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# Analysis of the post-earnings announcement drift: Evidence from the European market

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**Abstract**

The post-earnings announcement drift is the tendency for stock prices to shift in the direction of an earnings surprise, jeopardizing the concept of market unpredictability. Therefore, this dissertation aims to extend the literature about the PEAD anomaly, by studying and investigating the EURO STOXX 50 index, between 15th August 2012 and 31st December 2017. We assessed the presence of this phenomenon on the European market through the event studies methodology and empirical analysis of historical prices, trading volume, abnormal returns, and abnormal trading volume.

Overall, the study considered 944 earnings announcements of 50 companies that were listed on the EURO STOXX 50 index during the period analyzed. Subsequently, evidence of statistically significant average abnormal returns, cumulative average abnormal returns and average abnormal trading volume were found on the day that the earnings information was published as well as on the following days. Moreover, the introduction of news grouping (good, bad, neutral news) into our study allowed for a more intricate analysis of the PEAD effect amongst different types of earnings announcements. Good news were generally associated with high positive average abnormal returns (2.17%) on the day they were released, while the opposite was true for bad news, registering a considerable decline on the average abnormal returns (-2.01%) on the day of the announcement. Neutral news, with no impact on stock prices, maintained consistently negative average abnormal returns throughout the event window.

Our analysis broadens the study of the PEAD phenomenon on the European market by providing new data and results that validate the continuous existence of this anomaly and its impact on market efficiency. Thus, we reject the semi-strong form of market efficiency on the European market since it does not reflect quickly and correctly new publicly available information.

**Keywords:** market efficiency, earnings announcements, anomaly, price drift, events study, abnormal returns, abnormal trading volume

**JEL-Codes:** G12, G14, G1

## Resumo

A anomalia "post-earnings announcement drift" é a tendência dos preços das ações mudarem na direção das divulgações de resultados, colocando em causa o conceito da eficiciência de mercado. Desta maneira, esta dissertação tem como objetivo principal expandir a literatura acerca desta anomalia financeira ao estudar e investigar o indíce de mercado, EURO STOXX 50, entre 15 de agosto de 2012 e 31 de dezembro de 2017. Sendo assim, avaliámos a presença da "post-earnings announcement drift" no mercado europeu através da metodologia do estudo de eventos, bem como da análise empírica de preços históricos, volume de negócios, retornos anormais e volume de negócios anormal.

Em geral, o estudo considerou 944 divulgações de resultados de 50 empresas que estavam cotadas no índice de mercado, EURO STOXX 50, durante o período analisado. Posteriormente, evidências de retornos anormais médios, retornos anormais cumulativos médios e volumes de negócios anormais médios estatisticamente significativos foram encontradas no dia da divulgação de resultados, bem como nos dias seguintes. Adicionalmente, a introdução da categorização dos anúncios de resultados em más, neutras e boas notícias no nosso estudo permitiu uma análise mais complexa do efeito PEAD entre diferentes tipos de divulgações de resultados. Boas notícias foram primariamente associadas a retornos anormais médios positivos altos (2.17%) no dia em que foram publicas, enquanto que o oposto ocorreu para as más notícias, que registaram retornos anormais médios negativos altos (-2.01%) no dia da divulgação de resultados. Relativamente às notícias neutras, que não apresentam qualquer impacto no preço das ações, estas mantiveram retornos anormais médios consistentemente negativos ao longo da janelo do evento.

Esta tese amplifica o estudo da anomalia PEAD no mercado europeu ao providenciar novos dados e resultados que valiam a existência contínua deste fenómeno e o seu impacto na eficiência do mercado financeiro. Deste modo, rejeitamos a forma semi-forte da eficiência do mercado europeu visto que este não incorpora rápido e corretamente informaão que é disponível ao público em geral.

**Palavras-Chave:** eficiência de mercado, divulgação de resultados, anomalia, mudanças nos preços de ações, estudo de eventos, retornos anormais, volume de negócios anormal

**Códigos JEL:** G12, G14, G15

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## 1. Introduction

The tendency for stock prices to shift in the direction of a positive or negative earnings announcement that surpassed investors' expectations is called a post-earnings announcement drift. In order to understand it, we need to identify the foundations behind it, which directs us to the Efficient Market Hypothesis, first introduced back in 1970 by Eugene Fama. With this, market efficiency measures the level at which the market reflects correctly and fully all available information. Thus, if the market is efficient there is no clear route for investors to take advantage of stock prices, as the market would correctly value all securities, preventing the existence of under or overvalued stocks.

Therefore, Fama clarifies the existence of three different forms of market efficiency (weak, semi-strong and strong) that play a key role in understanding how markets react to information (earnings announcements, stock splits, analyst reports, interim announcements, dividend announcements,…) and its impact on stock prices.

