REASSESSING THE LONG-RUN ABNORMAL PERFORMANCE OF JORDANIAN IPOS: AN EVENT STUDY APPROACH

Fawaz Khalid AL SHAWAWREH

Mutah University, Department of Banking and Finance, Al-Karak, JORDAN
e-mail: Shawawreh@mutah.edu.jo, ORCID: 0000-0002-1355-5203

Abstract: This paper examines and reviews the fundamental challenges that academicians face when using the event study methodology to assess the long-term consequences of financial events on the economy and to describe market reactions. Numerous studies have demonstrated that businesses can experience abnormal returns from 1 to 5 years after major financial events. Also, this paper investigates the long-run price performance of initial public offerings (IPOs) in Amman Stock Exchange (ASE). The sample period expands from 2018 to 2022. Various findings are obtained by employing several analytical methods. First, long-run price performance of IPOs is negative, and a strong evidence shows that the long-run performance is sensitive to the benchmark employed. To assess the long-term performance of IPOs, I used both cumulative abnormal returns (CAR) and buy-and-hold abnormal returns (BHAR) as aggregated models. I explained the methodology which is adopted in this study in detail for the event–time approach. However, I used the crucial values for the skewness-adjusted t-statistic to infer statistical tests. Even though BHAR provided weaker results, all methods indicated negative long-run abnormal returns for IPOs. Yet this performance varied when comparing the performance utilizing ASEI, Fama–French three-factor (FF3F), and matching firm (MF) as benchmarks.

Keywords: event methodology, abnormal return, benchmark, IPOs, skewness-adjusted test.

JEL Classification: G140, G150.

1 Introduction

The efficient market hypothesis is based on the assumption that stock prices reflect all available information relevant to a financial event. The main objective of the event study strategy is to test the reaction of stock prices in the market when announcing information related to financial disclosure data for new issues that are offered for trading or the reissue from existing companies. The study of the event is one of the important methodologies applied in empirical research in various fields of business administration and economics, and not only in the field of finance. It can be applied in testing the effectiveness of financial markets, in testing theoretical models and their suitability in predicting future returns in the areas of corporate finance, and in evaluating administrative decisions facing enterprises, such as evaluating acquisitions, mergers, and restructuring, in addition to knowing the impact of these events on the market value of the enterprise in the short and long term. However, there are many thorny issues regarding the methodology for studying the event in the long term. Many studies specializing in economic and financial affairs have focused on the most important statistical problems that researchers can face in how to deal with these issues when measuring or estimating long-term returns. Among the most important researchers in this field are Barber and Lyon (1997), Kothari and Warner (1997), and Barber and Tsai (1999).

These researchers presented extensive discussions regarding the statistical inference methods that can be followed to achieve accurate results when implementing return measurement tests. In the long run, using various methods and different methodologies and by reviewing studies that dealt with methodologies that measure financial performance in the long term after important financial events, we find that these studies provide evidence that companies are gaining an unexpected or unusual return during the long term (1–3 or 5 years). The "abnormal return" (AR) is the difference between the real return of a security or financial asset and the expected return of the financial market, represented by the financial performance of the market index. This AR results from financial

events related to the financial market that affect the price of traded financial assets, and the events can include mergers, dividend announcements, company profit announcements, interest rate increases, lawsuits, and others, as all these things can contribute to the formation of this AR. However, the availability of evidence of this long-term performance (long-term ARs) contradicts the effective market hypothesis that the prices of shares or securities offered in the market will reflect the information available in the market within a short period of no more than a day or two. To solve this problem, Fama (1998) presented an explanation that the main reason for this phenomenon is attributed to the methodology used in estimating AR in the long term, and he indicated that the estimation of this return will differ when the method of calculating it changes, or it will disappear in the event of a change in the method of calculation.

This paper discusses the purposes and objectives of the event study, gives examples from previous studies, provides a detailed explanation of the application of the event study, and gives a guide to the most important procedures to be followed if this methodology is used in applied studies. A financial event study methodology has been developed to measure the impact of an unforeseen event on stock prices, determine the direction of this effect, and know the size of the perceived effects on stock prices under study.

2 Research problem

This research addresses several key questions that can be presented as follows:

- Is the measurement of the long-run AR of the study sample different when compared to the employed benchmark?
- Is the cumulative abnormal return (CAR) affected by the benchmark used?
- Is the buy-and-hold abnormal return (BHAR) affected by the benchmark employed?

3 Research objectives

This research aims to review and summarize the most important models related to the subject of event studies and also aims to discuss the necessary steps to apply the methodology used in these studies. The research will discuss the methodology known as the BHARs methodology as well as the return CARs, and the research will also address the application of statistical inference hypotheses for both methods, indicating the strengths and weaknesses of each from a statistical perspective. The research also deals with the application of this methodology to the Jordanian market to evaluate the long-term performance of a sample of companies that were listed in the market and offered their shares for the initial public offering (IPO) in the Amman Stock Exchange during a certain period of time as an example of a financial event that has importance and impact on the performance of the stock exchange in general.

4 Literature review

Event studies are frequently employed in finance research to examine the effects of announcements of corporate initiatives, regulatory changes, or macroeconomic shocks on stock prices. The methodological difficulties of conducting event studies in international finance research are examined in the article by Ghoul (2023). The author emphasized how researchers should pick an event, decide on the study period (short vs. long term), estimate ARs, determine statistically whether the event in question causes a reliable price reaction, and investigate the role of formal and informal institutions in explaining cross-country variations in price reactions. Also, the author offered an extension of event studies to the global fixed-income market, a significant but understudied asset class. The author concluded by outlining potential for future research as well as offering helpful advice for scholars doing cross-country finance event investigations. Their work is considered to be especially pertinent in light of the rising number of significant world events, such as the coronavirus disease 2019 (COVID-19) pandemic, Brexit, and the Paris and Trans-Pacific Partnership agreements.

Yarovaya, et al. (2021) examined the impact of human capital efficiency on equity fund performance during the COVID-19 outbreak. Data was gathered for 799 open stock funds spread across five European Union economies. The findings showed that during

the COVID-19 outbreak, equity funds with higher human capital efficiency (HCE) scores outperformed their peers. The long-term performance of IPOs in various domestic and international markets has been the subject of numerous studies. For a sample of 220 American IPOs issued during the period 1960–1969, Ibbotson (1975) demonstrated a negative relationship between the initial return of the public offering and the long-term performance of the stock price. He also demonstrated that there was an overall positive performance in the first year, a negative performance in the following 3 years, and an overall positive performance in the fifth year.

Sharif, et al. (2020) investigated the link between the COVID-19 outbreak, geopolitical risk, oil prices, and economic uncertainty in the USA. They used a wavelet-based approach to demonstrate the relationship between different time periods and investment horizons. It has been discovered that COVID-19 has a greater impact on US geopolitical risk as well as economic uncertainty. In another study, French (2018) investigated the patterns of market returns predicted by the occurrence of an event. From 2007 to 2016, 64 events were observed in six countries with both developed and developing economies. Market returns are said to be influenced by investor sentiment. Furthermore, the study's findings provide some critical information about the rate of price adjustment to obtain new information.

Another important study that examined the long-run stock performance is Dutta (2014). This paper investigates the robustness of existing long-run event study methodologies using the UK security market data. The study employs the BHAR approach and the calendar time approach method (CTA) to identify the long-term abnormal performance following corporate events. Although many recent studies consider the application of these two widely used approaches, each of the methods is a subject of criticism. This paper uses the standardized calendar time approach (SCTA) of Dutta (2014a), which presents a number of significant improvements over the traditional calendar time methodology. The simulated results reveal that all the traditional methodologies perform well in the UK stock market. Their findings further report that SCTA documents better specification and power than the conventional approaches.

