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Event study methodology: the adequate instrument to apprehend stock performance

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Abstract. The financial markets crises that occurred in history have been the primary focus for researchers allowing them to study and examine performance of securities, allowing the financial community to benefit from the rise and appearance of the event study methodology providing the finance researchers to be able to ascertain securities performance. Our paper is delighted to provide a clear definition of the concept of stock performance alongside the concept of performance and firm performance, to prove the credibility of the event study methodology to measure stock performance and finally the steps to measure the short-and long-term stock performance using event study methodology.

Keywords: *Stock performance, Performance, Firm performance, Event study methodology, Short-term stock performance, Long-term stock performance.*

1. Introduction

If markets are efficient, how can we test and validate this hypothesis? This question has encouraged many researchers to improve a technique capable of such task with minimum flaws. This technique is referred to as the event study methodology which has worked perfectly through the years validating the semi-strong form of the hypothesis.
Employed in different fields, this methodology keeps a particular reference to the financial field due to the study conducted to test the effect stock splits could be provoking to the market (Fama et al., 1969).
This study has been a revolution to the research methodology in the finance field because it has provided to the financial researchers the possibility to examine prices behavior subsequent to the occurrence of a specific event.
The semi-strong form of the efficient market hypothesis states that stocks react rapidly to the announcement of public events making it impossible to generate abnormal returns for investors, in other terms, it is improbable to beat the market (Fama, 1970).
In other words, the hasty reaction to new information would entail that on the short-term the alternative hypothesis that claims the existence of an impact on the prices should be accepted, and alternatively, on the long-term the possibility to make abnormal profits must be rejected.
However, before achieving the conclusions above, generating abnormal profits advocates the idea of outperformance of a stock leading to conclude that the existence of abnormal returns is the key to ascertain the performance of a stock.
Securities' performance has always been a preoccupation for the finance researchers since the first attempt to understand financial markets, because of that, many papers bas been published in order to study the stock performance alongside methods to measure it on the long-term as well as in the short-term. Still, the literature admits a penury towards a clear definition of "stock performance".
Hence, what is stock performance? And what would be the adequate mechanism to measure stock performance?

Our paper is particularly special because first is providing a clear definition to the concept of stock performance, second it is providing evidence to the credibility of event study methodology as an instrument to measure and apprehend stock performance and finally an exhaustive explanation for the conduction of the methodology. We explain the issues encountered by a researcher while conducting an event study methodology as well as the actions taken in place to resolve these issues.
Our paper is planned to provide first a definition for "Stock performance" by deriving it from the concept of "performance" which would occupy section I. Section II will be granted to the event study methodology. Section III will be dedicated to the measure of stock performance on the short-term. While Section IV will be devoted for long-term stock performance.

2. Stock Performance

a. The concept of performance

In the process of providing a definition of stock performance, it is very important to review the definition adopted in the literature concerning the concept of performance.
The term "performance" originated in the field of mechanics and is used particularly in this area to describe the capabilities of a machine. In other words, the performance of a machine is expressed with reference to the objectives defined beforehand (Pintea & Monica-Violeta, 2010).
Performance is linked in particular to effectiveness as an indicator of the degree to which an aspiration or an aim is achieved, and to efficiency as an indicator of the level of resources used to achieve that purpose (Samsonowa, 2012).
Performance is a concept related to achievement, accomplishment or effectiveness because it indicates whether an organization is doing well and acting effectively in order to attain its goals successfully (Cherrington, 1989).
In economics, performance is defined and linked to the objectives and competitiveness of the environment, which makes performance a concept based on the notion of comparison and benchmark (Pintea & Monica-Violeta, 2010).
Performance is a concept that admits the existence of three levels that describe the degree to which results are achieved; there is the level of performance, which refers to the optimal situation in which objectives are achieved, the second situation is a situation of under-performance, which refers to the failure to achieve the prescribed objectives, and finally the last situation is the exceeding of expectations to achieve a level of excellence (Âta GHALEM et al., 2016).

b. Firm Performance dimensions

The concept of firm performance is different because it does not have a universal definition, and historically it has evolved from a basic definition of performance to a multidimensional concept, in other words, the concept of firm performance relies particularly on dimensions which falls under the financial aspect involving the profitability, the market value and the growth performance, or the strategic aspect incorporating the satisfaction of employees, customer satisfaction, the environmental and social performance. Even though the literature admits different and variety of dimensions, we are presenting the ones that seem to be the most widespread dimensions; *the profitability performance, the market value performance, the growth performance, satisfaction of employees, customer satisfaction, environmental performance* and *social performance* which is presented in table 1.

