0	
	Test statistic	$z_{CAAR} = \frac{1}{\sqrt{N}} * \sum_{i=1}^{N} \frac{CSAR_i}{S_{CSAR_i}}$	$z_{adjCARR} = z_{CAAR} * \sqrt{\frac{1-\bar{r}}{1+(N-1)*\bar{r}}}$

Source: Own study based on (Wolf et al., 2014).

We conduct our research using three different lengths of event windows. First, we start with the event window (0, 3), as this length is important for the calculation of CAR and CAAR measures, allowing us to assess the durability of verified effects. To assess individual events (AR) and events in groups (AAR), we also use event windows (−1, 3) and (−2, 3). We extend our event windows by a few days before the event to investigate whether investors attempt to predict who will organise the analysed events before selecting a host. Our research is schematically illustrated in Figure 1.

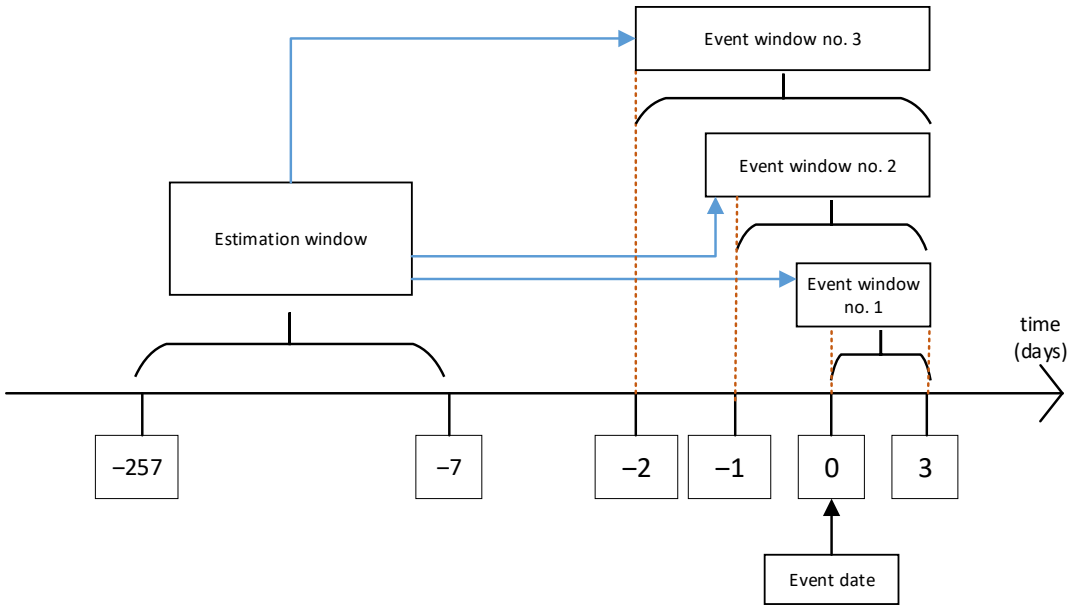

Figure 1. Description of established parameters for conducted event studies. Source: Own study

5. Results

Table 4 shows the results obtained based on AAR rates. The data presented in Table 4 contains the day in relation to the event, the value of the AAR rate, and the ratio of additional AR rates to negative ones. The next four lines contain the values of the Patell Z and Adjusted Patell Z test statistics along with the corresponding P-values. Additionally, statistically significant results are distinguished.

Table 4. AAR for winners, selected descriptive statistics, and value for statistical tests.