The study of the financial event has evolved over time by improving statistical models that can capture the impact of the financial event on the company and on the financial market in general. Brown and Warner (1980 and 1985), Ritter (1991), Levis (1993), Aktas, et al. (2007), Binder (1998), Corrado (2010), and Kritzman (1994) were among the first to contribute to providing financial event studies and understanding its effects on the financial market (which is why these studies are considered a cornerstone in this field). Previous research has demonstrated that the event study methodology can be used effectively in a variety of areas, including studying the impact of important financial decisions (MacKinlay, 1997), accounting disclosure and its impact on the market (Johannesen and Larsen, 2016), and many other areas such as mergers and acquisitions (Adnan, et al., 2016; Sorescu, et al., 2017), and the global financial crisis (Miyajima and Yafeh, 2007).

Using various benchmarks, including the Fama–French three-factor (FF3F) model, the market value-weighted index (VWMI), and the reference index made up of the remaining companies, Espenlaup and Gregory (2000) studied 588 public offerings that were listed during the period 1985–1992 in the UK, the study sample is prepared and categorized by size (size decile model). Regardless of the benchmarks employed, the results obtained supported the existence of long-term IPOs with subpar performance and high statistical significance.

Gregory, et al. (2010) investigated 2499 UK IPOs issued between mid-1975 and the end of 2004 using precisely built benchmarks based on an equal and value weighting schemes to estimate returns and revealed a compelling proof of long-term underperformance that lasts 36-60 months after listing.

According to Ritter (1991), which examined the performance of 1526 American IPOs issued between 1975 and 1984, the indices (NASDAQ, AMEX, and NYSE) had a dismal 3-year performance of about 27.39%. The ages of listed companies and their long-term performance were significantly correlated. After 5 years, IPOs or stock offerings (SEOs) performed significantly worse than non-issuing companies, according to Loughran and Ritter's (1995) study of a sample of 4753 US IPOs issued during the 1970–1990 period.

The average annual return for businesses conducting IPOs over the 5 years following issuance was only 5% and for SEOs was only 7% for stock offerings (SEOs).

Barber and Lyon (1997) used the CAR, BHAR, and FF3F models to analyze 1798 US IPOs issued between July 1963 and December 1994. They displayed three intriguing findings: the reference return test statistics-based CAR is positively skewed, and the size of the bias grows with the magnitude of the cumulative return, also, when CAR is calculated using an equally weighted market index, this positive bias is more obvious, finally, the researchers showed that FF3F leads to negatively biased test statistics at 12- and 36-month horizons. The methods of using the matching firm (MF) as a benchmark all produce well-defined test statistics.

Previous studies summarize that event study methodology estimates price changes or wealth effects after company events during the event window of a few days around an announcement by companies. Studies of long-term events focus on the performance of stock prices over a period of 3–5 years after the event. Existing literature has found a variety of findings, including cases of long-term over- and under-performance after corporate events (see Fama, 1998 and Ritter, 2002 for comprehensive surveys).

The purpose of this study is to provide fundamental insights into the methodology's implications for market efficiency as well as the effectiveness of event study in capturing the impact of events on stock behavior. The use of synthetic benchmarks to measure aftermarket performance and to compute cross-sectional CAR and BHAR to test the efficiency of portfolio-based (CAR. BHAR) was a major driving force behind the questions of this paper. The key findings of the aforementioned studies concur that most short-run tests are well specified, whereas the majority of the long-run tests are not well specified.

5 Test for stationarity in time series data

The stationarity test is a crucial step in analyzing time series data as it helps to determine if the statistical properties of the data remain constant over time. Stationary time series data is important because it allows for accurate forecasting and modeling, which is essential in various fields such as finance, economics, and engineering.

There are several tests available for checking the stationarity of time series data, such as the Augmented Dickey–Fuller (ADF) test, the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test, and the Phillips–Perron (PP) test, among others. Each of these tests has its strengths and weaknesses and should be chosen based on the nature of the data being analyzed.

It is important to note that stationarity is not a characteristic of all-time series data, and nonstationary data may require additional preprocessing before meaningful analysis can be performed. Therefore, it is essential to understand the underlying properties of the data and to perform proper testing to ensure accurate results.

Table 1 shows the results of a time series test indicating that the data is stationary, which means that the stationary time series data has a constant mean and variance and the statistical properties of the data remain stable over time. This characteristic allows for easier modeling, forecasting, and identification of patterns in the data. The table provides detailed information about the statistical properties of the data and displays the results of different statistical tests used to confirm the stationarity of the data, such as the ADF test and the PP test.

Having a table displaying these results can make it easier for analysts to identify the key characteristics of the data and make informed decisions based on that information. They can use this data to create models that accurately capture the patterns in the data and use those models to make predictions and forecast future values. In summary, a table showing the results of a time-series test indicating that the data is stationary provides valuable information that can aid in the analysis, modeling, and forecasting of the data. It can make it easier for researchers and decision-makers to understand the behavior of the data over time and use that knowledge to make informed decisions.

Table 1. Time series stationary test results
(*Source:* Author's own research)

Factor	Test name	Test statistic	*P*-value	Conclusion
ASEI-AR	Augmented Dickey–Fuller	–4.943	0.000	Stationary
	Phillips–Perron (PP)	–5.126	0.000	Stationary
FF3F-AR	Test name	Test statistic	*P*-value	Conclusion
	Augmented Dickey–Fuller	–7.246	0.000	Stationary
	Phillips–Perron (PP)	–7.246	0.000	Stationary
MF-AR	Test name	Test statistic	*P*-value	Conclusion
	Augmented Dickey–Fuller	–5.759	0.000	Stationary
	Phillips–Perron (PP)	–5.759	0.000	Stationary
SMB	Test name	Test statistic	*P*-value	Conclusion
	Augmented Dickey–Fuller	–6.630	0.000	Stationary
	Phillips–Perron (PP)	–6.630	0.000	Stationary
HML	Test name	Test statistic	*P*-value	Conclusion
	Augmented Dickey–Fuller	–8.089	0.000	Stationary
	Phillips–Perron (PP)	–8.089	0.000	Stationary
RM-RF	Test name	Test statistic	*P*-value	Conclusion
	Augmented Dickey–Fuller	–9.591	0.000	Stationary
	Phillips–Perron (PP)	–9.591	0.000	Stationary

6 Review of methodological issue

An analytical and descriptive method is presented by developing research hypotheses to test selected theories in this research. The descriptive study provides a view of the relevant aspects of the Jordanian IPO market. The event study methodology is chosen on the basis that it is a method of investigation to answer the research questions and to identify the important variables related to the research problem. When designing the study of a financial or an economic event, the length of the event period and the availability of the necessary data will be taken into account when determining the returns for the time period. The test period (TP) can be daily, weekly, monthly, or yearly. However, most previous studies focused on daily or monthly data. Therefore, we will explain below the most important steps that must be followed to implement the event study methodology.

Step 1: This step requires determining the type of event under study, as well as specifying the start date of the event, where the date for the announcement of the event is considered zero. Using the specific date of the financial event, the selection of a sample of companies must be appropriate to the nature of the event, so that companies can be classified into different groups based on their performance. The start date of the event may differ from one company to another according to the occurrence of the financial event in the market.

Step 2: The exact date of the announcement of the financial event must be specified. To monitor the reaction of this information on the prices of securities in the financial market, the period of study or testing must be determined. In event studies, determining the time horizon when studying the event in each time period is a crucial step as the researcher must determine TP (also known as the event window) and the estimation period (EP), which comes before the event window.

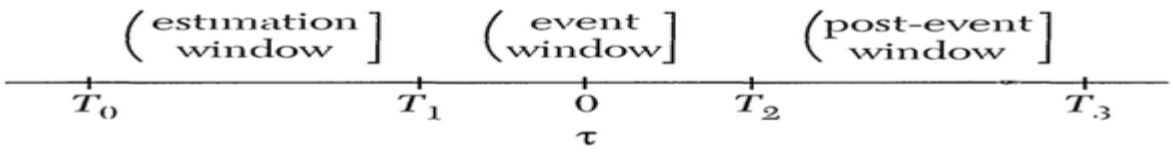


Figure 1. Time line for an event study.