Table 1*: Dimensions of Firm Performance*

Profitability Performance	The ability of a business to make profits, it measures the firm's capability to earn returns (Selvam et al., 2016)
Market Value Performance	The external judgment and future performance expectations, it shows that the maximization of the shareholders' wealth through better performance of business operations is acknowledged on the stock market (Selvam et al., 2016)
Growth Performance	It represents the positive change in size and maturation for a given period of time (Selvam et al., 2016). Growth performance is defined as the firm's capacity to expand its size (Whetten, 1987)
Satisfaction of employees	It describes the aptitude to attract and keep employees alongside recording lower turnover rates on the long term (Chakravarthy, 1986)
Customer satisfaction	It measures the expectation of customers accordingly to the products and services supplied by the firm to examine whether they meet or surpass their expectation (Selvam et al., 2016)
Environmental performance	Respect of environmental characteristics indicator subsequent to the comparison of different firms in an industry or just comparing different units of production in one single firm (Selvam et al., 2016)
Social performance	The adequate adaptation of a firm's missions and beneficial goals to be aligned with accepted social values, responsibilities and ethics (Selvam et al., 2016).

c. Towards a definition of stock performance

The distinction between financial performance and stock performance is important in the sense that financial performance refers to measures derived from accounting, whereas stock performance is related to the stock market (Cardebat & Dardour, 2013).

Financial performance is measured by indicators relating to profitability, asset utilization, growth, liquidity, debt and stock market measures (Griffin & Mahon, 2013).

Shane & Spicer (1983), in their paper on the relationship between the market's reaction to a company's environmental performance, speak of financial performance and justify their adoption of the stock market approach to measuring financial performance by the ability of this approach to eliminate the need to analyze the accounting measures that can be manipulated.

This distinction leads us to classify stock performance as a subdivision of financial performance that focuses mainly on indicators that have a direct association with the stock market, in the sense that stock market value is considered to be a determinant of financial performance acknowledging the positive association with them both (Capon et al., 1990). Selvan et al. (2016) categorized market value performance as a undivided part of financial performance explaining that the stock market is the mirror exposing the better performance of a firm.

Although several authors have taken the initiative to conduct studies on stock performance, it is rare to come across a definition of this concept.

Studies related to stock performance adopt the comparison of stock returns to market returns to calculate excess returns (Abdallah, 2015).

Abdallah (2015) mentions stock outperformance and underperformance, cataloging that underperformance is the situation in which a stock’s returns are lower than those of an assumed normal benchmark portfolio, while outperformance is the result of excess returns.

When we talk about stock market performance, Jensen's alpha is the most recurrent measure.

This alpha makes it possible to categorize whether a stock is outperforming or underperforming, these two concepts being defined as the ability of a stock to achieve a return that is higher or lower than the equilibrium price (Friend & Blume, 1970).
Basu (1977) concludes that stocks with a low P/E outperform those with a high P/E. This outperformance of stocks with a low P/E is measured by the calculation of excess returns and Jensen's alpha, in his study he used the calculation of abnormal returns in order to determine which stock outperformed the others concluding that the level of outperformance is the situation when prices exceed the equilibrium or benchmark return.
In parallel with the concept of performance, studies of stock performance or the performance of market securities aim to visualize whether the stock price is among the three levels existing in the literature on the concept of performance. With regard to the notion of objective, we can classify the equilibrium price of a stock as the objective to be achieved; a stock is performing well when its price is equal to the equilibrium price, in other words, it is not making an excessive or abnormal return, it is outperforming or underperforming when its return is higher or lower than the equilibrium price. It is essential to note that stock market performance is dissociated from financial performance by its exclusive interest in the stock market other than accounting, Stock performance can be defined as the ability of a stock to reach the equilibrium price, which is measured beforehand giving the stock the opportunity to be categorized into one of three performance levels.

