IMPACT OF MEGA SPORT EVENTS ON HOSTING COUNTRIES’ STOCK MARKET

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ABSTRACT

This paper examines the impact of the international sporting events on hosting country stock market. A total of 30 international sporting events had been utilized in this study where it comprises of five major sporting events namely Summer Olympics Games, Winter Olympics Games, FIFA World Cup, European Football Championships and Commonwealth Games. In particular, this study uses event study methodology to analyse and investigate the stock reaction toward the event announcement date and event starting month. The empirical result indicate that there is short term positive effect on announcement date across whole stock market of event hosting country but the result indicates no long term positive effect after event starting month.

Field of Research: Mega sport event, event study, abnormal returns, stock market reaction

1.0 Introduction

The international sporting events are usually perceived to create positively effects on the host countries’ economy. Thus, in recent decades, there has been increase competition among countries to host international sporting events. It is believed that successful organizing of major international sporting events will bring tremendous tangible and intangible benefits and values to the hosting country. Hence, many developing countries such as South Korea, China, Mexico and South Africa are entering the bidding competition for the major international sporting events with the intention to capitalize them as an opportunity to improve city, state and as well as national economic.

The country hosting international sporting events involve substantial investment into various sectors of the economy such as construction, hotels, telecommunications, hospitality, food and tourism. This investment eventually will boost up the economy of hosting country. Therefore, the economic impact of the international sporting events usually receives broad publicity. However, a full evaluation of this economic impact is rather difficult, since such an international sporting events has short term and long term effects, as well as direct and indirect effects, which complicates the estimation of its costs and benefits.

There is no one simple, direct measure of the impact of hosting international sporting events to a national economy. However, there are many indirect measures where the impact may be gauged from hosting an international sporting event. Among these impact measures or indicators, the most popular one is by observation or study of the impact through analysis of the movement of hosting countries’ stock market movement. The stock market index is a barometer of a country’s economy and is commonly believed to reflect the expectations of the economic outlook. Thus, by observing the trends or movement of the stock within a specified timeframe of the event, it provides some indication of the impact of hosting the international events.
In recent years, there are numerous works of academic studies which focus on the economic impact of the international sporting events on the hosting country. The studies revealed that the international sporting events resulted in the fresh cash inflows, which creates a multiplier effect on the host country’s economy and have significant impact on the hosting nation’s economic development (Burgan & Mules, 1992; Baade & Matheson, 2002; Zhang & Zhao 2007).

It is often claimed by economist that hosting international sporting events can generate economic benefits to the hosting country. The empirical evidence is quite mixed. Although many countries competed to host international sports events such as the Olympic Games and the World Cup, the benefits associated with the successful bided country hosting the event are uncertain. This study will examine the impact of an international sporting event announcement and the event starting to the behaviour or movement of a hosting country’s stock market. Therefore the research questions are; 

Does the 1) event announcement date 2) event starting month of the international sporting events of a successful bidding country has statistically significant on their country’s stock market?

The objectives of this study are too examine short term impact of bid winning country’s stock market toward the event announcement date by the organizer, and to examine long term impact of events hosting country’s stock market after the events starting month.

The study on the impact of the international sporting events on the hosting country stock market index is divided into five sections. First section includes the introduction of the study, problem statement, research questions, and research objectives. Second section explains about the literatures review where the background of the study will be expanded. Third section covers the research data and methodology used in the analysis, summary statistics and theoretical bases. Fourth section includes the data analysis, the findings, analysis of the graphs and tables, followed by discussion using the statistical analysis. Fifth section covers the concluding remarks in relation to the literatures review and references.

2.0 Literature Review

Numerous works of academic literature emphasized how international sporting events have had significant impacts on the host nation’s economic development. As early as 1995, Humphreys and Plummer (1995) predicted the short-term and long-term effects on Atlanta’s economy when hosting the 1996 Summer Olympics Games. The short-term economic impacts are composed of direct, indirect, induced and total impact. The direct impacts involved the expenditure on industries such as the expenditure on broadcasting equipment for international broadcasters. They concluded that there was about $1.2 billion direct spending during the year of 1991 to 1997. The indirect economic impacts were associated with visitor spending. There was about $823 million indirect spending by visitors in the 18 days prior to the 1996 Summer Olympic commenced. Follow by Kim, Rhee, Yu, Koo and Hong (1989) summarized that there was about 2,382 billion Korean won invested into Olympic related projects. Moreover, there were about 336,000 jobs opportunity created during year 1982 to 1988. The most impacts of investments were in the infrastructure industry with a 38.8 percent increase followed by the manufacturing industry with a 35 percent increase and then the construction industry with a 32.4 percent increase.