Figure 1. The time horizon for studying the event.
(*Source:* Author's own research)

The effect of the event on stock prices (returns) is studied and analyzed in TP, which has a range between T1 and T2 around the date of the event (the event announcement), which is day 0 as shown in Figure 1.

Step 3: Estimate the expected return E($R_{i,t}$) for each share in the sample during the period of the EP window. The expected return is used as a reference return in the normal situation, where the actual return is compared to it during the period of the event window (TP), which represents the return. There are several models that can be used to estimate the expected return, including measuring the normal return, as there are many models that can be used to measure the expected or normal return for the market (benchmark) to compare it with the return of a financial asset or security. Among the studies are these models for comparing performance in a variety of contexts. The most important of these models are the following:

- Market-adjusted returns model

This form can be used as follows:

$$AR_{it} = r_{it} - r_{Mt} \qquad (1)$$

This return (Rmt) is susceptible to statistical and economic biases that do not provide the required accuracy in measuring the unexpected or unusual return, resulting in misleading results when evaluating long-term stock returns. The average return is the rate of return during the appreciation period (EP), so that each stock in the sample can use the rate of return during EP as its expected return (Brown and Warner, 1985; Lambertides, 2009). The expected return is the market return (Rm, t) in the same time period, assuming that all stocks on average generate the same rate of return (Ritter, 1991; Bruner, 1999; Weber, et al., 2008). The use of market-adjusted returns does not require an EP.

- Market model

The most common expected return model is the market model. It is based on a reference market's actual returns and the correlation of the firm's stock to the reference market. Formally, the model is described in equation (2). AR on a specific day within the event window is the difference between the actual stock return (rit) on that day and the normal return, which is predicted based on two inputs: the typical relationship between the firm's stock and its reference index (expressed by the and parameters), and the actual return of the reference market (Rm, t):

$$AR_{i,t} = r_{i,t} - \left(\alpha_i + \beta_i R_{m,t}\right) + \varepsilon_{i,t} \qquad (2)$$

where r_{it} and Rmt represent the return on the security and the return on the market portfolio, respectively. The two parameters of the model can be estimated from the data covering TP. The market model is probably the most commonly used option as a benchmark for comparison between the return of a security and the expected return in the literature for the study of financial economics. They are estimated using the least squares regression equation (OLS) over EP. This method is used to control the relationship between stock returns and market returns; it allows for a change in the risks associated with the selected stocks under study. The adjusted market return model was used in several studies before the event, such as Small, et al. (2007) and Homan (2006).

- Capital Asset Pricing Model (CAPM)

When using the CAPM model, the expected return consists of the risk-free return (Rft) plus the market risk premium (Espenlaub, et al., 2000) and the model's "beta" measures the risk of stock i assuming that the investor requires a higher return to compensate for greater risk. Several event studies have applied the Capital Asset Pricing Theory (CAPM) as a benchmark for comparing the real return of a financial asset and the expected return.

$$AR^{CAPM} = R_{i,t} - \left[R_{f,t} + \beta_i(R_{m,t} - R_{f,t})\right] \quad (3)$$

where (R_i) represents the actual return, R_f the risk-free return, and (R_m) the expected return of the market portfolio.

- Fama-French three-factor model (FF3F)

One of the models that have been used in previous studies to estimate the unusual return is this model, which is a modified version of the FF model. It includes more risk factors, such as the market return factor $(Rm,t - Rf,t)$, the volume factor, which represents the difference between the rate of return of a portfolio of small and large stocks, and the book value factor to market value, which represents the difference in the rate of return between portfolios with high book value ratios. The market and its low ratios (Fama and French, 1993). This method uses the monthly returns over the length of the time period under study, and it can be applied similarly to the CAPM theory, as it has been widely used in the literature of previous studies (Barber and Lyon, 1997; Loughran and Ritter, 1995; Dutta and Jog. 2009). The model can be described as follows:

$$FF^{AR}{}_{i,t} = R_{it} - [\, R_{ft} + \beta^{ff} (\, R_{mt} - R_{ft}\,) + S^{ff}{}_i SMB_t + hi^{ff} HML_t \quad (4)$$

- Reference portfolio

The expected return according to this method is the return of a reference portfolio consisting of a large number of shares, classified on the basis of the following criteria: volume, the ratio of book value to market value, or both. To calculate this reference expected return, there is no need for an EP, as all companies are classified into different groups depending on certain characteristics. For example, companies are categorized into 10 groups of different sizes, and then the average return on all shares in each group is calculated. It is considered as an expected return for the reference portfolio (Ritter, 1991; Barber and Lyon, 1997).

$$AR^{p}_{i,t} = R_{i,t} - R_{p,t} \quad (5)$$

- Matched firm approach (MF)

Similar to the practice of using a portfolio's return as an expected return, this return is assumed to be the same as the return for a similar company during the testing period. The matching process is carried out on the basis of the relevant risk characteristics, matching them with shares not included in the event, and among the characteristics that can be adopted are the size (market value of shares), the ratio of book value to market value, or both. AR in this model is calculated as the difference between the return of the security in the sample and the return of the security of a similar company in the financial market that has not been exposed to the same financial event. To reach an accurate level in calculating the difference, there are several limitations that must be taken into account in a similar company in terms of matching in the level of volume as well as in the level of industry. The return of a large sample cannot be compared with the return of a small sample, even in the same sector or industry.

$$AR_{MF} = R_{it} - R_{MF} \quad (6)$$

Step 4: Measure the abnormal performance of financial assets.

At this stage, AR is calculated for each share in the sample, which is the difference between the real

(actual) return in time (t in the event window) and the expected return on the share, E(Ri,t):

Abnormal Return = Actual Return − Normal Return

$$AR_{i\tau} = R_{i\tau} - E(R_{i\tau}) \quad (7)$$

where $AR_{i\tau}$ represents AR of a financial asset or security during the period of time τ, $R_{i\tau}$ represents the real return of a financial asset or security during the time period τ, and $E(R_{i\tau})$ represents the normal return on a financial asset or security during the period of time τ.

After the unexpected or abnormal return is calculated about the event date for the sample of companies under study using the appropriate form to compare the return with the return of the general index of the financial market or the reference, the unexpected return is collected (aggregate ARs) either using the BHAR method or applying the CAR methodology, and the research will address both methods in detail later with a practical application. After that, the level of statistical significance is tested and the results are interpreted accordingly. At this stage, AR is calculated for each share in the sample, which is the difference between the real (actual) return in time (t) in the event window and the expected return on the share, $E(Ri,t)$.

Step 5: Statistical test: The researcher will test the strength of the statistical test according to the indicator used and compare it with the unusual return that was calculated according to what was clarified in the methodology of the study of the event. Therefore, certain formulas will be employed, which the researcher will use to calculate the results of the statistical test.

7 Models of aggregation and benchmarks

In this study, the researcher used three reference criteria and compared each of these criteria with the IPO yield to calculate AR, and then calculated the aggregation model for each comparison to determine the degree of sensitivity of the standard and aggregate models to ARs in the long term. The researcher chose these criteria because they are appropriate and have not been employed before in the Jordanian market, in addition to the fact that the data needed by these criteria is available. Below is a discussion of these criteria and the collected models for further clarification.

7.1 The Capital Asset Pricing Model (CAPM)

According to this benchmark, the researcher will make some statistical calculations before using it because of the nature of this benchmark that requires it; so, the following must be done. First, calculate the monthly return of the IPO companies during the study period R_{it}. Second, calculate the risk-free monthly rate of return (Rft), which represents the returns of treasury bonds in the Ministry of Finance and the Central Bank based on a number of issues. Third, calculate the monthly value of return as it varies from month to month and depends on the return of the public offering (R_{it}) and the market return (R_{mt}), calculating the monthly market return during the study period (R_{mt}) represented by the general index of the Amman Stock Exchange weighted by value. Finally, the appropriate formula for calculating AR according to this benchmark will be as follows: $\mathrm{AR}^{\mathrm{CAPM}} = R_{it} - [R_{Ft} + \beta(R_{mt} - R_{Ft})]$, (Espenlaub and Gregory, 2000), where R_{it} represents the monthly return of each firm belonging to the study sample in the month of the event, R_{mt} represents the monthly return of the market and can be measured by measuring the return of the Amman Stock Exchange Index (ASEI) in the month of the event, and β represents the beta model and can be estimated.