3. Event Study: A methodology to ascertain securities performance

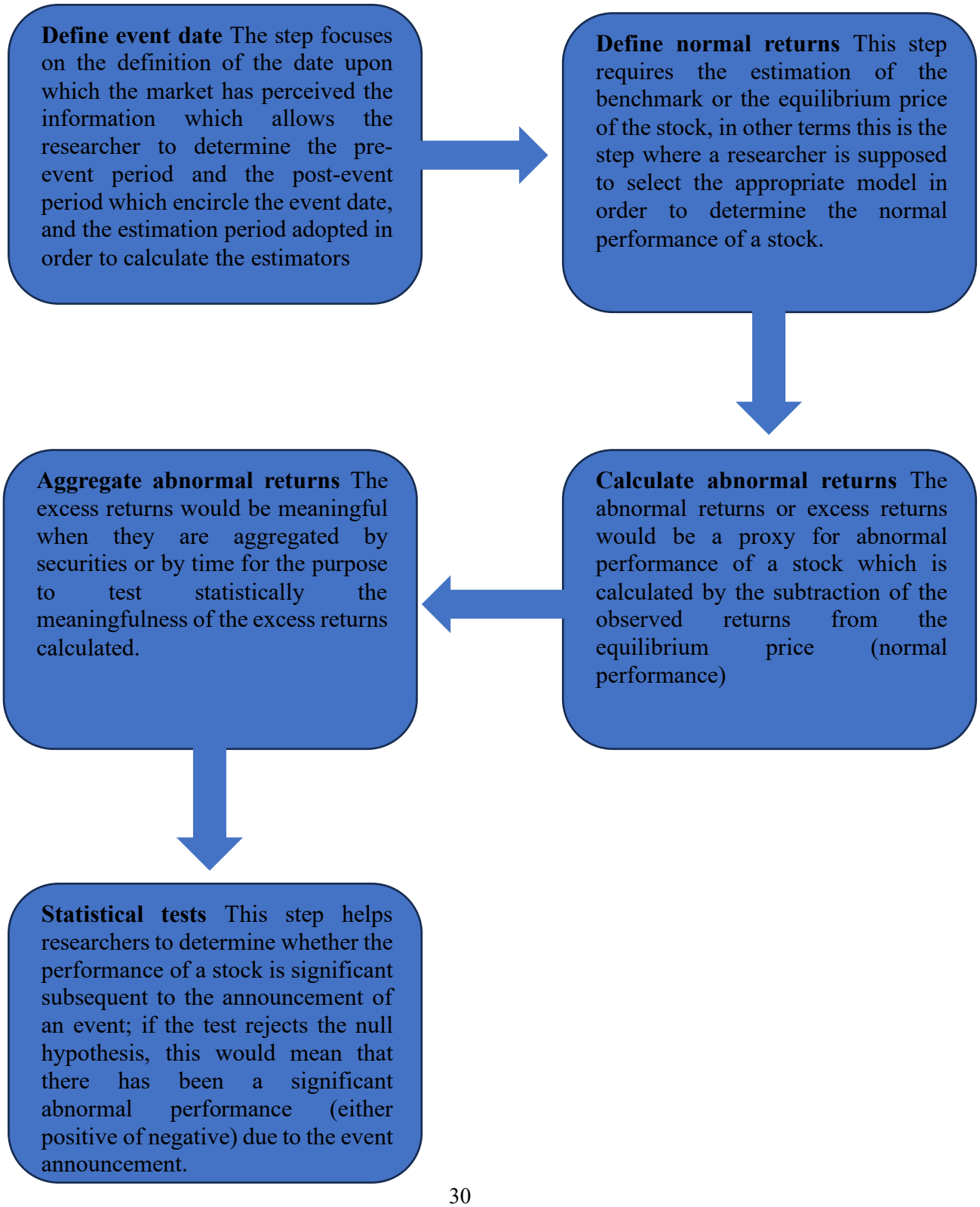
a. Definition of the methodology

Considered as the most important methodological approach for market based empirical finance research, the event study methodology takes “residual analysis” and “abnormal performance index tests” as other names for the same identical purpose which is the study and the analysis of security price behavior around the information announcement moment (Bowman, 2006).
The literature provided a definition to the methodology which classifies the event study as a statistical technique capable of estimating the impact of the occurrence of an event on security prices, the underlying idea is to disentangle the specific information affecting the stock alone from the information affecting the market as a whole (Mitchell & Netter, 1994).
The methodology of event study measures the impact of a specific event on the value of the firm (MacKinlay, 1997). It relies on a fundamental hypothesis which tries to assess the effect of an event on the value of a firm, in other words, it tries to determine whether the value of the firm has changed which will be translated in the stock showing abnormal returns or performance, the central key here for the event study methodology relies on the concept of abnormal performance (Serra, 2007).
Accordingly, the purpose and the objective of the methodology would surround around the idea of existence of abnormal or excess returns earned by the holders of the securities at the time of event occurrence (Peterson, 1989).
An event study could take many aspects; it could be utilized for the purpose to test the efficient market hypothesis or it could be a technique to assess a the information usefulness of an event occurring (Henderson, 1990). The Fama, Fisher, Jensen et Roll paper on 1969 could illustrate the first aspect which has been identified as an efficient market study that attempts to demonstrates the reaction of the market towards the announcement of stock splits, the study focused primarily on determining whether the market can predict the announcement and how rapidly the prices would adjust (Bowman, 2006). The event study through an information usefulness aspect pursuit the demonstration of the information content existing while the announcement of the event; Ball and Brown paper on 1968 examined the information content existing while announcing earnings, the major objective of the study aimed to assess the importance of financial information (Bowman, 2006).