Sub-sample	Day relative to event	−1	0	1	2	3
	Average abnormal return (AAR)	−0.03%	**0.73%**	0.15%	−0.24%	−0.08%
	Pos:Neg	5:4	7:2	7:2	3:6	3:6
	Patell Z	0.354	2.247	0.291	0.143	−0.435
	Patell Z P-values	0.724	0.025 (**)	0.771	0.886	0.663
	Adjusted Patell Z	0.337	2.143	0.278	0.137	−0.415
WIN BC Index (N=9)	Adjusted Patell Z P-values	0.736	0.032 (**)	0.781	0.891	0.678
	Average abnormal return (AAR)	−0.21%	**0.36%**	**0.76%**	0.10%	−0.16%
	Pos:Neg	5:8	10:3	8:5	4:9	5:8
	Patell Z	−0.162	1.483	1.445	0.806	−0.558
	Patell Z P-values	0.872	0.138	0.148	0.420	0.577
WIN MI	Adjusted Patell Z	−0.151	1.388	1.353	0.754	−0.522
(N=13)	Adjusted Patell Z P-values	0.880	0.165	0.176	0.451	0.602

If the test showed statistical significance of at least 0.1, the symbol * was used, and for 0.05 and 0.01 significance, the symbols ** and *** were used, respectively.

The results for blue-chip indices indicate a statistically significant positive abnormal rate of return on the day of the event, i.e., the selection of the host of the Summer Olympics (Table 4). These narrow indices, grouping the largest companies in the selected host country, record an abnormal positive rate of return of 0.73% on the day of the event. On the next day, after the event, there is a positive abnormal rate of return recorded, but its value is 0.15%, and this result is not statistically significant. Unlike in the most extensive research on this matter conducted so far (Zawadzki and Potrykus, 2023), we did not obtain statistically significant results the day after the event. This state of affairs should be associated with the following reasons. First, we made a division between the main indices and blue-chip indices. Second, we removed Japan's second announcement because of COVID-19. Third, we used 250 days instead of 100 days for the market model.

Importantly, the obtained results are not robust if blue-chip indices are replaced by main indices for the analysed markets. Based on the data in Table 4, it can be seen that although positive values for AAR rates were obtained on the day of the event and the day after the event for the main indices (0.36% and 0.76%, respectively), these results are not statistically significant. This means that a positive reaction to the announcement of the host of the Summer Olympics has a statistically significant impact on the largest listed companies in the host country, but this does not translate into the broadly understood capital market. It should also be added that we did not obtain statistically significant AAR

rates of return other than those described in Table 4 in the longest event window that we examined, which was (−5, 10). Results from this large study are available upon request.

In the next step of our study, we assessed how the indices behaved in countries that also applied to host a given event, but their candidacy was ultimately rejected. It should be emphasised here that the day of the event is the same day on which the organiser of the future sports event was announced. Unlike the winner, which was always only one host, the number of losers varied from zero to a maximum of five. The general tendency is that the number of countries willing to organise the Summer Olympic Games is smaller over time. The results of this study are presented in Table 5.

Table 5. AAR for losers, selected descriptive statistics, and value for statistical tests.

Sub-sample	Day relative to event	−2	−1	0	1	2	3
	Average abnormal return (AAR)	**−0.85%**	**0.49%**	0.07%	0.25%	−0.32%	0.12%
	Pos:Neg	8:13	11:10	11:10	12:9	10:11	9:12
	Patell Z	−2.992	2.044	0.672	0.348	−0.207	−0.253
		0.003	0.041				
	Patell Z P-values	(***)	(**)	0.502	0.728	0.836	0.800
	Adjusted Patell Z	−2.714	1.854	0.609	0.316	−0.188	−0.230
		0.007	0.064				
LOSER BC (N=21)	Adjusted Patell Z P-values	(***)	(*)	0.542	0.752	0.851	0.818
	Average abnormal return (AAR)	**−0.78%**	**0.59%**	0.41%	0.53%	−0.01%	−0.11%
	Pos:Neg	7:15	12:10	11:11	14:8	14:8	8:14
	Patell Z	−2.846	2.364	0.402	0.352	0.048	−1.272
		0.004	0.018				
	Patell Z P-values	(***)	(**)	0.688	0.725	0.962	0.203
	Adjusted Patell Z	−2.789	2.317	0.394	0.345	0.047	−1.247
LOSER		0.005	0.021				
MI (N=22)	Adjusted Patell Z P-values	(***)	(**)	0.694	0.730	0.963	0.212