7.2 MF Model

According to this model, each IPO company matches every existing company that is in the market and has the same market value (same size), same age, or both belong to the same sector. This model uses MFs as a benchmark for measuring ARs. The researcher will first keep track of companies that have already entered the market and have the same IPO company size, particularly if they both have the same age and are in the same industry, before making a comparison. The following formula will be used to calculate AR in accordance with this reference standard:

$AR^{MF} = R_{it} - R_{MF}$, (Ritter, 1991), where R_{it} represents the monthly return of each firm belonging to the study sample in the month of the event and R_{st} represents the monthly return of the portfolio, so that it is built from all companies in the market of similar size to the company that belongs to the study sample. The average monthly return of the portfolio is calculated and compared to the average monthly return of the sample under study.

7.3 Amman Stock Exchange Index (ASEI)

The third benchmark used in this study is ASEI, which is represented by the general index weighted by market value.

According to this benchmark, a comparison will be made between the companies listed on the stock exchange and ASEI itself. Finally, the appropriate formula for calculating AR according to this measure would be $AR^{ASEI} = R_{it} - R_{mt}$, where R_{it} represents the monthly return of each firm in the study sample during the event month. The market return in the month of the event is represented by *t*.

8 The aggregated models

When analyzing long-run returns, there is undoubtedly a need for a model that quantifies AR. The market-adjusted return model has been widely used in recent research on calculating AR for IPOs. This model directly measures AR, as shown below:

$$AR_{it} = r_{it} - r_{Bt} \quad (8)$$

That is, AR is the result of subtracting the monthly return per share (IPO) (r_{it}) from the return on the benchmark (r_{Bt}) during a certain period, based on a specified criteria used to estimate abnormal return.

8.1 Model 1: CAR

According to Ritter (1991), the earning per share (EPS) adjusted benchmark (i) in event month *t* can be calculated by measuring the difference in return between the sample earnings per share and the benchmark return in the same event month *t*.

$$AR_{it} = r_{it} - r_{Bt} \quad (9)$$

where AR_{it} represents a firm's abnormal return in the month of event *t*, r_{it}it is the rate of return for company *i* in the month of the event *t*, and r_{Bt} represents the rate of return for the benchmark used and for the time period corresponding to the company's return in the month of the event.

The rate of return can be measured as follows:

$$r_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}} \quad (10)$$

where r_{it} represents the rate of return for company *i* in the month of the event *t*, P_{it} is the closing price of a share in the event month, and P_{it-1} is the closing price of share *i* in event month *t*– 1 and is denoted by P_{it-1}. AR can be calculated as follows:

$$AAR_t = \frac{1}{n}\sum_{t=1}^{nt} AR_{it} \quad (11)$$

where AAR_t is the arithmetic-weighted average of AR in the event period and *n* represents the number of firms belonging to the study sample in the month of the event.

Therefore, CAR is calculated as

$$\text{CAR} = \sum_{t=1}^{t} \text{AR}_t \quad (12)$$

where CAR is from t=1 to month t. If the result shows a positive trend, it means that the performance of the sample is better than the performance of the chosen benchmark.

8.2 Model 2: BHAR

The compound return is determined as follows when this technique is employed to determine AR for a firm i:

$$\prod_t^T (1 + r_{it}) - 1 \quad (13)$$

where $\text{BHR}_{i,t}$ represents the measure of return by buying and holding stock i over time t, r_{it} represents

the monthly return of firm i in the month of the event t, t represents the first month, and, T represents the end of the event period. AR is measured according to this strategy by calculating the difference between

Table 2. Models and test statistics used in literature for event study methodologies (*Source:* eventstudytools.com)

Models	Test statistics	Other features
• Market model • Market adjusted • Comparison period mean adjusted • Capital Asset Pricing Model (CAPM) • Fama–French 3-factor model • Fama–French–momentum 4-factor model • Fama–French 5-factor model	• T test • Cross-sectional T • Crude dependence adjustment T • Patell Z • Adjusted Patell Z • BMP/standardized cross-sectional test • Adjusted standardized cross-sectional test • Skewness corrected • Rank Z • Generalized rank Z • Generalized rank T • Sign Z • Generalized sign Z • Wilcoxon	• Automatic non-trading day adjustments • Choice between simple and log returns • Optional data file creation service

the compound return for the share i over the time period t and the compound return for the benchmark in the same time period as shown below (Levis, 1993; Ritter, 1991):

$$\mathrm{BHR}_{i,t} = [\prod_t^T (1 + r_{it}) - 1] - [\prod_t^T (1 + r_{BM}) - 1] \quad (14)$$

where r_{it} represents the monthly buy-and-hold return of company i in the month of event t and r_{BM} represents the monthly buy-and-hold return of the benchmark (ASEI) corresponding to the event month t. Also, the cumulative abnormal buy-and-hold return for a number of shares (n) can be calculated as follows:

$$\overline{BHAR}_{i,t} = \frac{1}{n}\left[\sum_{t-1}^{n}(BHAR_{i,t})\right] \quad (15)$$

Table 2 summarizes the most important models that are used in financial event studies, as well as the statistical tests used to detect the power of inference tests.

8.3 The strengths and weaknesses of event study methodology

The advantage of adopting event study technique is that when using security prices, the projected consequences of the event are instantly reflected in security prices. It has a strong and straightforward design and is capable of identifying abnormal performance. Also, it can be used in less-than-ideal circumstances and is more accurate than accounting-based measures. It is regarded as a neutral assessment of investment risk and return.

On the other hand, the drawbacks of the event study methodology can be summed up in the following way. First, it is difficult to determine the potential implications because the fundamental presuppositions are unclear. Also, the results are impacted by independent events as well as unanticipated events. Moreover, it makes use of ARs, a measure of a firm's performance that is only partially accurate, and it necessitates up-to-date cause-and-effect knowledge. Furthermore, choosing a sample is difficult because it calls for the identification of ARs. The market must be efficient, which is a crucial condition, since it only explains the impact on abnormal returns (AR).

9 Long-term abnormal performance of Jordanian IPOs: Empirical analysis

The purpose of this study is to use the financial event study methodology by measuring ARs of the IPO companies in the Amman Stock Exchange, bearing in mind that the ongoing public offering process itself is an influential financial event in the market. This is because

it is crucial to test the various formulas for event study methodology in practice. After these businesses have been listed for 3 years, their returns are monitored; in cases where a sample of these businesses is involved in the event, the date of the event is established, and the return is then calculated from the date of listing and compared to the financial indicators, some of which represent the Amman Stock Exchange's general index and the other was created using techniques for analyzing the event and theories that had already been established in the body of previous literature on the topic. Companies frequently decide to raise money through public offerings, also known as IPOs, when they need to do so. A company can raise the capital it requires through IPOs by selling stock to the general public for the first time. The money raised through an IPO can be used by the company for working capital, debt repayment, or future expansion. There are numerous perceptions that could be used to explain how IPOs perform over time, first, from the perspective of an investor, the existence of price patterns may present opportunities for active trading strategies to produce higher returns. Second, the ability of the IPO market to provide accurate information is called into question by the possibility of achieving abnormal (non-zero) performance profits after the sale. It supports the idea that rumors have an impact on market prices, and that this is true for both the general stock market and the IPO market in particular. Third, there are noticeable changes in the volume of IPOs over time (Ritter, 1991).

9.1 Sample selection

The study sample is representing the listed public offering companies which traded in Amman bourse during the period starting from Jan 2018 and extending to Jan 2022. The total number of companies with an IPO as an initial sample that completed the study period is 115 firms. We excluded companies that have changed their legal status from limited liability to going public (15), and we also removed companies that have been privatized (10), and thus, the subtotal is 90. Also, we excluded private placement companies (30), so the final study sample was 60.