b. Event study methodology process

Even though event study methodology admits the previous two aspects, the process to conduct this statistical technique stays the same and which consists primary of defining the event date, secondary a researcher is supposed to be defining the normal returns in order to calculate the excessive returns providing the possibility to aggregate these excessive returns for the purpose to apply the significance tests. These steps can be summarized in the figure 1:

Figure 1: Event methodology process



c. The credibility of the event study methodology to assess securities performance

"A security's price performance can only be considered abnormal relative to a particular benchmark" (Brown & Warner, 1980). From this statement provided we can rule out that the literature concerning the event study methodology proves that authors agree on the fundamental idea that an event study is able to estimate the abnormal performance existing at the announcement of a new information.

Consistently to the concept of stock performance provided below which relies on the estimation of an equilibrium price considered as a benchmark as stated by Brown & Warner. We can see that the estimation of excess returns, which are calculated by subtracting the price observed from the benchmark price that is estimated using a specific model capable of generating an equilibrium price or in other words the price that the stock should have reached considering the absence of new information, are a proxy to evaluate the performance of a stock because a positive excess return would prove that the stock has outperformed the normal equilibrium price and a negative excess return proves an underperformance situation.

The finance literature knows no better method but the event study methodology to ascertain the performance of a stock by calculating excess returns reflecting the abnormal performance of a stock subsequent to the announcement of an event. McWilliams and Siegel (1997) pointed out to the importance of the methodology in the finance research field when they described it as a powerful tool capable of helping researchers assess the financial impact of changes in corporate policy, they emphasized about the methodology because it can provide a researcher the possibility to determine the existence of abnormal stock price effect associated with an unanticipated event.

The popularity of the event study methodology gave it all the legitimacy to be the first and only method to adopt while seeking to study the performance of a security, this popularity and recognition admitted inside the research finance field would not have been attained without the ability of the event study methodology to obviate and remove the need to analyze measures of profit based on accounting which have been criticized since accounting measures are rarely perfect indicators of the true performance (McWILLIAMS & Siegel, 1997).

For the particularity of the event study methodology to be immune to accounting measures manipulations, McWilliams and Siegel (1997) provided an example where managers could provoke manipulations which can affect accounting profits merely by selecting the desirable accounting procedures, contrarily from accounting profits measures, stock prices are hardly subject to insiders' manipulations.

Since event study methodology is based solely on stock price changes, it would be able to measure the impact of an event more effectively than any other methodology based on accounting returns (McWILLIAMS & Siegel, 1997).

The importance and practicability of the event studies methodology, the Stock Exchange Committee SEC has taken the initiative to use stock price evidence to prove fraud cases involving insider trading cases using the event study methodology (Mitchell & Netter, 1994).

Corrado (2011) provided a hypothetical example of insider trading using merger announcement to show that event study procedures are commonly recognized as evidence to decide whether insiders has benefited from their use of private information, providing the scale of their gain.

4. Measurement of stock performance on the short-term

a. Conducting a short-term event study

The pillar of the short-term event study methodology is that the information will be reflected completely and instantly in the prices (Fama, 1970). Using the event study in its short-term aspect allows researchers to be capable of quantifying the effect of a specific event (MacKinlay, 1997).

The particularity of short-term event studies is that they allow the examination of abnormal performance which ranges for a maximum of 40 days event window (Ding et al., 2018).
It is important to mention that an event is wrapped around post event period, which comes after the event date, and pre-event period representing the period before the event. Both formulating alongside the event date the event period. The estimation period is that period antecedent to the event period which is usually large for its importance to estimate the parameters of the model.
The market model is largely the most used model for estimating the abnormal performance of stock prices (Ding et al., 2018). The market model ensures the construction of firm specific expected return estimates (Fama, 1997).
The abnormal return is the difference between the observed return and the estimated return using the market model, where the parameters α_i and β_i are estimated during the estimation period relying on the Ordinary Least Squares (OLS) method:

$$AR_{it} = R_{it} - (\alpha_i + \beta_i R_{mt})$$

AR_{it}: Abnormal return for security *i* on period *t*
R_{it} : Return of security *i* on period *t*
R_{mt}: Market return on period *t*
α_i : The model intercept estimated during the estimation period
β_i : Slope of the security *i* estimated during the estimation period