In 2002, Maden (2002, 2007) analyzed the economic impact on 2000 Sydney Olympic Games using three phases modeling which are referred as pre-event, event year phase and post-event phase. He revealed that the expenditure on construction sector grew sharply during the pre-event phase from year 1998 to 1999 by about AUS$ 0.7 million. In the event year from 2000 to 2001, the international tourism
expenditure reached a peak of over AUS$ 0.5 million and an increase of employment opportunity with approximately 26,000 jobs for Australia and extra of 15,600 new jobs for New South Wales. Similarly Kasimati (2003) studied on economic impact of the Summer Olympic and stated that the economic impact arises because of a larger amount of the new money that flowed in and re-circulated within the hosting country once the city was announced to host the Summer Olympics Games.

Two years later, Veraros et al. (2004) analyzed the stock market reaction of Greece (winner) and Italy (loser) toward the announcement date of 2004 Olympic Games. They summarized that Athens, as the hosting city for the Olympic Games of 2004 had positive abnormal returns on the Athens Stock Exchange (ASE) index. However, it shows no significant effect on the Milan Stock Exchange (MSE) general index. Chen (2005) studied on Japanese and Korean stock market reaction to the 2002 World Cup, he noticed that no significant impact on the overall Korean and Japanese stock markets, empirical results evidenced a kick-off game effect, impacts on certain industries portfolios, and individual game effects.

The research by Tziralis, Tolis, Tatsiopoulos and Aravossis (2006) stated that the Olympics impacted Attica’s economy by increasing of the labor force with extra employment opportunity and an increased expansion of road networks and improved of existing roads. Moreover, the Games also resulted in the growth of the sectors of constructions, hotels and restaurants in a scale larger than the overall growth of the national economy.

Martins and Serra (2007) studied the market reaction to the announcement of the selected country hosting the Summer Olympic Games and Winter Olympic Games, the World Football Cup, the European Football Cup and World specialized exhibition. They concluded no evidence supporting that industries were more likely to extract direct benefit from the events, and there are insignificant cumulative abnormal returns for losing bidders.

Another related study by Willner (2007) examined the impact on the macroeconomic variable Gross Domestic Product (GDP) on the 1998 Seoul Summer Olympics Games by using the ordinary least squares (OLS) model. He found that there was a positive and significant relationship between Olympics and economic growth and investment growth with slightly higher tourist and investment activities in the Olympics year.

Nishio et al (2007) analyzed the economic impact of the Olympics using stock market indices of host countries. They found that stock prices of companies related to tourism, construction and miscellaneous services are more responsive to selection announcement and the hosting of the Olympics Games than other industries like mining or chemicals which are not directly affected by the Olympics Games.

Dick and Wang (2008) examined the stock market reactions to the announcement of the Olympics Games host cities during the last three decades. They found a significant and positive announcement effect of hosting the Summer Olympics Games which is reflected in the returns (additional 2 percent accumulated over the following days). They do not find any significant results for the Winter Olympics Games.

Mirman and Sharma (2008) investigated the stock market impact for the year 1996 to 2010 Olympic Games by comparing the stock market reaction of winners and losers around the announcement date. They revealed the Winter Games announcement, stock markets in winning countries performs significantly worse than in losing countries, while there are insignificant results for the Summer Games.

In the latest article “Commonwealth Games and the Economy” published by Institute International Trade, India, the research analyst Shradha Diwan (2010) pointed out that the Commonwealth Games
2010 in India expected to result in an overall economic impact of USD 4.9 billion on India’s GDP during a period of four years starting from 2008 and ending 2012, and created an employment opportunity for approximately 2.5 million people.