Based on the data in Table 5, it follows that on the day of the event and after the event was announced, no statistically significant abnormal rates of return were recorded. It can therefore be concluded that in a losing country there is no stock sale, which was assumed at the beginning of this paper, for both the BC and MI indices. Nevertheless, interesting results were obtained before the day of the event. In the window (−1, 3), we obtained a statistically significant result one day before the event. This is why we extend our event window to (−2, 3). Two days before the event, there is a negative, statistically significant abnormal rate of return. Additionally, on the day before the event, we also obtain statistically significant positive AAR rates.

While examining individual days in the event window is important and allows for the assessment of the effect of investor behaviour on each of the examined days separately, the results from Table 6, which contain results for CAAR rates, are the basis for assessing the durability of those effects.

Table 6. CAAR results for winners and losers.

Grouping variable	Event window	CAAR Value	pos:neg CAAR	Number of CAARs considered	Patell Z	Patell Z P-value	Adjusted Patell Z	Adjusted Patell Z P-value
WIN BC	(−1, 3)	0.52%	7:2	9	1.163	0.245	1.109	0.268
WIN BC	(0, 3)	0.55%	8:1	9	1.123	0.261	1.071	0.284
WIN MI	(−1, 3)	0.85%	11:2	13	1.348	0.178	1.262	0.207
WIN MI	(0, 3)	1.06%	10:3	13	1.588	0.112	1.486	0.137
LOSER BC	(−2, 3)	−0.24%	10:11	21	−0.159	0.874	−0.144	0.886
LOSER BC	(0, 3)	0.12%	11:10	21	0.280	0.779	0.254	0.800
LOSER MI	(−2, 3)	0.63%	11:11	22	−0.389	0.697	−0.381	0.703
LOSER MI	(0, 3)	0.82%	12:10	22	−0.235	0.814	−0.231	0.818

Table 6 shows the results for CAAR rates for both winners and losers. The following table columns show the length of the event window. Two event window lengths, for winners, were considered: (−1, 3) and (0, 3). The second event window was chosen due to the fact that such an event window, if it turns out to be statistically significant, will be the basis for formulating a short-term investment strategy from the date of the event. The next column provides the value of the above-average cumulative rate of return for the studied event window lengths. These results for the winners are positive in each of the analysed cases and higher for the shorter of the examined windows. These values are also higher for main stock indices than for blue-chip indices, and this pattern occurs for both winners and losers. The next column contains the number of positive and negative CAARs in the examined windows. Table 6 also contains information on the number of cases considered and, most importantly, the values of test statistics along with the P-value. None of the presented results turned out to be statistically significant, and although the value of CAAR rates for winners is significant, it cannot be the basis for formulating a statistically significant investment strategy. Importantly, for other tests (generalised rank Z, generalised sign Z), we obtain statistically significant results for winners in both the analysed event windows. These results are available upon request. To sum up, the market reaction for winners in the event windows is high but not statistically significant. For losers, no statistically significant reaction was observed for both the analysed event windows (−2, 3) and (0, 3).

6. Discussion

The obtained research results can be considered on several levels. They will be discussed in this section in the order in which the research hypotheses were proposed.

First, the positive reaction of the markets to the announcement of the selection of the host of the Summer Olympic Games confirms previous recent research, including Dick and Wang (2010), Floros (2010), Mirman and Sharma (2010), and Zawadzki and Potrykus (2023). What distinguishes this research is the use of a division into main indices and blue-chip indices. Statistically significant and positive reactions are only visible in the case of the blue-chip indices of the host countries on the day of the announcement of the event. Although broad market indices also show positive AAR values, they are not statistically confirmed. A possible explanation for the results obtained is the fact that it is easier for larger and more recognisable stock companies to obtain contracts resulting from the organisation of such

an event. In some countries, the state is at least a minority shareholder in blue-chip companies. Therefore, on the day of the event, there is a clear interest of potential investors to purchase the shares of the largest firms, since the smaller the company, the less noticeable its involvement in organising the event.