After the estimation process the next step called for is to aggregate the abnormal returns which is a cross-sectional aggregation in order to determine whether the distribution of returns is significantly different from zero (Kothari & Warner, 2004), which it is;

$$\overline{RA_t} = \frac{1}{N}\sum_{i=1}^{N} AR_{it}$$

$\overline{RA_t}$: Mean abnormal return during period *t*
N : Number of securities in the sample
AR_{it} : Abnormal return of security *i* on period *t*

Time-series aggregation the event has caused any abnormal performance around the event period (Kothari & Warner, 2004).

$$\overline{CAR_{t_1.t_2}} = \frac{1}{k}\sum_{t=t_1}^{t_2} \overline{RA_t}$$

$\overline{CAR_{t_1.t_2}}$: Mean cumulative abnormal return of all securities during periods between t_1 and t_2
k : Number of days from t_1 to t_2
$\overline{RA_t}$: Mean abnormal return during period *t*

The application of statistical tests is the important phase in the entire process of conducting an event study methodology, the importance dedicated to this phase is due to the possibility to apprehend the significance of results obtained and the abnormal returns calculated (Henderson, 1990).
In concert of the efficient market hypothesis in its semi-strong form, the null hypothesis would suggest that the impact is zero when the event occurs. In other words, if prices react to new information, then the abnormal returns would not be equal to zero and the null hypothesis is rejected. Rejecting the null hypothesis consists of testing the impact between two periods t_1 and t_2 using the mean cumulative abnormal return $\overline{CAR_{t_1.t_2}}$ or to test the impact of the entire

sample's securities on the event date using the mean abnormal return on date t $\overline{RA_t}$.
The *student' t-test* is utilized to validate or reject the null hypothesis; it helps in the process of calculating the *p-value* which cannot fall into the rejection area of the confidence interval which is usually between 5% and 10%. In other words, a *p-value* that is superior of the confidence interval provides enough evidence to keep the null hypothesis and reject in case of a *p-value* lesser than the confidence interval.

b. Heteroskedasticity, cross-section correlation and residuals correlation

The absence of autocorrelation between residuals is one of the assumptions pillar to the market model; in other words the residuals should not be correlated otherwise we would interpret the correlation as the impact of past returns on future and present returns; this situation occurs particularly whilst using daily prices as a result of *nonsynchronous trading* (Brown & Warner, 1985).
Nonsynchronous trading refers to the divergence existent between the return of the security and the market return on period t ; as we all know, the market return is calculated based on the stock index which is calculated relying on the price at the end of the day, thus, sometimes it happens that some securities are not traded at the end of the day which would provoke a gap between the index and the security creating a *nonsynchronous trading* situation and consequently the Beta would be biased (Henderson, 1990).
The abnormal returns correlation might be due to the relative difference existing between the number of observations in the estimation period and the event period, because when the estimation period is relatively large than the event period the biased test statistic would be closer to the unbiased leaving tiny error for test of significance (Binder, 1969).
In some cases, the studying event occurs at a bull market while on the other side, the market was doing bad *"bear market"* when residuals were calculated during the estimation period; this situation would produce a correlation between residuals and the variable R_{mt} causing a biased model (Henderson, 1990).
Variance instability is one of the issues event study methodology witnesses; variance returns is proven to be increasing during the event period (Patell & Wolfson, 1979).
The probability to detect heteroscedasticity induced by the event is very likely to happen since the security's return on the event date is independent of the random action provoked by the announcement of the event, the abnormal return would probably witness a higher variance during the event period than the other periods (Beaver, 1968).

c. Solutions for the biases of short-term event studies

Recent studies, for the purpose to eradicate the issues of the heteroscedasticity, have sought to abandon the use of cumulative abnormal returns and pursued the standardization of abnormal returns before aggregating them (Henderson, 1990). The technique would suggest that statistical tests should consist of the utilization of standardized abnormal returns (Brown & Warner, 1985).
However, before standardizing it is essentially to calculate the standard-error of the abnormal returns of a security during estimation period S_i.

$$S_i = \sqrt{\frac{\sum_{t=1}^{K}(AR_{it} - \overline{AR_i})^2}{K-1}}$$

K : Number of days during the estimation period
AR_{it} : Residuals of security i on period t during estimation period
$\overline{AR_i}$: Mean residuals during the estimation period

The standardized abnormal return is calculated as follows:

$$SAR_{it} = \frac{AR_{it}}{S_i}$$

SAR_{it} : Standardized abnormal return of security *i* on period *t*
AR_{it} : Abnormal return of security *i* on period *t*
S_i : Standard error of abnormal returns for security *i* during estimation period