9.2 Research hypotheses

By determining whether there is a difference in ARs, CARs, and BHAR when a specific benchmark is used, all these hypotheses will be tested through the use of certain tests at a 5% level of significance.

H01: The long-term AR is not significantly different from zero once ASEI is employed as a benchmark.

H02: The long-term CAR is not significantly different from zero once ASEI is employed as a benchmark.

H03: The long-term BHAR is not significantly different from zero once ASEI is employed as a benchmark.

H04: The long-term AR is not significantly different from zero once MF is employed as a benchmark.

H05: The long-term CAR is not significantly different from zero once MF is employed as a benchmark.

H06: The long-term BHAR is not significantly different from zero once MF is employed as a benchmark.

H07: The long-term AR is not significantly different from zero once the FF3F model is employed as a benchmark.

H08: The long-term CAR is not significantly different from zero once the FF3F model is employed as a benchmark.

H09: The long-term BHAR is not significantly different from zero once the FF3F model is employed as a benchmark.

9.3 Statistical hypothesis testing

In this study, there are three benchmarks that were used as indicators to compare the performance of each company in the sample. So, this study will develop the following null hypotheses according to the reference scale.

9.4 Test the significance of AR

After calculating AR using ASEI, MF, and FF3F as benchmarks, the parametric test “one-sample t-test” is used to test if AR differs from zero at the level of statistical significance ($\alpha = 5\%$) (the null hypotheses test H01, H04, H07) as follows.

After the CAR and BHAR values are calculated using the benchmarks ASEI and FF3F, the skewness-adjusted *t*-test was performed to test these hypotheses to determine whether the cumulative abnormal average return and the abnormal buy-and-hold return (CAR, BHAR) were different from zero when using certain benchmarks. The skewness-adjusted *t*-test, introduced by Hall (1992), corrects the cross-sectional *t*-test for a (possibly) skewed AR distribution. This test is applicable for averaged AR $(H0: E(\mathrm{AAR}) = 0)$, the cumulative averaged AR $(H0: E(\mathrm{CAAR}) = 0)$, and the averaged BHAR $(H0: E(\mathrm{ABHAR}) = 0)$. In what follows, we will focus on cumulative averaged ARs. First, recall the (unbiased) cross-sectional sample variance:

$$S^2_{\mathrm{CAAR}} = \frac{1}{N-1}\sum_{i=1}^{N}(\mathrm{CAR}_i - \mathrm{CAAR})^2 \qquad (16)$$

Next, the (unbiased) sample skewness is given by

$$\gamma = \frac{N}{(N-2)(N-1)}\sum_{i=1}^{N}(\mathrm{CAR}_i - \mathrm{CAAR})^3\, S^{-3}_{\mathrm{CAAR}} \qquad (17)$$

Finally, let

$$t_{\mathrm{skew}} = \sqrt{N}(S + \tfrac{1}{3}\gamma S^3 + \tfrac{1}{6N}\gamma) \qquad (18)$$

The skewness-adjusted test statistics for BHAR can also be represented as follows:

$$S^2_{\mathrm{ABHAR}} = \frac{1}{N-1}\sum_{i=1}^{N}(\mathrm{BHAR}_i - \mathrm{ABHAR})^2 \qquad (19)$$

The (unbiased) sample skewness is given by

$$\gamma = \frac{N}{(N-2)(N-1)}\sum_{i=1}^{N}(\mathrm{BHAR}_i - \mathrm{ABHAR})^3\, S^{-3}_{\mathrm{ABHAR}} \qquad (20)$$

Let

$$S = \frac{\mathrm{ABHAR}}{S_{\mathrm{ABHAR}}} \qquad (21)$$

Then the skewness-adjusted test statistic for ABHAR is given by

$$t_{\mathrm{skew}} = \sqrt{N}(S + \tfrac{1}{3}\gamma S^3 + \tfrac{1}{6N}\gamma) \qquad (22)$$

10 Empirical analysis results

Whether the return is estimated using the FF3F model or the return of the ASEI model, the monthly returns of the shares of the IPO companies are calculated along with the monthly returns for each reference index (benchmark). The long-term performance of the stock is then examined for the companies included in the study sample after the calculation of AR, cumulative extraordinary return (CAR), and holding period return (BHAR).

We should review some descriptive statistics using the three aggregation models employed in this study (BHAR, CAR, and AR) before beginning to analyze the financial event represented by the long-term performance of the Jordanian IPO. See Table 3 for a description of this descriptive statistic for the study sample, which spans a full 48 months from the start of listing and consists of 60 companies.

In Table 3, panel A, we observe that the mean values of AR, CAR, and BHAR are -0.00466, -0.0743, and - 0.2879 and the median values are -0.004, -0.065, and -0.087, respectively. They belong to values ranging between the minimum value of -0.765 for BHAR with a standard deviation of 0.476 and the maximum value of return achieved by AR (0.004), followed by CAR (0.002), and then lastly, we find that BHAR showed the worst performance of -0.007. In panel B, when the FF3F model is employed as a benchmark, we find that the average AR is -0.00987, while CAR for the whole period is -0.12845 and the average BHAR is -0.15709, which is the worst compared to the previous two aggregated models. When using the MF approach, the descriptive statistics are shown in panel C. CAR over the sample period is -0.0785, which is better than the performance of FF3F as a benchmark, while the performance of BHAR is the worst among the other models.

.

Table 3. Descriptive statistic of the study sample
(*Source:* Author's own research)

	No. of months	Mean	Median	Std. deviation	Minimum	Maximum
Benchmark A: ASEI model						
AR	48	–0.00466	–0.004	0.00843	–0.023	0.004
CAR	48	–0.0743	–0.065	0.02659	–0.105	0.002
BHAR	48	–0.2879	–0.087	0.47632	–0.765	–0.007
Benchmark B: FF3F model						
AR	48	–0.00987	–0.0906	0.009065	–0.018	0.037
CAR	48	–0.12845	–0.1356	0.150986	–0.280	0.047
BHAR	48	–0.15709	–0.0678	0.169874	–0.290	–0.027
Benchmark C: Matching Firm (MF) model						
AR	48	–0.00526	–0.013	0.006123	–0.055	0.022
CAR	48	–0.07853	–0.042	0.065430	–0.149	0.018
BHAR	48	–0.45789	–0.076	0.664091	–0.746	–0.009

Table 4. AR, CAR, and BHAR when using ASEI as a benchmark
(*Source:* Author's own research)

Month	AR	CAR	BHAR
1	0.0372	0.0217	–0.2122
6	–0.0065	0.0183	–0.2818
12	–0.0089	–0.0173	–0.2649
18	–0.0038	–0.1923	–0.2910
24	–0.0194	–0.2176	–0.3570
30	–0.0172	–0.2587	–0.3890
36	–0.0190	–0.3287	–0.4255
42	–0.0256	–0.3834	–0.5352
48	–0.0289	–0.4218	–0.6388

Table 5. AR, CAR, and BHAR when using FF3F model as a benchmark
(*Source:* Author's own research)

Month	AR%	CAR%	BHAR%
1	0.0017	0.0018	–0.0252
6	–0.0031	–0.0606	–0.0422
12	–0.0026	–0.0702	–0.0482
18	–0.0016	–0.0813	–0.0592
24	–0.0051	–0.0925	–0.0512
30	–0.0025	–0.1037	–0.0522
36	–0.0002	–0.1215	–0.0572
42	0.0024	–0.1253	–0.0632
48	0.0031	–0.01453	–0.0663

10.1 Long-term performance of the Jordanian IPO

The analysis of the long-term performance of the Jordanian IPO companies depends on the benchmark employed for this purpose. So, this study will present the results of these benchmarks as shown below.

10.2 First benchmark: ASEI model

AR, CAR, and BHAR have all been calculated by the researcher using this benchmark. See Table 4 for a breakdown of these values over a given time period.