3.0 Data Collection and Methodology

This chapter describes the data collection and methodology adopted in this study. The sub-sections discuss data collection method, sources of data, sample selection criteria, event study approach, event date, estimation window & event window, market and risk adjusted model, return calculation, abnormal return calculation, cumulative average abnormal return calculation, t-statistical test and hypothesis development.

3.1 Data Collection

The data applied in this study can be categorized into two sets. The first set of data are the daily and monthly closing prices for S&P 500 (Standard & Poor 500) and those bid winning countries’ index of an event, such as FTSE100 (London), KOPS1 100 Index (Korea), NYSE (New York, USA), TOPIX (Japan), S&P/TSE (Canada), Madrid SE (Spain), S&P/ASX200 (Australia), RTS (Russia), Milan COMIT (Italy), SBF 250 (France), ATHEX Composite Index (Greece), SSE Composite (Shanghai, China), IBOVESPA (Brazil), OSLO (Norway), DAX 30 (Germany), FTSE/JSE (South Africa), NZX 50 Index (New Zealand), KLCI (Malaysia), S&P BSE SENSEX (India), OMXS30 (Sweden), BEL20 (Belgium), PSI20 (Portugal), ATX (Austria), SMI (Switzerland) and WIG (Poland).

These set of data are obtained from Thomson DataStream. Daily closing price data is used to compute daily return for the analysis of short term impact for the events announcement date, whereas the monthly closing price is used to calculate the monthly return for the analysis of long term impact after the event began.

The second set of data consist of international sporting events announcement date and event starting date from the event organizers such as Olympics International Committee (OIC), FIFA World Cup, Commonwealth Games Federation (CGF) and European Football Association (UEFA). There are numerous international sporting events held globally, and only 30 international sporting events will be selected for this study after the screening process.

3.3 Event Study Approach

Event study approach is adopted in this study to analyze the impact of the international sporting events on hosting country stock market’s movement or behavior. This approach is the most common, simple method, widely accepted and frequently used methodology by researchers to analyze the relationship between the effect of a specific event and the market return of a firm or stock market. In general, this event study approach allows the investigation of the stock prices behavior or stock index adjacent to the events and it uses the changes in stock prices or stock index to estimate the effect of an event.

They are several types of event studies approach used in this related study. In this study, Fama, Fisher, Jensen & Roll (1969) Market Efficiency Hypothesis (EMH) test will be explored. The hypothesis stated that the stock prices on financial market are rapidly and fully reflective to all new available information. Hence, investor cannot make excess return based on the available information they have obtained.
because when the market is efficient, the stocks are traded at fair and reasonable prices. When the financial market is under equilibrium, investor cannot outperform the market.

In this study, market efficiency test is use to assess the stock market reaction to the relevant information such as events announcement date and events starting month related to the international sporting events. The following are the systematic structure for this event study.

3.4 Event Date

This study focuses on how the event announcement date and event starting date of an international event affect the host country stock market. In the event, the announcement date or starting date falls under non-trading day such as weekend or public holiday, where the market is closed, the next available trading date will be defined as event date.

3.5 Estimation Window and Event Window

Prior to obtaining data of an events hosting country stock index, it is crucial to identify the estimation period and the event window to be used for this analysis. The estimation window is a time period prior to the event for obtaining α and β in the Market Model whereas the event window is the time period around the event of interest which is used to investigate the abnormal returns. Figure 3.1 shows the event study time line.

Figure 3.1: Event Study Time Line

In this time line, t=0 represents the event date, t=-48\text{days} to t=+30\text{days} represents the event windows and t=-36\text{months} to t=-12\text{months} represents the estimation window. The negative sign means prior to the event date whereas positive sign after the event date.

3.11 Hypothesis Development

This study examines whether hosting international sporting event have effects on a country’s capital market. The hypothesis significant test assumption as follows:

Hypothesis H1 : The event announcement date of an international sporting event has short term positive impact on hosting country’s stock market.

Large investment such as construction and road infrastructure normally takes place during pre-event period. The event’s starting date will be the extension of investment in other sectors such as telecommunication, broadcasting, transportations and airline industries. Hypothesis H2 below will test whether the event starting month has long term positive impact on the hosting country’s stock market:
Hypothesis H2: The event starting month of an international sporting event has long term positive impact on hosting country’s stock market.