Consequently, the statistical test would be as follow:

$$t = \frac{\sum_{i=1}^{N} SAR_{it}}{\sqrt{N}}$$

N : Number of securities in the sample
SAR_{it} : Standardized abnormal return of security *i* on period *t*

For the event induced heteroskedasticity Boehmer, Musumeci and Pulsen (1991) advocate for a test which resolves this issue by, first standardizing the abnormal return by the square root of variance residuals calculated during the estimated period, then it is averaged across all securities, next the cross section standard deviation is calculated in order to perform the test. Consistently with the technique of standardized abnormal returns, after computing the standardized abnormal return for security *i*, it is average cross-sectionally by;

$$\overline{SAR_t} = \frac{1}{N}\sum_{i=1}^{N} SAR_{it}$$

SAR_{it} : Standardized abnormal return of security *i* on period *t*
N : Number of securities
$\overline{SAR_t}$: Average standardized abnormal return on period *t*

The cross-section standard deviation S_t is calculated as follows:

$$S_t = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(SAR_{it} - \overline{SAR_t})}$$

And the Boehmer, Musumeci and Poulsen test (1991) would be performed as follows:

$$t_{BMP} = \frac{\overline{SAR_t}}{\frac{S_t}{\sqrt{N}}}$$

Another solution has been provided to the event study methodology to resolve the event induced heteroskedasticity is the use of the standard deviation of the forecast developed by Patell. Standardizing abnormal return by the standard error S_i takes into consideration that the variation happening in the estimation period is identical to the variation in the event period, for that issue, Patell has invoked a way to adjust this situation using the standard error of the forecast S_{ft} to standardize the abnormal returns and perform tests (Henderson, 1990).

$$S_{ft} = S_i \cdot \sqrt{1 + \left(\frac{1}{K}\right) + \frac{(R_{mj} - R_m)^2}{\sum_{t=1}^{K}(R_{mt} - R_m)^2}}$$

S_{ft} : Standard error of the forecast for security *i* during estimation period
S_i : Standard error of abnormal returns for security *i* during estimation period

K : Number of days during the estimation period
R_{mj} : Market return on period j during event period
R_{mt} : Market return on period t during estimation period
R_m : Mean market returns during estimation period

5. Measurement of stock performance on the long-term

In order to quantify and evaluate the performance of securities on the long horizon, the steps are consistent with the event methodology process described above, the difference merely exists in the process of determining the model for normal returns and the aggregation of the abnormal returns. Concerning the test of significance, it follows the semi-strong form of efficient market hypothesis suggesting that abnormal returns tend to zero on the long term.
The measurement of stock performance on the long term encounter two types of errors; a rejected null hypothesis because the benchmark is biased in the process of estimating abnormal returns, the second error is accepting the null hypothesis because the test used to discriminate the mean abnormal return from zero does not have enough power statistically (Ang & Zhang, 2011).
These two errors are result of failure to conduct a proper procedure which articulates around two tasks; the first one consisting of measuring the long horizon abnormal returns and the second one entailing the testing of the null hypothesis that the long term abnormal returns have a distribution concentrated around zero (Ang & Zhang, 2011).
Consequently, two approaches have been developed through the years in order to get the best measure of abnormal returns on the long run; the Calendar-Time Portfolio method and the Abnormal Return Buy and Hold method, which would be presented in the following sections.

a. The Abnormal Returns Buy and Hold "BHAR" method

The experience of investor on the long term is well apprehended by the compounded short term returns in order to obtain long term buy and hold returns, they are tested for periods of five years after an event, consistently to much of event study literature (Fama, 1997).
The use of the mean buy and hold abnormal returns are considered as the appropriate estimator for long term horizon because it measures accurately the experience of investors (Barber & Lyon, 1996).
The BHAR method consists of estimating the abnormal return AR_i by subtracting the compounded returns of firm i from the benchmark return.

$$AR_i = R_i - BR_i$$

Where BR_i benchmark return indicating the return that would have been if the event had not occurred, and R_i , is the compounded monthly returns of firm i for a period of τ months, which is calculated as

$$R_i = \prod_{t-1}^{\tau}(1 + r_{it}) - 1.$$

r_{it} : the return of firm i on month t.
One of the issues that surrounds the method is the selection of the benchmark, because the use of wrong benchmarks in order to measure long term abnormal returns would provoke erroneous inference of the significance of the occurrence of a particular event (Ang & Zhang, 2011).
As a consequence; as benchmark returns, most studies prefer to use either a single matched firm or the matched reference portfolio (Ang & Zhang, 2011).
The use of the matched reference portfolio to calculate buy and hold abnormal returns could be provoke biases of new listing, rebalancing and skewness, as a result the best alternative way to advocate the benchmark is to apprehend the control firm approach (Barber & Lyon, 1996).
The control firm approach allows the elimination of the new listing bias because the sample and the control firm are supposed to be listed in the same identified event month, as well as the rebalancing bias since they both are not rebalanced while calculating the returns, and the

skewness bias because both the sample and the control firm are expected to make large positive returns (Barber & Lyon, 1996).