The PEAD effect has been deeply studied by different authors that often choose to analyze the phenomenon in distinct perspectives, with some authors not considering it an anomaly and presenting a diverse set of reasons as to why it happens, occasionally referring to Ball & Brown (1968) as the study that initiated all progress towards understanding PEAD, since it implies that investors often underreact to earnings information leading to a price momentum shortly after the news event. With this, we aim to fully assess the European stock market reaction, in terms of market price and trading volume, to new information events with the goal of understanding if the PEAD trend still applies nowadays. Therefore, by extracting and investigating the EURO STOXX 50 data, which comprises the fifty most liquid stocks in Europe, we are cutting the problem of minimal trading volume stocks that are not relevant to understanding the problem at hand.

In addition to this, we chose to explore the temporal period of 15th August 2012 – 31st December 2017 since the literature of this period in European markets is rather scarce. Furthermore, the expected methodology to be used will be event studies to compute the abnormal returns generated by the drift and the abnormal trading volume, all of which will be further explained in Chapter 3 of the dissertation.

The number of studies analyzing the PEAD effect on the European market is rather sparse, with the latest published article in Gerard (2012). In general, authors will focus on specific markets with countries like Spain (Pellicer (1999)), United Kingdom (Frost &

Pownall (1994)), Bosnia (Berezovskis & Visnapuu (2010)), Finland (Kallunki (1996)) and other European countries being the target for PEAD analysis.

Most of the literature about this effect agrees that the continuous presence of the PEAD phenomenon across different financial markets undermines the Efficient Market Hypothesis suggested by Eugene Fama, since markets are expected to react immediately and correctly to new information, however, due to investor underreaction stock prices will drift in the same direction as the earnings announcement event. Several authors have tried to understand this phenomenon over the last decades, attempting to find factors that could explain it. Some particularly interesting articles include Vega (2006) who explores the role of private information on the PEAD anomaly, stating that "the more information investors have about the true value of an asset, and the more they agree and trade on this information, the smaller the abnormal return drift" (p.131). Sadka (2006) investigates the function of liquidity risk on the PEAD anomaly. Bushan (1994) studies the relationship between direct/indirect costs of trading and the PEAD anomaly. Further literature will be analyzed in the next chapter of the report. Chordia & Shivakumar (2006) attempt to link earnings momentum to price momentum. Livnat & Mendenhall (2006) point out that the PEAD could also be caused by disparities between analyst forecasts and data obtained from time-series models.

In general, the relationship between market efficiency and anomalies like PEAD is still not completely understood and as new data arrives it is relevant to observe if past findings helped decrease this abnormal drift in prices or if the same still prevails nowadays.

In summary, the main research questions revolve around understanding how significant the post-earnings announcement drift in Europe is, specifically amongst the fifty most liquid stocks, and if the price drift has decreased or increased compared to previous periods on the literature.

The results we obtained during our empirical analysis confirm the hypothesis that the PEAD effect is present on the European market and that it is highly significant on the day of the release of the earnings announcement and the following day. The average abnormal returns, average cumulative abnormal returns and the average abnormal trading volume values validate the drift in these variables on the direction of the earnings announcements, further corroborating that the market did not react quickly enough to the release of earnings information throughout our study.

Regarding the dissertation's structure, chapter 2 will focus on the literature review where topics like market efficiency, past studies on post-earnings announcement drift, event

studies, and brief analysis on specific markets analyzed by the literature will be discussed. Chapter 3 will present the data extracted and the databased used. Chapter 4 will be the foundation for the thesis where the event studies methodology will be depicted thoroughly. Chapter 5 aims to describe and display the results obtained with the data sample previously defined. Lastly, chapter 6 will revolve around some concluding remarks and an overall summary of the results obtained throughout the dissertation.

## 2. Literature Review

In our literature review we intend to understand market efficiency and how critical of a concept it is to the PEAD effect by learning how it was created and the major contributions some of the authors made in order to apply it effectively. Moreover, we also aim to fully explain the PEAD phenomenon by gathering many of the reasons for its existence and the measures to prevent it that the literature has found over the years. Lastly, we also wish to encompass other's authors scientific studies of the PEAD effect on distinct specific markets and their conclusions.

### 2.1 Market Efficiency

Market efficiency is a rather key component in financial markets, otherwise, anomalies like PEAD can have adverse effects and allow for abnormal returns, resulting in a stock price that is different from its true value.

However, the price does not need to be equal to its fundamental value at all points in time, it can deviate but randomly, always returning to its fundamental value in the end. With the post-earning announcement drift, the price does not deviate randomly but in the direction of the earnings surprise, so if the news event is positive the stock price will diverge positively instead of randomly in an unknown direction and vice-versa.

The topic of market efficiency was first introduced by Bachelier (1900) who recognized a subtle connection between information and stock price, meaning that often news events will have an impact on stock prices with no evidence that the event in itself is responsible for the price changes.

Bachelier (1900) along with other several authors like Cowles (1933), Working (1934), Kendall (1953), Roberts (1959) and Samuelson (1965) laid the foundations to understanding market efficiency, with Eugene Fama introducing the Efficient Market Hypothesis in 1970 allowing the financial world to reduce its knowledge gap regarding the concept.