We find in the table that AR is positive after 6 months of trading, then the performance begins to decline gradually from the first year to the fourth, and this result is consistent with previous literature regarding this phenomenon. But there is a clear discrepancy in performance between the three measures used to judge the performance of companies, to be precise, AR, CAR, and BHAR. When looking at the results, we find that the worst performance was by the buy-and-hold strategy, followed by the CAR strategy.

10.3 Second benchmark: FF3F model

FF3F is the second benchmark employed in this study to assess the long-term performance of Jordanian IPOs. The results and values of AR, CAR, and BHAR for specific time window using this approach are presented in Table 5.

In Table 5, the general performance of the IPO companies in the Amman Stock Exchange after a month of general trading appears less than the standard index by about 0.017%, which represents the value of AR after a month of trading. It is noted that the poor performance continues at the end of the first year till the fourth year (0.26%, 0.51%, 0.02%, and 0.31%, respectively). We can notice that the performance has improved at the final year of TP, while it is highly volatile during the middle period (second and third) of the testing event window. When comparing the performance to another benchmark, for example, BHAR, it is noted that there is also a negative AR after the first month of trading (2.52%). The level of poor performance increases to 4.22%, 4.82%, 5.12%, and 6.63% at the end of 6 months, the end of the first year, and till the fourth year, respectively. This weak performance extends throughout the period and increases gradually until it reaches the last year of the tested period.

10.4 Third benchmark: MF model

Table 6 shows the abnormal monthly return of the study sample when we use the MF model as a benchmark for comparison. It is known that when using this model, we choose the matched firm for each company in the sample according to certain characteristics such as size, sector, and age of the company. The difference between the monthly return of each firm in the sample and the return of MF in the market is then calculated. The researcher calculated the monthly return of the matching companies during the study period and then calculated AR, CAR, and BHAR for this benchmark. See Table 6 which sheds light on these values from 1 to 4 years after listing.

In Table 6, we notice that after 1 month of trading, the accumulated AR was 0.043%, and it jumped to 3.25% at the end of the first year of trading. Then the level of poor performance rose to 5.27%, 11.37%, and 18.52% during the following years, respectively. While the value of AR according to the BHAR strategy after 6 months of trading was 3.66%, it increased to 5.47%) at the end of the first year of trading, and then the level of poor performance rose again during the following years to 6.27%, 75.64%, and 82.27%, respectively. In total, it can be said that using this benchmark, the performance of Jordanian companies (IPO) was lower than the corresponding companies by about CAR 18.37% and BHAR 82.52%. This also gives further evidence for the finding that the long-term results of the IPO performance as an event in the market are consistent with what have been documented in previous studies.

10.5 Parametric T-test

It should be noted that the parametric test is used to determine whether the null hypothesis – that the average

AR is significantly different from zero – is correct (Erikson, 2008).

10.5.1 One sample T-test

In this study, the researcher used one-sample T-test to determine if there is a difference in AR (null hypothesis H01, H02, H03) using three benchmarks. See Table 7 which summarizes the results of the T-test for AR.

Panel A of Table 7 shows the abnormal average return (AR) when using ASEI as a reference benchmark. Existing evidence indicates that this measure is different from zero (0.008). It has been proven that this difference is statistically significant for AR, as the value of P (0.00), at a significant level (5%). Therefore, the null hypothesis that the difference in the mean of the sample from zero is rejected due to the value of P, which hand, as noted in panel B, it appears that the abnormal is less than 5%, since the difference is large. Thus, the null hypothesis (H01) is rejected. On the other average return (AR) using MFs as a second metric differs from zero as well (0.0031). In fact, this difference has been proven statistically for ARs that have a P-value 0.012 at the 5% level of significance. Therefore, the null hypothesis that the difference in the sample mean from zero is rejected due to the P-value of less than 5%, since the difference is large. Hence, the null hypothesis (H02) is rejected. Finally, panel C of the same table shows that the abnormal average return (AR) when using FF3F as the third and final benchmark differs from zero (-0.0034). Also, this difference is approved for AR with a P-value of 0.048 at the level of statistical significance 5%. The null hypothesis about the difference in the sample mean from zero due to a P-value of less than 5% is rejected. Thus, the null hypothesis (H03) is rejected.

Table 6. AR, CAR, and BHAR when using Matching Firm model (MF) as a benchmark
(*Source:* Author's own research)

Month	AR%	CAR%	BHAR%
1	0.00394	0.00434	–0.00366
6	0.00034	–0.02576	–0.04566
12	0.00034	–0.03256	–0.05466
18	–0.00046	–0.04196	–0.05266
24	–0.00106	–0.05276	–0.06266
30	–0.00216	–0.10406	–0.33026
36	–0.00306	–0.11316	–0.75646
42	–0.00336	–0.15736	–0.79406
48	–0.00396	–0.18516	–0.82226

Table 7. One-sample statistics and t-test for AR
(*Source:* Author's own research)

Panel A: Amman Stock Exchange Index (ASEI)						
AR	*N*	Mean	Std. dev.	df	**t-statistic**	P-value
	48	–0.0095	0.00763	47	–4.246	0.0000*
Panel B: Matching Firm (MF)						
AR	*N*	Mean	Std. dev.	df	**t-statistic**	P-value
	48	–0.0057	0.00629	47	–3.76	0.023**
Panel C: FF3F model						
AR	*N*	Mean	Std. dev.	df	**t-statistic**	P-value
	48	–0.0048	0.00953	47	–3.051	0.037**

11 Long-term performance analysis

The main goal of this study is to analyze the financial performance of a sample of companies that are listed in ASE as IPOs based on CAR and by BHAR.

To do this, we will use a technique developed by Barber and Lyon (1997) to compare the expected return in two different ways (CAR, BHAR), as well as the skewness-adjusted t-test. By examining the outcomes of both methods and the long-term performance of the IPO firms, the researcher will discuss both approaches.

12 Empirical analysis results

The analysis must rely on the outcome of each measure to be used as a source for hypothesis testing to test the level of significance of AR for both methods (CAR, BHAR) and ascertain whether there are differences between them when using any of the three benchmarks (ASEI, MF, FF3F).

Table 8. Skewness-adjusted t-test when ASEI is employed
(*Source:* Author's own research)

Panel A: Cumulative abnormal return (CAR)						
	N	Event window	Mean	Std. dev.	Skewness-adjusted t-test	
		Month			Value	Probability
CAR	60	1	0.01745	0.0653	2.583	0.000*
	60	6	0.0356	0.0863	4.876	0.000*
	57	12	–0.0253	0.0674	–4.345	0.000*
	52	24	–0.0186	0.0872	–5.201	0.000*
	48	36	–0.0232	0.0765	–4.934	0.001*
	45	48	–0.0393	0.0654	–3.682	0.010*
Panel B: Buy-and-hold abnormal return (BHAR)						
	N	Event window	Mean	Std. dev.	Skewness-adjusted t-test	
		month			Value	Probability
BHAR	60	1	–0.0342	0.0854	–2.198	0.004*
	60	6	–0.0365	0.0574	–2.634	0.006*
	57	12	–0.0426	0.0986	–2.483	0.009*
	52	24	–0.0454	0.0793	–2.089	0.003*
	48	36	–0.0489	0.0845	–2.762	0.007*
	45	48	–0.0559	0.0949	–2.438	0.005*

Table 9. Skewness-adjusted t-test when MF benchmark is employed
(*Source:* Author's own research)

Panel A: Cumulative Abnormal Return (CAR)						
	N	Event window	Mean	Std. dev.	Skewness-adjusted	
					Value	Probability
CAR	60	1	0.0348	0.5387	0.345	0.545
	60	6	–0.0217	0.5487	–0.254	0.765
	57	12	–0.0276	0.6742	–0.194	0.798
	52	24	–0.0354	0.6198	–0.543	0.802
	48	36	–0.0375	0.7342	–0.587	0.823
	45	48	–0.0403	0.7432	–0.687	0.837
Panel B: Buy-and-Hold Abnormal Return (BHAR)						
	N	Event window	Mean	Std. dev.	Skewness-adjusted	
					Value	Probability
BHAR	60	1	–0.0438	0.5398	–1.453	0.156
	60	6	–0.0563	0.4329	–1.209	0.196
	57	12	–0.0597	0.4034	–1.438	0.065
	52	24	–0.0632	0.5932	–1.621	0.145
	48	36	–0.0698	0.6109	–0.954	0.117
	45	48	–0.7046	0.6543	–0.974	0.146

12.1 First benchmark: ASEI

Following the T-test and determination of the P-value through various time windows, use of the ASE index as a benchmark was analyzed and the results are shown in Table 8.