The buy and hold method face a different kind of issues, but this time they are encountered in the test of significance phase; the first one is the assumption of returns normality provoking a skewness, the second issue is the cross-section dependence between returns.

The skewness of abnormal returns signifies that the returns are not distributed normally, which would affect the significance of tests since it is used with the t-student distribution. However, if the suggestions of the Central Limit Theorem that large number of independent random variables has approximately a normal distribution, are consistent with the independence of the observations of BHAR, then there would be no issue testing the significance of the results (Kothari & Warner, 2004).

Nevertheless, the lack of independence between the BHAR is the problem for being unable to apply the Central Limit Theorem suggestions and therefore the conclusion to be addressed for is that the skewness is provoked partly by the cross-section dependence of returns arising from overextending and overlapping long term returns observations (Kothari & Warner, 2004).

Kothari & Warner (2004) summarized the causes of the cross-section dependence into three reasons: – Some sample firms are likely to share the same calendar period since the measurement is happening in the long run – Some events tend to be occurred at waves because of economic reasons or opportunistic deeds provoked by the management or the shareholders – The domination of some industry in the sample over other industries knowingly that some events tend to happen at the same time for a specific industry.

To put under the microscope the cross-section bias, Kothari & Warner (2004) presented a ratio that estimates the magnitude of the bias which is calculated with dividing the standard deviation of abnormal returns taking into consideration the dependence of the data by the standard deviation assuming the data is independent.

$$\sigma_{AR}(dependence) = [\frac{1}{N}\sigma^2 + \left(\frac{N-1}{N}\rho_{i,j}\sigma^2\right)]^{\frac{1}{2}}$$

$\sigma_{AR}(dependence)$: Standard deviation of abnormal returns taking into consideration dependence of data.

N: Number of securities in the sample

σ^2 : The variance of abnormal returns for each firm

$\rho_{i,j}$: Correlation between firm *i* and *j* abnormal returns

When the formula in brackets is omitted, the standard deviation is calculated assuming the absence of cross section data and the $\sigma_{AR}(independence)$ would be equal to $\frac{1}{N}\sigma^2$.

Consequently, the ratio $\frac{\sigma_{AR}(dependence)}{\sigma_{AR}(independence)}$ would equal $\left[1 + (N-1)\rho_{i,j}\right]^{\frac{1}{2}}$ and representing how the true standard deviation is higher from the one assuming independence.

Lyon et al. (1999) developed a technique capable of resolving the skewness and cross-sectional biases with the adoption of the **bootstrapped skewness adjusted t-statistic**. The technique consists of calculating the skewness adjusted t-statistic with the formula above.

$$t_s = \sqrt{n}(S + \frac{1}{3}\hat{y}S^2 + \frac{1}{6n}\hat{y})$$

$$\text{Where } S = \frac{\overline{AR_\tau}}{\sigma(AR_\tau)} \text{ and } \hat{y} = \frac{\sum_{i=1}^{n}(AR_{i\tau} - \overline{AR_\tau})^3}{n\sigma(AR_\tau)^3}$$

t_s: skewness adjusted t-statistic

$\overline{AR_\tau}$: The abnormal returns sample mean

$\sigma(AR_\tau)$: The sample standard deviation of abnormal returns for the sample firms

$AR_{i\tau}$: The buy and hold abnormal return for security *i* for the period τ

$\hat{y}$: Coefficient of skewness

After the calculation of the skewness adjusted t-statistic, the bootstrap phase consists of constructing a bootstrapped distribution of the skewness adjusted t-statistic; the procedure rely on repeated random sampling to measure the significance of relevant test statistics (Ang & Zhang, 2011).
From the original sample, a researcher at this stage is supposed to draw a large number of samples and calculate the adjusted t-statistic for each sample, which would result in a distribution of test statistics helping to assess whether to original skewness adjusted t-statistic from the original sample falls in the rejection area of the distribution allowing for the rejecting of the null hypothesis stating that the abnormal performance tend to be zero (Kothari & Warner, 2004).
In spite of the complication of this approach, the results of significance would vary each and every time the procedure takes place which would provoke as a consequence different contradictory conclusions (Ang & Zhang, 2011).