Eugene Fama was one of the pioneers regarding market efficiency, further developing theory around the concept and creating the Efficient Market Hypothesis. According to Malkiel & Fama (1970) there are three conditions for capital market efficiency: "(i) there are no transactions costs in trading securities, (ii) all available information is costlessly available to all market participants, and (iii) all agree on the implications of current information for

the current price and distributions of future prices of each security" (p.387), so if all of these are fulfilled then prices fully reflect all available information, which means that the stock price represents the true value of the asset, implying an efficient market overall.

Fama (1970) provides empirical evidence of three different forms of market efficiency that are determined according to the "adjustment of security prices to three relevant information subsets", which fully reveals how efficient a market is by following the type of information that has been reflected in the stock prices. With this, the three different forms of market efficiency, in conformity with Eugene Fama's Efficient Market Hypothesis, are the following:

- **Weak-form efficiency** – Stock prices only reflect past information that has been available such as historical prices and trading volume;
- **Semi strong-form efficiency** – Stock prices reflect past data and all publicly available information about firms;
- **Strong-form efficiency** – Stock prices reflect all information about firms (public and private), including data that may be only known by market analysts or company insiders.

Fama provided the foundations to understand market efficiency and how anomalies/market inefficiencies stack up against the theory that has been developed. However, despite the consistency of evidence towards the Efficient Market Hypothesis in the early years after its constitution, many authors found some inconsistencies as new data surfaced and new techniques started being used. Jensen (1978) gathered all the evidence from current articles at the time to pinpoint some of the problems and drawbacks of Fama's Efficient Market Hypothesis. With this, Jensen (1978) highlights Ball (1978), which provides "methodological suggestions for reducing the estimation bias due to inadequacies in the asset pricing model" (p.4) and points out, through empirical evidence, the possibility of earning abnormal returns after an earnings announcement due to an incorrect adjustment of the stock price, proving wrong Fama's Hypothesis. Whereas Ball (1968) attributes the possibility of earning abnormal returns to a deficiency in the capital asset-pricing model, Watts (1978) suggests that abnormal returns after earnings announcements can be a cause of market inefficiencies and not technical problems in the model.

In summary, despite the precision of Fama's theory and its sizable contribution to understanding market efficiency, it is not flawless, and many authors developed other methods as time went on.

## 2.2 Historical Review of the Post-Earnings Announcement Drift

The Post-earnings announcement drift is a topic that has allured a high number of researchers, in the hope of understanding the anomaly and how it impacts market efficiency. The phenomenon definition is rather simple, revolving around a shift in the stock price in the direction of the earnings event, be it positive or negative, allowing investors to earn abnormal returns and creating the so-called price momentum or price continuation anomaly, which means that the price is not reflecting its fundamental value. Singal (2006) explains the basics behind this phenomenon, attributing the type and quality of information to be the key drivers for the impact on stock prices, dictating whether the changes will be temporary or permanent. Additionally, Singal (2006) states that there are three dimensions of information quality signals:

- **Size of the price variation** – Captures the importance of the earnings announcement;
- **Precision of the information quality** – If the information is precise, then high trading volume is sure to happen, as investors will work towards rebalancing their portfolios and updating their positions;
- **Source of information** – Is the information coming from a well-known and regarded public source or is it disconnected from the main hub and put out by a private unreliable source. This has a considerable impact on prices since public information has higher credibility and therefore will attract more investors, provoking bigger price changes.

Considering these signals, Singal (2006) declares that "if extraordinary price changes are followed by an increase in trading volume and public announcements, then a price continuation is likely to result in a one-month abnormal return of about 3.5 percent for positive events and –2.25 percent for negative events" (p.57). In short, price changes followed by high trading volume result in price continuations/drift/momentum and price changes trailed by low trading volume end up in price reversals.

Singal (2006) also mentions some factors that could explain the anomaly, such as information cascades where earnings announcements are immediately followed by analyst reports that will further push the price change and solidify the price momentum, strategic trading by institutional investors, whom can influence price changes due to the sizable trading volume these investors can partake in and investor behaviour, which can explain why

investors may underreact to an earnings announcement as a result of clinging to their beliefs and updating them ever so slowly after persistent trading on a stock that fails consistently.

With the basic definitions and concepts analyzed, it is important to proceed towards a historical assessment of the various articles that contributed and explored the PEAD topic. The first foray into the PEAD anomaly research was done by Ball & Brown in 1968, who found that after a negative earnings/income event, abnormal stock returns are more likely to follow that same negative trend of the event and vice-versa, generating discussion around what would, shortly, be called the post-earnings announcement drift.