Contrary to expectation, it was not possible to confirm the negative reaction of the markets of the countries that lost the race to host the Summer Olympic Games on the day the results were announced by the International Olympic Committee (Engelhardt et al., 2018; Hayduk III, 2022). Unexpectedly, however, it was found that the negative reaction of these markets, expressed by a drop in AAR, takes place two days before the announcement of the selection results. Such an unusual sale two days before the host announcement should be the subject of further scientific research, as it may indicate a "leak" of information regarding the event organiser. For a change, one day before the announcement, we obtained positive AAR rates. Such volatility has been recognised in the area of economics as a cobweb model (Berardi, 2022; Commendatore and Currie, 2008). After one day of strong decline, the market records an abnormal rate of return, in order to find a point of balance. Such price fluctuations are not unique and can be noticed in previous research that used event study analysis (Bash, 2020; Prusak and Potrykus, 2021a; Sakawa and Watanabel, 2023).

These findings may have far-reaching impacts on public and private bodies. The announcement of the host of the largest sporting event has been proven to be strong enough to attract a market reaction in terms of stock indices. The spreading of such "news" may give investors the chance to obtain an abnormal return and outperform the market. Purchasing the stocks of the largest companies on the day that the host is announced is one of the most important ways for investors to gain success. When bidding to host the Olympics, policymakers should take note of the financial markets' positive responses. This argument serves to convince all stakeholders involved in planning mega sporting events. It reinforces the case for hosting these mega events in significant financial hubs. It is worth mentioning that the sample of these events is closed because this quantitative analysis includes each Olympic Games from 1984 to 2032. This guarantees the study's methodological rigor in terms of validity and transferability. There are two ways to conduct a more comprehensive study: expanding the research to other mega sporting events (FIFA World Cup, Winter Olympic Games) or considering a sector analysis. It would be prudent to investigate whether comparable effects apply to other well-known non-sporting events, albeit still large, such as EXPO.

It should also be emphasised that in the conducted study, there is a small number of winners, which results from the nature of the analysed events (one event in four years), which is fewer than the number of losers. This fact should be taken into account when generalising conclusions.

7. Conclusions

We have assessed how national stock exchange markets react to the announcement of the host of the Summer Olympic Games. In general, we look closely for investors' reactions in the countries of both winners and losers. We extend past research in this area by making the above division, but also by considering blue-chip indices and main market indices separately. We present the results using an event study for all those levels: winners' blue-chip, winners' main indices, losers' blue-chip, and losers' main indices.

Our findings hold significant practical implications. First, there are individual and institutional investors who may be interested in shaping stock prices and investment behaviour due to the possibility

of hosting a mega sporting event. The results may assist investors in better understanding the impact of sporting events on the stock markets and improve the efficiency of their investment strategies. Second, our study has significant implications for business executives who may want to increase the firm's visibility and market value, not least in the sectors closely connected with the organisation process of the sporting event. Finally, our investigations could support government decisions on whether or not to bid for future sporting events. This is due to the fact that the results of our research refer to both the potential benefits and costs directed not only towards hosts but also towards runner-up countries.

In future research, a more detailed analysis for certain sectors (banking, tourism, and construction, for example) should be provided. As shown by the analysis of blue-chip and main market indices, the results vary over the type of index for winners. The exact reasons for the negative returns for losers two days before the event should also be determined. Finally, a division between developed and developing countries should also be made in future research.

Author contributions

Krystian Zawadzki – Conceptualisation, Data preparation, Investigation, Project administration, Supervision, Validation, Writing – original draft, Writing – review & editing, Funding acquisition. **Marcin Potrykus** – Conceptualisation, Data preparation, Calculations, Analysis, Investigation, Methodology, Software, Visualisation, Writing – original draft.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in creating this article.

Conflict of interest

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