4.0 Results and Discussion

4.1 Cumulative Average Abnormal Return on Events Announcement Date Using Daily Returns

This section shows the Cumulative Average Abnormal Return (CAAR) of 30 international sporting events countries stock market following the event announcement date and the CAAR trend pre-event [-30,-1], event date [0] and post-event [+1,+30].

Figure 4.1.1 presents the CAAR across whole stock market of 30 international sporting events hosting country. The CAAR trend starts from positive zone follows by a slight drop to negative zone and then back to positive zone till sudden drop to negative zone 12 days prior to the event announcement date. The abnormal return during this period is fluctuating within range of -0.71% to +0.49%. However, the CAAR trend shows an obvious increase after the event announcement date in which the abnormal return increased 2.07% from -0.62% (on the event announcement date) up to 1.45% on the day 25 (about 3 times of increase) and increase of 1.95% at day 30. This shows that market reacted positively after the events announcement date whereby the investors perceive that by hosting the international sporting events, the country will get involve substantial investment into various sectors of the economy in the country and these economic activities eventually will boost up the country’s economy and bring prosperity to the country.

The following section shows the CAAR trend across whole stock market of each international sporting event hosting countries following the event announcement date and the CAAR trend pre-event [-30,-1], event date [0] and post-event [+1,+30].

Figure 4.1.1: CAAR(-30,+30) across whole stock market of 30 international sporting events hosting countries adjacent to the events announcement date on each of the days in the 30 days symmetric window

Table 4.1: The t-test on the Average Abnormal Returns of the -30 days prior to and 12 days after the Announcement date

<table>
<thead>
<tr>
<th>Days</th>
<th>AAR</th>
<th>CAAR</th>
<th>STDEV</th>
<th>t-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>-30</td>
<td>0.001433</td>
<td>0.001433</td>
<td>0.014586</td>
<td>0.5471</td>
</tr>
</tbody>
</table>
Table 4.1 tests the average abnormal returns of the stock market index 30 days prior and 12 days after the announcement dates. The results show that one day after the announcement date, the stock index has a significant increase. The average abnormal return increases continuously for 7 days provided a positive 0.7% increase in Cumulative average abnormal returns.

4.2 Cumulative Average Abnormal Return on Events Starting Date Using Monthly Returns

This section shows the Cumulative Average Abnormal Return (CAAR) of 30 international events hosting countries stock market following the event starting dates and the CAAR trend pre-event [-36,-1], event month [0] and post-event [+1,+36] using monthly returns to test the long term effect.

Figure 4.2.1 presents the CAAR trend across whole stock market of 30 international sporting events where it starts from positive zone and drop to negative zone from month 25 till the event announcement month. The CAAR trend shows positive increase of 3.36% 3 month prior to the event announcement.
month and decrease 3.79% 4 month after event month. However, the CAAR trend shows an obvious increase of 10% from -6.82% at month 5 to 3.18% at month 23 but drop to -1.81% from event month till month 36 which the return is lowest than event month. This indicates CAAR trend with short asymmetric window generate negative return whereas CAAR trend with long asymmetric window generate positive return but it generate negative return in longest asymmetric window.

Figure 4.2.1: CAAR(-36,+36) across whole stock market of 30 international sporting events hosting countries adjacent to the events starting month on each of the months in the 36 months symmetric window

Table 4.2: The t-test on the Average Abnormal Returns of the months prior to and after the Starting date