Ball & Brown's scientific contribution accelerated the investigation into the PEAD anomaly, generating countless articles by different authors, each with different perspectives and theories about the phenomenon. Abarbanell & Bernard (1992) attempted to link analyst's behaviour and reaction to earnings announcements as a possible explanation for the post-earnings announcement drift, understanding whether an underreaction or overreaction to the news event could cause this drift in prices and according to Abarbanell & Bernard (1992) "security analysts behaviour is at best only a partial explanation for stock price underreaction to earnings, and may be unrelated to stock price overreactions". (p.1)

Atiase (1985) and Grant (1980) focused on the effects of pre-disclosure information, which may lead to abnormal returns after an earnings announcement. In particular, Atiase (1985) hoped to generate a link between firm size, differential information, and earnings announcements, providing an example of some disclosures possessing information for lower sized firms but not higher sized firms, in terms of capitalized value. This topic is further developed by Atiase & Bamber (1994), who found "that the magnitude of trading volume reaction is an increasing function of both the magnitude of the associated price reaction and the level of pre-disclosure information asymmetry". (p.1)

The most common trend amongst researchers that explore the post-earnings announcement drift anomaly is the duality between two explanations: delayed price response to the new information or a misusage of the Capital-Asset Pricing Model by researchers that fail to fully adjust the returns to risk, so the abnormal returns that are earned after an earnings announcement are, in fact, just a "risk premium". Bernard & Thomas (1989) test both explanations and although the authors do not find evidence on a link between PEAD and failure to measure risk, they find compatibilities, in the evidence, between PEAD and delayed price response. The researchers state that although they managed to eliminate a possible explanation, there are still questions left to answer, such as understanding how to build an

equilibrium on the market when it cannot even fully incorporate earnings information into the stock prices, which is generally easy to access and identifying why the market is disrupted by earnings content that can be predicted by studying the previous quarter earnings.

The article was further developed by the same two authors, just a year later, Bernard & Thomas (1990), who found evidence of stock prices failing to fully reflect "the implications of current earnings for future earnings, specifically three-day price reactions to announcements of earnings". (p.305)

Furthermore, Bernard & Thomas (1990) criticize the general behaviour of the most known markets such as NYSE and AMEX, which adopt a simple view of earnings expectations, considering "that future earnings will be equal to earnings for the comparable quarter of the prior year". (p.338)

Both studies of Bernard & Thomas are then followed up by Mendenhall & Battalio (2004), who link investor trade size and different information subsets to the PEAD anomaly, finding mixed results regarding the relationship between returns predictability and small-sized trades by investors. Essentially, investors that enter large trades tend to spot and answer to analyst's earnings forecast errors whereas investors that start small trends are more likely to underreact to current earnings information/forecasts for future earnings data.

Other conclusive main findings include underweighting of earnings-related information by Mendenhall (1991), meaning an underreaction by investors and the overall stock market to earnings news events, patterns in unexpected earnings as a possible explanation for the PEAD according to Bartov (1992), which is backed up by empirical evidence that markets fail to control the impact of past earnings announcements for future earnings announcements leading to the drift in stock prices and the creation of a nonlinear model that relates unexpected returns and unexpected earnings by Freeman & Tse (1992).

Additionally, Bartov (2000) kept investigating the PEAD phenomenon and highlighted a relationship between stock price patterns after earnings announcements and the fraction of firm shares held by institutional investors (negatively correlated), which is a proxy for investor sophistication. However, the trio of authors, Bartov et al. (2000), advised caution in quoting their findings due to poor results in the proxy used.

In summary, most of the articles mentioned attribute three different reasons to why the PEAD anomaly exists, such as a delayed price response where prices fail to immediately reflect news content, misconceptions and miscalculations of expected returns, through CAPM, after earnings announcements and, lastly, an underreaction by investors to relevant

earnings information.

Investor underreaction is analyzed in detail by Mendenhall (2004), which attempts to explain why "unbiased investors or arbitrageurs do not and cannot eliminate the underreaction in order to enforce market efficiency". (p.875) The author proposes that the PEAD anomaly is attributed to investors who underreact to earnings information and arbitrage cannot correct the anomaly since the needed trades to correct it are too risky. Fundamentally, Mendenhall (2004) advocates arbitrage risk is a key driver of the PEAD's phenomenon persistence across different markets. Moreover, the higher the arbitrage risk, the higher the drift in prices after an earnings surprise, since the arbitrageur will not take that type of risk and will try to hedge his position on the stock price that is not reflecting its fundamental value. Lastly, the researcher also found evidence of a positive link between the size of the drift, arbitrage risk, and transaction costs.

Most recently, Dellavigna & Pollet (2009) linked limited attention and underreaction of investors to Friday earnings announcements and the PEAD anomaly. Ultimately, the authors found conclusive evidence that the PEAD is more intense and sizable when earnings announcements take place on Friday due to more inattention by investors with a looming weekend and a close of the market. Additionally, an interesting piece of evidence found throughout many of these articles is that the post-earnings announcement drift tends to be more persistent and stronger amongst illiquid, smaller, low-priced securities that are traded by small inexperienced investors.

### 2.3 – World market analysis of the PEAD anomaly

There have been many authors that went through a deep analysis of specific markets to find how significant, the PEAD phenomenon was in each market, which also provides answers regarding efficiency through how sizable the drift is in different countries allowing for interesting comparisons and conclusions.