The results of the statistical test (skewness-adjusted t-test) using ASEI as a benchmark for different periods of time depending on the CAR method and BHAR are presented in Table 8.

CARs for the various event windows are different from zero, as shown in table 8 panel A. The P-value at 5% level of significance indicated that these differences were statistically significant. Since the P-values are below the power level of the statistical test (5%), the null hypothesis regarding the difference of (CAR) is rejected using this benchmark (H02). On the other hand, BHAR is seen in panel B of the same table as being different from zero. P-values are used to statistically demonstrate these differences. Using this standard, the null hypothesis (H03) regarding BHAR differences is rejected at the 5% level of statistical test power. The benchmark selection will highlight the differences between CARs and BHARs techniques. This finding can be explained by the market capitalization of the largest listed corporations, which has a significant influence on how index values are processed; it is a skewed indication of these companies, Lyon, Barber and Tsia (1999).

12.2 Second benchmark: MF model

After computing the skewness-adjusted t-test and P-values for various time periods, MF was used as a second benchmark in the study to test several hypotheses (H06, H07, and H08) and Table 9 displays the empirical results of the same.

The results of the statistical test (skewness-adjusted t-test) using the MF approach as a benchmark for different periods of time depending on the CAR method and the BHAR method are presented in Table 9.

CAR during the event period deviates from zero, as shown in panel A of Table 9. Consequently, at the 5% level of significance, the null hypothesis is accepted that the difference in returns (CAR) is acceptable using this benchmark (H06) because the P-values exceed the threshold of statistical significance (5%) for these differences. Also, BHAR, as seen in panel B, seems to deviate from zero. The null hypothesis (H07) regarding the differences in BHAR returns is accepted using this benchmark because of the P-values that exceed 5%, even though these differences are not statistically proven according to the P-value.

12.3 Third benchmark: FF3F

Table 10 shows the empirical results of using FF3F as a benchmark, which is the last one used in this study to test the hypotheses (H07, H08, H09) after calculating skewness-adjusted test and P-values under different event windows.

Statistical test results (skewness-adjusted test) using FF3F as a benchmark employed for different periods depending on the CAR method and BHAR are presented in Table 10.

Panel A of Table 10 shows that CARs during the event period are different from zero. These differences were not statistically proven according to the t-statistic and P-values at 5% level of significance. So, the null hypothesis that the results of CAR differ from zero using this benchmark (H09) is accepted due to the P-values exceeding the level of significance (5%). On the other hand, as shown in panel B, the abnormal BHAR appears to be respectively different from zero as well. In fact, these differences have not been proven statistically according to t-statistics. Therefore, the null hypothesis is accepted since the (BHAR) outcomes is different from zero, at 5% level of significance.

13 Conclusion

The results of this study are in agreement with the results of many previous studies regarding the poor long-term performance of IPOs (e.g., Ritter, 1991; Levis, 1993; Loughran and Ritter, 1995; and Drobetz, et al., 2005) and numerous studies that discussed the performance of IPOs in the long term. The study provides more evidence for the poor performance of the phenomenon of public offerings in the long term, given that the level of performance of the initial subscription varies according to the benchmark index (Espenlaub and Gregory, 2000).

Based on this study's findings, which were for a sample of 60 companies that had made IPOs on the Amman Stock Exchange during the time period covered above, ASEI performed poorly compared to other indices over the period of the following 48 months. The results showed that the performance weakness reached 42.22% (CAR) and 63.88% (BHAR) when using ASEI as a benchmark. Also, poor performance was shown when FF3F model was used as a benchmark. The performance decline was 1.45% when using the CAR aggregation model and 6.63% when using the aggregative method (BHAR) after 48 months following listing. However, when the third benchmark was employed, the poor long-run performance reached 18.52% and 82.23% when CAR and BHAR were employed as aggregated models, respectively.

This study discussed the idea of using an event study methodology to examine the financial and economic events and their significance in assessing companies' performance in the long term, demonstrating the theoretical aspect by reviewing the models and the common financial and economic tools that can be used.

Table 10. Skewness-adjusted t-test when FF3F benchmark is employed
(*Source:* Author's own research)

Panel A: Cumulative Abnormal Return (CAR)						
	N	Event window	Mean	Std. dev.	Skewness-adjusted test statistics	
					Value	**Probability**
CAR	60	1	0.0310	0.1872	1.342	0.804
	60	6	–0.0106	0.1183	–1.128	0.073***
	57	12	–0.0189	0.1409	–1.501	0.100***
	52	24	–0.0264	0.1865	–1.809	0.061***
	48	36	–0.0329	0.2165	–1.703	0.069***
	45	48	–0.0358	0.2360	–1.648	0.073***
Panel B: Buy-and-Hold Abnormal Return (BHAR)						
	N	Event window	Mean	Std. dev.	Skewness-adjusted test statistics	
					Value	**Probability**
BHAR	60	1	–0.0863	0.8375	–1.295	0.087***
	60	6	–0.0801	0.6429	–1.571	0.094***
	57	12	–0.0697	0.4385	–1.604	0.045**
	52	24	–0.0954	0.6241	–1.783	0.050**
	48	36	–0.1058	0.7410	–1.301	0.075***
	45	48	–0.1164	0.8642	–1.542	0.075***

Table 11. Summary of null hypothesis testing
(*Source:* Author's own research)

First benchmark: Amman Stock Exchange Index (ASEI)	Null hypothesis	Result
AR	(H01: AR = 0, when ASEI is a benchmark)	Rejected
CAR	(H02: CAR = 0, when ASEI is a benchmark)	Rejected
BHAR	(H03: BHAR = 0, when ASEI is a benchmark)	Rejected
Second benchmark: Matching Firm approach (MF)	Null hypothesis	Result
AR	(H04: AR = 0, when MF is a benchmark)	Rejected
CAR	(H05: CAR =0, when MF is a benchmark)	Accepted
BHAR	(H06: BHAR = 0, when MF is a benchmark)	Accepted

Third benchmark: FF3F model	Null hypothesis	Result
AR	(H07: AR = 0, when FF3F is a benchmark)	Rejected
CAR	(H08: CAR = 0, when FF3F is a benchmark)	Accepted
BHAR	(H09: BHAR = 0, when FF3F is a benchmark)	Accepted

to assess the market performance of a sample of companies fairly. The strength of these models was also statistically tested to expose the extent to which they could be used to explain the performance of the listed firms. In general, research on financial and economic events demonstrates that stock prices in developed markets change in response to newly disclosed information, both in the long and short term. We anticipate that the method of analyzing economic and financial events will continue to be a highly useful resource in the fields of finance and economics.

Finally, multivariate regressions show that some performance indicators, such as asset turnover and return on equity, are negatively correlated with long-term returns. These two metrics serve as equity and asset efficiency indicators. The more a firm underperforms its pricing over the next 3 years, the higher its asset and equity efficiency was in the year of its IPO. A significant negative relationship between long-term returns and the hot period dummy variable is also shown by multiple regressions, demonstrating that hot issue IPOs underperform more over the long term. The same models highlight the association between proceeds and long-term anomalous returns.