<table>
<thead>
<tr>
<th>Months</th>
<th>AAR</th>
<th>CAAR</th>
<th>STDEV</th>
<th>t-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>-30</td>
<td>0.010294</td>
<td>0.013449</td>
<td>0.03198</td>
<td>1.762988</td>
</tr>
<tr>
<td>-20</td>
<td>-0.00739</td>
<td>-0.06124</td>
<td>0.050471</td>
<td>-0.80252</td>
</tr>
<tr>
<td>-15</td>
<td>0.006376</td>
<td>-0.04733</td>
<td>0.043386</td>
<td>0.804983</td>
</tr>
<tr>
<td>-14</td>
<td>0.004251</td>
<td>-0.04308</td>
<td>0.045853</td>
<td>0.507759</td>
</tr>
<tr>
<td>-13</td>
<td>-0.00012</td>
<td>-0.0432</td>
<td>0.040733</td>
<td>-0.01588</td>
</tr>
<tr>
<td>-12</td>
<td>0.007648</td>
<td>-0.03555</td>
<td>0.060117</td>
<td>0.696848</td>
</tr>
<tr>
<td>-11</td>
<td>0.01328</td>
<td>-0.02227</td>
<td>0.049897</td>
<td>1.457726</td>
</tr>
<tr>
<td>-10</td>
<td>0.005299</td>
<td>-0.01697</td>
<td>0.037211</td>
<td>0.860664</td>
</tr>
<tr>
<td>-9</td>
<td>0.000216</td>
<td>-0.01676</td>
<td>0.03257</td>
<td>0.036379</td>
</tr>
<tr>
<td>-8</td>
<td>-0.0089</td>
<td>-0.02566</td>
<td>0.03835</td>
<td>-1.27067</td>
</tr>
<tr>
<td>-7</td>
<td>-0.01231</td>
<td>-0.03796</td>
<td>0.065274</td>
<td>-1.03276</td>
</tr>
<tr>
<td>-6</td>
<td>0.000911</td>
<td>-0.03705</td>
<td>0.04871</td>
<td>0.102488</td>
</tr>
<tr>
<td>-5</td>
<td>-0.00076</td>
<td>-0.03781</td>
<td>0.064916</td>
<td>-0.06405</td>
</tr>
<tr>
<td>-4</td>
<td>-0.00935</td>
<td>-0.04716</td>
<td>0.052552</td>
<td>-0.97471</td>
</tr>
<tr>
<td>-3</td>
<td>-0.01527</td>
<td>-0.06243</td>
<td>0.039025</td>
<td>-2.14348**</td>
</tr>
<tr>
<td>-2</td>
<td>0.014221</td>
<td>-0.04821</td>
<td>0.054898</td>
<td>1.418815</td>
</tr>
</tbody>
</table>
Table 4.2 tests the average abnormal returns of the stock market index 30 months prior and 12 months after the starting date. The results show that three months before the starting date, the stock index has a significant decrease. The average abnormal returns are not significant after the starting date of the games.

The following section shows the CAAR trend across whole stock market of each international sporting event hosting countries following the event starting month and the CAAR trend pre-event [-36,-1], event month [0] and post-event [+1,+36].

4.3 Statistical Analysis on Event Announcement Date using Daily Returns
This section tests the hypothesis and the significant of the impact of hosting international sporting events on events announcement date as well as determining whether international sporting events have significant short term impact on stock market return.

Table 4.3.1 present the result of the Cumulative Abnormal Return (CAR) value, standard deviation and t-statistic of the international sporting events on event announcement date. This table shows the CAR adjacent to the international sporting event announcement date on several windows both for symmetric windows [-30,+30], [-20,+20], [-15,+15], [-10,+10], [-5,+5], [-3,+3] and asymmetric windows[0,+3], [0,+5], [0,+10], [0,+15], [0,+20], [0,+30]. The abnormal return is calculated based on market adjusted model.

Table 4.3.1: CAR adjacent to the events announcement dates for all stock markets

<table>
<thead>
<tr>
<th>Time Windows</th>
<th>CAR</th>
<th>Standard of Deviation</th>
<th>t-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Symmetric Windows (Day)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[-30,+30]</td>
<td>1.33%</td>
<td>0.0798</td>
<td>0.9259</td>
</tr>
<tr>
<td>[-20,+20]</td>
<td>0.02%</td>
<td>0.0599</td>
<td>0.0210</td>
</tr>
<tr>
<td>[-15,+15]</td>
<td>0.57%</td>
<td>0.0501</td>
<td>0.6277</td>
</tr>
</tbody>
</table>
Panel A reports the values of CAR across All Games for six symmetric windows where the t-statistic result shows windows [-30,+30], [-20,+20] and [-15,+15] are statistical insignificant whereas windows [-10,+10], [-5,+5] and [-3,+3] are statistical significant with return at 1.08%, 0.77% and 0.8% respectively. Panel B reports the values of CAR across All Games for six asymmetric windows where the t-statistic result shows windows [0,+3], [0,+5], [0,+10], [0,+15] and [0,+30] are statistical significant with return at 0.81%, 0.95%, 1.42%, 1.33% and 0.80% respectively except windows [0,+20].