A noteworthy assessment of the PEAD anomaly between the United States of America and the United Kingdom is made by Frost & Pownall (1994), which clarifies that, at the time, the stock price response to earnings surprises in the USA was more effective than its counterpart in the United Kingdom. Therefore, the study concludes that the drift is less intense in the USA then it is in the United Kingdom, although there is evidence of its existence in both countries.

A more recent study by Chung & Hrazdil (2011) found evidence of the PEAD

phenomenon on the North American market, which the authors mainly attributed to a failure by the market to incorporate earnings information onto the stock prices. Moreover, the authors established a link between PEAD and efficiency on firms, with less efficient firms being more profitable as a result of the PEAD effect then more efficient firms. In general, Chung & Hrazdil (2011) contribute to Frost & Pownall's (1994) article by extending the literature with new evidence of the PEAD anomaly in the market.

Other striking research includes a study on a Nordic market by Kallunki (1996), which concludes that the presence of the PEAD anomaly in the Finnish market is attributed to a misestimation of abnormal returns and that the drift is bigger when a negative earnings announcement takes place compared to when a positive earnings announcement ensues, an investigation on the Spanish market conducted by Pellicer et al. (1999) that infers a continuous persistence of a drift in prices in the direction of the earnings announcement, highlighting stock price volatility around earnings news events and that, surprisingly, the PEAD irregularity is less common on Baltic markets such as Estonia, Latvia, and Lithuania according to Berezovskis et al. (2010).

Regarding the European market, there is a recent study by Gerard (2012) in which the researcher analyses European companies and the presence of the PEAD anomaly. According to the author, "information uncertainty plays an important role in determining the magnitude of the premiums earned by these strategies" (p.58) (abnormal returns/abnormal trading volume after an earnings surprise). Furthermore, Gerard (2012) displayed that stocks with higher idiosyncratic risk are more affected by the PEAD anomaly and will allow for higher abnormal returns to be earned. Essentially, Gerard (2012) states that "idiosyncratic volatility constitutes a limit to arbitrage that prevents investors from eliminating the premiums". (p.67)

There have been other studies that investigated the PEAD effect on the Eurozone, such as Nesteruk (2018) whom focused on the 2008 financial crisis and its impact on the PEAD effect and Vuorela (2018) who studied how a firm's size and the sector it operates influences the magnitude and continuity of the drift, collecting evidence that the PEAD phenomenon is still relevant on the European market in 2018.

The next chapter will introduce our dataset and its respective description, in terms of the companies that were included or excluded from our analysis, while also establishing the categorization of the earnings announcement dates that were collected.

# 3. Data

## 3.1 Dataset

Firstly, upon analysis of the EURO STOXX 50 index throughout the study period (15th August 2012 – 31st December 2017), we decided to include all companies that were listed in the index for more than one year on our study. With this, we avoid survivorship bias by incorporating companies that are no longer in the index but are still relevant to our study due to being at least one year on the index. Furthermore, some companies that only entered the index towards the middle of 2017 were excluded from the index. Overall, the study is comprised of 51 companies, all of which were in the index for at least one year.

Lastly, the companies Osram Licht (XET) and Intesa Sanpaolo were excluded from the index due to a lack of closing prices and trading volume data between 2012 and 2014. Moreover, Unilever was also removed from our analysis due to low liquidity compared to the other companies in the study, averaging a very low number of shares traded compared to its shares outstanding, which, according to the literature, would lead to a thin trading problem if the company were to remain in our analysis.

Regarding the earnings announcement's dates, interim reports along with fiscal year-end reports are the focus of the study, which include quarterly, half-year and yearly reports. Preliminary earnings announcements were not included in the study due to being subject to change before the official earnings announcement, which means the effects on prices may end up being unsubstantial or inconclusive. Furthermore, earnings seasons are crucial to understanding the PEAD anomaly since the market increases its activity exponentially around that time, with investors constantly updating their positions by considering how each company performed. Additionally, it is not unusual for some companies to release their earnings information amid an earnings season, mainly because different companies may be structured differently and can have distinct quarter dates.

Overall, all European companies included in the EURO STOXX 50 index must report their financial information according to the IFRS (International Financial Reporting Standards). With this, firms must include in their report the balance sheet, statements of income, changes in equity and cash-flow.

Due to constraints in data availability, trading volume and closing prices information are missing for specific days of the year throughout our period of analysis. Upon research, most of these days corresponded to holidays and, therefore, were excluded from our study.

In summary, the major inputs extracted were turnover by volume, historical prices

and earnings announcement dates. The study aims to analyse if the PEAD anomaly is present and significant in any of these companies' shares, throughout the investigation period.

Due to constraints in database availability, the only option for data extraction was Thomson Reuters Eikon and Thomson Reuters Datastream that made possible the collection of important data inputs for our study. Overall, Thomson Reuters is one of the most trusted financial platforms in the world, when it comes to extracting and collecting data while proving up to date information on the global economy.