The long-term implications of IPOs on issuing corporations are the focus of this study, which intends to assist investors in making more informed decisions about the equity holdings in their portfolios. Also, it can assist regulators in formulating equity market-related policy. This data makes it possible to more accurately estimate long-term IPO results and better plan the timing of IPOs. In-depth investigation into the causes of the simultaneous underperformance of price and operations is possible.

14 References

[1] Adnan, A., Hossain, A., Adnan, A., Hossain, A., 2016. Impact of M&A announcement on acquiring and target firm's stock price: An event analysis approach. *International Journal of Finance and Accounting*, No. 5(5), pp.228-232.

[2] Aktas, N., de Bodt, E., Cousin, J.-G., 2007. Event studies with a contaminated estimation period. *Journal of Corporate Finance*, No.13(1), pp.129-145. https://doi.org/10.1016/j.jcorpfin.2006.09.001

[3] A. Craig MacKinlay, 1997. Event Studies in Economics and Finance, *Journal of Economic Literature,* 1997, vol. 35, Issue 1, pp.13-39.

[4] Barber, B.M., Lyon, J.D., 1997. Detecting long-run abnormal stock returns: The empirical power and specification of test statistics. *Journal of Financial Economics,* No. 43, pp.341-372.

[5] Binder, J., 1998. The event study methodology since 1969. *Review of Quantitative Finance and Accounting*, No. 11(2), pp.111-137. https://doi.org/10.1023/A:1008295500105

[6] Brown, S.J., Warner, J. B., 1980. Measuring security price performance. *Journal of Financial Economics,* No. 8, pp.205-258.

[7] Brown, S.J., Warner, J.B., 1985. Using daily stock returns: The case of event studies. *Journal of Financial Economics*, No. 14, pp.3-31.

[8] Bruner, R.F., 1999. An analysis of value destruction and recovery in the alliance and proposed merger of Volvo and Renault. *Journal of Financial Economics*, No. 51, pp.125-166.

[9] Carlson, M., Fisher, A., Giammarino, R.O.N., 2006. Corporate investment and asset price dynamics: Implications for SEO event studies and long run performance. *Journal of Finance*, No. 61, pp.1009-1034.

[10] Corrado, Charles J., 2010. Event Studies: A Methodology Review, *SSRN*, pp.1-36, http://dx.doi.org/10.2139/ssrn.1441581

[11] Drobtz, W., Kammermann, M., Walchli, 2005. Long-run performance of initial public offerings: the evidence for Switzerland, *Schmalebach Business Review*, Vol. 57, pp.253-275

[12] Dutta, A., 2014. Investigating Long-Run Stock Returns after Corporate Events: the UK Evidence. *Corporate Ownership and Control*, Vol. 12 (1), pp.298-307.

[13] Espenlaub, S., Gregory, A., Tonks, I., 2000. Re-assessing the long-term under-performance of UK Initial Public Offerings. *European Financial Management***,** Vol. 6(3), pp.319-342. https://doi.org/10.1111/1468-036X.00127

[14] Dutta, S., Jog, V., 2009. The long-term performance of acquiring firms: A reexamination of an anomaly. *Journal of Banking & Finance*, No. 33, pp.1400-1412.

[15] El Ghoul, S., Guedhami, O., Mansi, S.A., Sy, O., 2023. Event studies in international finance research. *Journal of International Business Studies*, No.54, pp.344-364. https://doi.org/10.1057/s41267-022-00534-6.

[16] Fama, E.F., 1998. Market efficiency, long-term returns and behavioral finance, *Journal of Financial Economics,* No. 49, pp.283-306.

[17] Fama, E.F., French, K.R., 1993. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, No. 33, pp.3-56.

[18] Gregory, A., 1997. An Examination of the long run performance of UK acquiring firms. *Journal of Business Finance & Accounting***,** No. 24, pp.971-1002.

[19] Gregory, A., Guermat C., Al-Shawraweh, 2010. UK IPOs: Long Run Returns, Behavioural Timing and Pseudo Timing. *Journal of Business Finance and Accounting*, Vol. 37(5-6), pp.612-647

[20] Homan, A.C., 2006. The Impact of 9/11 on financial risk, volatility and returns of marine firms. *Maritime Economics & Logistics*, Vol. 8, pp.387-401.

[21] Ibbotson, R.G., Jeffrey F. Jaffe, 1975. Hot Issue Markets. *The Journal of Finance,* pp.1027-1042

[22] Johannesen, N., Larsen, D.T., 2016. The power of financial transparency: An event study of country-by-country reporting standards. *Economics Letters*, Vol. 145, pp.120-122.

[23] Kothari, S.P., Warner, B., 1997. Measuring long-horizon security price performance, *Journal of Financial Economics,* No. 43, pp.301-339.

[24] Kothari, S.P., Warner, B., 2007. Econometrics of events studies, handbook of corporate finance: *Empirical Corporate Finance*, Vol. 1, Elsevier North Holland, Amsterdam, pp.3-36.

[25] Kritzman, M.P., 1994. What practitioners need to know… about event studies. *Financial Analysts Journal*, Vol. 50(6), pp.17-20. https://doi.org/10.2469/faj.v50.n6.17

[26] Lambertides, N,. 2009. Sudden CEO vacancy and the long-run economic consequences. *Managerial Finance*, No. 35, pp.645-661.

[27] Levis, M., 1993. The Long-Run Performance of Initial Public Offerings: The UK experience 1980-1988, *Financial Management*, pp.28-41.

[28] Loughran, T., Ritter, J.R., 1995. The new issues puzzle. *Journal of Finance***,** No. 50, pp.23-51.

[29] Lyon, J.D., Barber, B.M., Tsai, C., 1999. Improved Methods for Tests of Long-Run Abnormal Stock Returns, *Journal of Finance*, Vol. 54, pp.165-201.

[30] Miyajima, H., Yafeh, Y., 2007. Japan's banking crisis: An event-study perspective. *Journal of Banking & Finance*, Vol. 31(9), pp.2866-2885. https://doi.org/10.1016/j.jbankfin.2007.03.006

[31] Ritter, J.R., 1991. The long run performance of initial public offerings. *Journal of Finance*, No. 46, pp.3-27.

[32] Sharif, A., Aloui, C., Yarovaya, L., 2020. COVID-19 pandemic, oil prices, stock market, geopolitical risk and policy uncertainty nexus in the US economy: Fresh evidence from the wavelet-based approach. *International Review of Financial Analysis*, No. 70, pp.101496. https://doi.org/10.1016/j.irfa.2020.101496

[33] Small, K., Ionici, O., Zhu, H., 2007. Size Does Matter: An Examination of the Economic Impact of Sarbanes-Oxley. *Review of Business*, No. 27, pp.47-55.

[34] Sorescu, A., Warren, N.L., Ertekin, L., 2017. Event study methodology in the marketing literature: An overview. *Journal of the Academy of Marketing Science*, Vol. 45(2), pp.186-207. https://doi.org/10.1007/s11747-017-0516-y.

[35] Weber, J., Willenborg, M., Zhang, J., 2008. Does auditor reputation matter? The case of KPMG Germany and ComROAD AG. *Journal of Accounting Research*, Vol. 46, pp.941-972.

[36] Teoh, S.H., Welch, I., Wong, T.J., 1998. Earnings management and the underperformance of seasonedequity offerings. *Journal of Financial Economics*, No.50, pp.63-99

[37] Yarovaya, L., Mirza, N., Abaidi, J., Hasnaoui, A., 2021. Human Capital efficiency and equity funds' performance during the COVID-19 pandemic. *International Review of Economics & Finance*, Vol.7*1*, pp.584-591. https://doi.org/10.1016/j.iref.2020.09.017.

[38] Yousfi, M., Ben Zaied, Y., Ben Cheikh, N., Ben Lahouel, B., Bouzgarrou, H., 2021. Effects of the COVID-19 pandemic on the US stock market and uncertainty: A comparative assessment between the first and second waves. *Technological Forecasting and Social Change*, Vol. 167, pp.120710. https://doi.org/10.1016/j.techfore.2021.120710.