### 4.4 Statistical Analysis on Event Starting Date Using Monthly Returns

This section tests the hypothesis and the significant of the impact of hosting international sporting events on events starting dates as well as determining whether international sporting events have significant long term impact on stock market return using monthly returns.

Table 4.4.1 present the result of the CAR value, standard deviation and t-statistic of the international sporting events date. This table shows the CAR adjacent to the international sporting event starting month on several windows both for symmetric windows [-36,+36], [-30,+30], [-24,+24], [-18,+18], [-12,+12], [-6,+6] and asymmetric windows[0,+6], [0,+12], [0,+18], [0,+24], [0,+30] and [0,+36]. The abnormal return is calculated based on market adjusted model.

**Table 4.4.1: CAR adjacent to the events starting date for all stock market**

<table>
<thead>
<tr>
<th>Time Windows</th>
<th>CAR</th>
<th>Standard of Deviation</th>
<th>t-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Symmetric Windows (Month)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[-36,+36]</td>
<td>-4.69%</td>
<td>0.5725</td>
<td>-0.4483</td>
</tr>
<tr>
<td>[-30,+30]</td>
<td>-2.67%</td>
<td>0.4995</td>
<td>-0.2929</td>
</tr>
<tr>
<td>[-24,+24]</td>
<td>3.72%</td>
<td>0.4029</td>
<td>0.5059</td>
</tr>
<tr>
<td>[-18,+18]</td>
<td>5.51%</td>
<td>0.3523</td>
<td>0.8563</td>
</tr>
<tr>
<td>[-12,+12]</td>
<td>0.89%</td>
<td>0.2951</td>
<td>0.1651</td>
</tr>
<tr>
<td>[-6,+6]</td>
<td>-2.48%</td>
<td>0.2631</td>
<td>-0.5166</td>
</tr>
<tr>
<td>Panel B: Asymmetric Windows (Month)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[0,+6]</td>
<td>-2.44%</td>
<td>0.1865</td>
<td>-0.7178</td>
</tr>
<tr>
<td>[0,+12]</td>
<td>0.40%</td>
<td>0.2168</td>
<td>0.1017</td>
</tr>
<tr>
<td>[0,+18]</td>
<td>3.83%</td>
<td>0.2041</td>
<td>1.0265</td>
</tr>
<tr>
<td>[0,+24]</td>
<td>5.10%</td>
<td>0.2398</td>
<td>1.1655</td>
</tr>
<tr>
<td>[0,+30]</td>
<td>1.48%</td>
<td>0.2592</td>
<td>0.3122</td>
</tr>
<tr>
<td>[0,+36]</td>
<td>-0.85%</td>
<td>0.2807</td>
<td>-0.1771</td>
</tr>
</tbody>
</table>
Panel A reports the values of CAR across All Games for six symmetric windows where the t-statistic result shows all widows are statistical insignificant.
Panel B reports the values of CAR across All Games for six asymmetric windows where the t-statistic result shows all windows are statistical insignificant.

5.0 Conclusion

This study investigates and analyses the impact of international sporting events on events hosting country stock market. A total of 30 international sporting events had been utilized in this study where it comprises of five major sporting events namely Summer Olympics Games, Winter Olympics Games, FIFA World Cup, European Football Championships and Commonwealth Games. The data applied in this study consists of daily and monthly stock return of events hosting countries. The market model and t-Statistic test are used to analyse the effect of the events and to test the significant of effect toward the stock market return.

The results of the analysis on the announcement date impact of 30 international sporting events hosting countries stock market shows evidence that the international sporting events announcement date has short term positive effect on hosting countries stock market, whereas the analysis on the event starting month impact shows no evidence that the international sporting events starting date has long term positive effect on hosting countries stock market.

The CAR significant test results of 30 international sporting events on events announcement date (as presented in Table 4.3.1) indicates statistically significant in short and long symmetric as well as the short and long asymmetric windows. However, the CAR significant test results for event starting month indicate (as presented in Table 4.3.2) statistically insignificant in short and long symmetric as well as the short and long asymmetric windows.

References