### 3.2 Data Presentation and Description

Firstly, it is important to indicate that 944 earnings announcement dates were extracted from the Thomson Reuters database. These event reports represent 50 companies that were listed in the Euro Stoxx 50 for, at least, one year. Table 1 provides data on the different types of news events that were collected:

**Table 1 - Earnings Announcements Description by Type**

| *Earnings Announcements* | *Yearly* | *Half-Yearly* | *Quarterly* |
|---|---|---|---|
| Event Reports | 153 | 99 | 692 |
| Event Frequency | 16.21% | 10.49% | 73.30% |

With this, most of the collected event reports are quarterly reports which generally include an income statement, a balance sheet and a cash flow declaration. Usually, quarterly earnings announcements along with analyst forecast reports are the main source of information to investors who are looking to update their portfolio positions. The release period of this type of events normally generates fluctuations in the market, depending on whether a firm has surpassed or not analysts' earnings estimates for the quarter, even if there is a notable earnings growth.

Furthermore, we followed MacKinlay's (1997) directive and grouped the different earnings announcements into three distinct categories:

- **Good News** – Registered when the security's return on the event day (t=0) is positive;
- **No News** – Registered when the security's return on the event day (t=0) is zero or close to zero;

- **Bad News** – Registered when the security's return on the event day (t=0) is negative.

Thus, Table 2 describes the frequency of each one of the news event categories on our dataset:

**Table 2 - Earnings Announcements Description by News Outcome**

| *Earnings Announcements* | *Good News* | *No News* | *Bad News* |
|---|---|---|---|
| Event Reports | 480 | 5 | 459 |
| Event Frequency | 50.85% | 0.53% | 48.62% |

In this chapter of the dissertation, abnormal returns and abnormal trading volume have not been calculated and will be further analysed in the event studies methodology chapter.

However, some of the main inputs considered in our empirical analysis are displayed, by company, in terms of closing prices and trading volume in Appendix 1 and 2.

Lastly, the analysis period was changed during the construction of this dissertation due to missing closing prices data in 2011 which was needed for events between January 2012 and April 2012. Due to the Covid-19 pandemic, access to the university's library was not an option. Because of this, we decided to change the timeline of the empirical analysis from January 1st, 2012 – December 31st, 2017 to August 15th, 2012 – December 31st, 2017.

## 4. Methodology

Firstly, as mentioned before, the methodology that will be followed on this report is the event studies methodology since it allows to understand not only the impact of an event, such as earnings announcements, dividends announcements and other types of events that can cause price changes on a security price, but also to grasp the importance of information and news events, in general, on market price fluctuations.

Overall, an event study revolves around an empirical analysis of a specific news event and its impact on a security's stock price and trading volume. Hence, why event studies are the best form of understanding the post-earnings announcement drift and the impact of earnings surprises on stock prices

Furthermore, the methodology is based around a construction of an event window to assess the price changes before and after an earnings announcement, as well as the calculation of abnormal returns through different available models that seek to appraise normal returns.

With this, the first step is to select which model will be used to estimate the normal or expected returns. MacKinlay (1997) offers a variety of possible approaches and separates them into two different categories, being them statistical or economic methods. According to the author, statistical models are based on numerical hypotheses regarding the behavior of asset returns, whereas economic models don't consider statistical assumptions and are more reliant on investors' behavior theories.

MacKinlay's article of the event studies methodology will be used as a basis for the analysis of the abnormal returns. Furthermore, an abnormal trading volume study will also be a focus of this dissertation by following Beaver's (1968) article about the topic in question.

MacKinlay (1997) highlights several known models to compute the returns, such as the constant mean return model, the market model, economic models like the Arbitrage Pricing Theory (APT) and the Capital Asset Pricing Model (CAPM) as well as known multi-factor models like the Fama and French 3-factor model.

Regarding our study of the PEAD phenomenon in Europe, the most indicated model to use is the market model, which is a statistical model, since its better suited to capture the impact of different events and information on prices and returns. Moreover, the market model is widely used amongst the literature when it comes to assessing the significance and presence of the PEAD anomaly, being regarded as the most efficient model in terms of its simplicity and ability to better evaluate the effects of events on security prices. The most

recent European study about the PEAD effect made by Vuorela (2018) applied the market model to its empirical analysis. Furthermore, Garfinkel & Sokobin (2006) established a link between PEAD returns and distinct measures of trading volume on the day of the earnings announcement release by successfully using the market model.

The market model defines the relationship between the normal return of a certain security i and the return of the market portfolio. Essentially:

$$\mathbf{R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}} \quad (1)$$

Where:

$R_{it}$ are the normal returns of a security i for the period t

$\beta_i$ and $\alpha_i$ are the market model parameters

$R_{mt}$ are the returns of the market portfolio for the period t

$\varepsilon_{it}$ is the zero mean disturbance term

Moreover, $E(\varepsilon_{it} = 0)$ and $Var\ (\varepsilon_{it}) = \sigma^2_{\varepsilon_t}$ .