b. The Calendar Time Portfolio method

It is essentially to mention that this is an approach that is supposed to be valid only for random samples, however for nonrandom samples there would be misspecifications (Kothari & Warner, 2004), another reason for the existence and the adoption of a different approach to evaluation long term performance referred to as the Calendar Time Portfolio (Lyon et al., 1999).
Lyon et al. (1999) conducted the CTP method with the Fama French Three-Factor model which is conducted as follows: supposedly the event period is five years, then an event portfolio is formed for each calendar month regrouping all the firms having an event within the range of five years of the calendar month chosen, the next step consists of calculating the return of each portfolio in order to perform the regression using the Fama French three factor model. The estimation of the intercept of the model provides the possibility to test the null hypothesis that the mean monthly abnormal return on the CTP is zero.
The CTP can take a different aspect when it is performed using the mean monthly abnormal returns, the formulation of portfolios is the same, but after this phase, for each portfolio calculate the abnormal return for each security by a benchmark which is a reference portfolio or market return.
The following step would be to calculate the mean abnormal return of all firms for each portfolio, to estimate the grand mean abnormal return which is the mean abnormal return of all portfolios providing the possibility to determine whether this grand mean abnormal return would be significantly different from zero using the t-test and p-value.
The calendar time portfolio method has an immunity concerning the cross-correlation bias of abnormal returns, it serves as the best solution for that specific issue (Kothari & Warner, 2004).
The use of monthly calendar time portfolio approach is the strong and adequate method serving to measure long term abnormal performance (Fama, 1997).
Fama (1997) oppose the use of the BHAR methodology because the errors ascending from the imperfection that exists within the estimations of expected returns are compounded with long term returns.
Fama (1997) explains the imperfection and assimilate it to a concept of “bad model problem” which contains two types; he clarifies that any asset pricing model is merely a model and actually does not entirely define the expected returns, the second type of the problem would be the deviation from the model’s predictions that could be produced by any sample period even if a true model exists.
The use of monthly calendar time portfolio approach is the strong and adequate method serving to measure long term abnormal performance (Fama, 1997). Three reasons beneath this

endorsement; the monthly returns are less vulnerable to the imperfection from the bad model problem, the cross-correlations are taken into consideration instinctively in the portfolio variance since the portfolios are formed for each calendar month, and the distribution of the portfolio returns would be distributed normally allowing the use of the classical statistical inference (Mitchell & Stafford, 1999).

c. BHAR and the Calendar Time Portfolio Methods

Both methods are measures of long-term performance of securities since they both focus on longer event periods consisting on monthly returns for three to five years. The possibility to capture the investors' experience is considered the strength of the BHAR method, however, the BHAR method could encounter many obstacles in the process, the first obstacle of determining the best benchmark returns as well as the obstacle of the skewness of the excessive returns would make the BHAR method harder to conduct because a researcher would be imposed to make the most appropriate benchmark returns and tend to use the bootstrapping in order to resolve the skewness problem which would provoke a situation where there are different results of significance tests and therefore different conclusion each time. The bad model problem discussed by Fama (1997) is also an obstacle making the BHAR method more fragile to the problem of compounded returns. These issues are not encountered while conducting the CTP, a reason why Fama (1997) opposes the use of BHAR and declares that the CTP is the appropriate method in order to assess long term securities performance.

6. Conclusion

Our paper focused on stock performance, first on providing a definition consistent with the definition of the concept of performance and the multidimensional aspect of firm performance, and secondly on the most accepted procedure to measure the performance of stocks in financial markets, the event study methodology.

Kothari & Warner (2004) conducted a census of event studies published in the five most primary journals and found 565 published papers existing between years of 1974 and 2000.

Without a doubt, it would not have apprehended all the interest and importance inside the financial community unless, first the simplicity of the procedure, the statistical roots of the methodology and the actions taken to improve the significance of the results given by the procedure, providing it with enough legitimacy around the research community.

Our paper not only provides a definition of stock performance, but it provides evidence to the credibility of the event study methodology to measure securities performance. It summarizes for researchers the process to conduct the methodology as well as in the short term as in the long term, the issues encountered in the process and the actions taken in place to resolve them, which would be very helpful for future researchers willing to apply the methodology.

The event study methodology would not have taken the credibility in the financial community without the published papers between 1969 (the FFJR paper) to 1999 (Lyon et al paper) considered the pillars for finance researchers to conduct a flawless event study. A reason why we have focused particularly on papers published in this interval of time.

7. References

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