According to MacKinlay (1997), when using the market model abnormal returns can be defined as:

$$\mathbf{AR_{it} = R_{it} - E(R_{it})} \quad (2)$$

Where:

A$R_{it}$ are the abnormal returns of a security it for the period t

E $(R_{it}) = \widehat{\alpha_i} + \widehat{\beta_i} R_{mt}$ or $E(R_{it}|X_t)$ , which are the expected returns of a security it for the period t

$\hat{\alpha}_i$ and $\hat{\beta}_i$ are the estimated market model parameters

$X_t$ can be defined as a constant when using the constant mean return model and as $R_{mt}$ when using the market model

In short, abnormal returns are an efficient measure for the presence of PEAD in a given security, since it allows to understand if a certain news event had an increased positive or negative impact when compared to the market average or the expected return. Fundamentally, this method allows us to compare the actual returns of stocks, after a news event, with the expected return of that same stock before the event.

All European companies included in our study are or have been listed in the EURO STOXX 50 index, as mentioned before. Thus, we decided to select the EURO STOXX 50 index as the market portfolio for our empirical analysis.

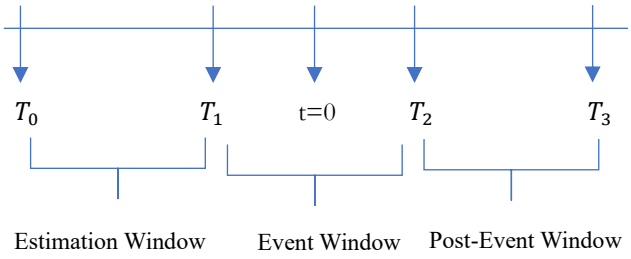
### 4.1 Time line for the event study

As stated by MacKinlay (1997), "the initial task of conducting an event study is to define the event of interest and identify the period over which the security prices of the firms involved in this event will be examined - the event window". (p.14)

The timeline of an event study does not only consider the event window and the post-event window, it also considers the pre-event window which is of interest to investigate if the information of an earnings announcement was already made available to the market prior to its release.

With this, the next step is to define the estimation, event and post-event windows as shown by Figure 1:

**Figure 1 - Time line for an event study**




The process of selecting the different analysis windows for our study took into consideration the example left by MacKinlay (1997). Thus, the definition of the timeline cannot either be too narrow, since it will not be able to capture the impact of the earnings announcement on the security, or too large due the fact that it could depict other information unrelated to the news event.

Since there is not a rulebook or a standard time line that is common amongst the literature, we decided to apply an event window of 41 days over the earnings announcements.

Therefore, the pre-event window is defined as [-20, -1] and the post-event window as [+1, +20] with the event window being set at time 0. Regarding the estimation window, we decided to use an ample and broad period defined as [-140, -21]. Most of the literature agrees on either 10, 20, 40 or 60 days for the event window as is evidenced by Gerard (2012).

### 4.2 Abnormal Return Analysis

Firstly, before estimating the market model parameters, a procedure needs to be considered. The OLS estimation process is the most indicated one for the market model and as such, our empirical analysis for the abnormal returns is based on this econometric procedure.

The null hypothesis in this analysis, $H_0$, tests if the earnings announcements have no impact on the performance of the returns. Under $H_0$, abnormal returns will follow a normal distribution with conditional mean 0 and conditional variance $\sigma^2(AR_{it})$.

Thus:

$$\mathbf{AR_{it} \sim N\left(0, \sigma^2(AR_{it})\right)} \quad (3)$$

With:

$$\mathbf{\sigma^2(AR_{it}) = \sigma^2_{\varepsilon_i} + \frac{1}{L_1}\left[\frac{1+(R_{mt}-\widehat{u_m})^2}{\hat{\sigma}^2_m}\right]} \quad (4)$$

According to MacKinlay (1997), "the conditional variance has two components. One component is the disturbance variance $\sigma^2_{\varepsilon_i}$ and a second component, which is the additional variance due to the sampling error in $\alpha_i$ and $\beta_i$". (p.21)

Essentially:

L is the estimation window

$\sigma^2_m$ is the variance of the market returns during the estimation window

$\hat{u}_m$ is the mean of the market returns, during the estimation window being, fundamentally, $\frac{1}{L_1}\sum_{t=t_0+1}^{t_1} R_{mt}$

$\sigma^2_{\varepsilon_i}$ is the disturbance variance of a given security I, being $\frac{1}{L-2}\sum_{t=t_0+1}^{t_1}(R_i - \hat{\alpha}_i - \hat{\beta}_i R_{mt})^2$

Equation (4) second component refers to the added variance caused by the sampling error in the market model parameters $\alpha_i$ and $\beta_i$. Thus, as the estimation window $L_1$ increases, the second component tends to zero and the sampling error will start to fade away. Then, without the sampling error, the variance of the abnormal returns will be $\sigma_{\varepsilon_i}$ and the observations will, eventually, become neutral.

As such:

$$\sigma^2(\mathrm{AR_{it}}) = \sigma^2_{\varepsilon_i} \tag{5}$$

In order to give continuation to Equation (3), aggregation of abnormal returns needs to be considered. This aggregation can be prepared through two distinct dimensions, beyond time and across stocks. Thus, the procedure requires the usage of cumulative abnormal returns (CAR) to begin the aggregation through time.

The cumulative abnormal returns from $t_1$ to $t_2$, where $T_1 < t_1 \leq t_2 \leq T_2$, can be defined as the sum of all abnormal returns for the considered time period:

$$\mathrm{CAR_i}(t_1, t_2) = \sum_{t=t_1}^{t_2} \mathrm{AR_{it}} \tag{6}$$

As the estimation window rises, the variance of the cumulative abnormal returns becomes:

$$\sigma^2_i(t_1, t_2) = (t_2 - t_1 + 1)\sigma^2_{\varepsilon_i} \tag{7}$$

Therefore, the distribution of the CA$R_i$ under the null hypothesis ($H_0$) is as follows:

$$\mathrm{CAR_i}(t_1, t_2) \sim \mathrm{N}(0, \sigma^2_{\varepsilon_i}(t_1, t_2)) \tag{8}$$

The aggregation of the abnormal returns across securities takes into consideration average abnormal returns ($\overline{AR}$), unlike aggregation through time. Furthermore, according to MacKinlay (1997), it is assumed that there is not any overlap in the event windows of the securities being studied. This allows for the CA$R_i$ and abnormal returns to be independent across stocks.

Thus, the aggregated abnormal returns are defined as:

$$\overline{\mathrm{AR_t}} = \frac{1}{\mathrm{N}} \sum_{i=1}^{\mathrm{N}} \mathrm{AR_{it}} \tag{9}$$

Where:

N is the number of events

Regarding the variance, it can be expressed in the following equation:

$$\mathrm{Var}\ (\overline{\mathrm{AR_t}}) = \frac{1}{\mathrm{N}^2} \sum_{i=1}^{\mathrm{N}} \sigma^2_{\varepsilon_i} \tag{10}$$

Following the calculation of the average abnormal returns and its variance, these can

be aggregated by recurring to the same procedure as before. Therefore, the cumulative abnormal returns and its variance for any interval in the event windows are:

$$\overline{\mathrm{CAR}}(t_1, t_2) = \sum_{t=t_1}^{t_2} \overline{\mathrm{AR}_t} \tag{11}$$

$$\mathrm{Var}\left(\overline{\mathrm{CAR}}(t_1, t_2)\right) = \sum_{t=t_1}^{t_2} \mathrm{Var}(\overline{\mathrm{AR}_t}) \tag{12}$$

However, it is also possible to compute the CA$R_t$ of each security and then aggregate through time:

$$\overline{\mathrm{CAR}}(t_1, t_2) = \frac{1}{N} \sum_{i=1}^{N} \mathrm{CAR}_i(t_1, t_2) \tag{13}$$

$$\mathrm{Var}\left(\overline{\mathrm{CAR}}(t_1, t_2)\right) = \frac{1}{N^2} \sum_{i=1}^{N} \sigma_i^2(t_1, t_2) \tag{14}$$

In order to test the null hypothesis, $H_0$, a new estimator must be used since $\sigma_{\varepsilon_i}^2$ is not known. Thus, to test that the abnormal returns are zero, we can use either one of the following estimators $\theta_1$and $\theta_2$:

$$\overline{\mathrm{CAR}}(t_1, t_2) \sim N[0, \mathrm{Var}(\overline{\mathrm{CAR}}(t_1, t_2))] \tag{15}$$

$$\theta_1 = \frac{\overline{\mathrm{CAR}}(t_1,t_2)}{\mathrm{Var}(\overline{\mathrm{CAR}}(t_1,t_2))^{\frac{1}{2}}} \sim N(0,1) \tag{16}$$

$$\theta_2 = \frac{\overline{\mathrm{AR}_t}}{\mathrm{Var}(\overline{\mathrm{AR}_t})^{\frac{1}{2}}} \sim N(0,1) \tag{17}$$

### 4.3 Abnormal Trading Volume Analysis

After testing the impact of the earnings announcements, through the calculation of the abnormal returns, on the security prices it is also important to measure the effect of the news events on the trading volume.

Therefore, by following the same procedure that was used when following the market model to calculate the abnormal returns and recurring to Beaver (1968) the abnormal trading volume can be defined as:

$$AV_{it} = V_{it} - E(V_{it}) \tag{18}$$

Where:

$V_{it}$ is the trading volume of a certain security i for the period t

$E(V_{it}) = \widehat{\alpha_i} + \widehat{\beta_i} V_{mt}$ is the expected trading volume of a given security it for the period t

The trading volume can be computed, in two distinct ways, one free of market adjustments and another where market influences are considered, according to Beaver (1968):

$$V_{it} = \frac{number\ of\ shares\ of\ firm\ i\ traded\ in\ day\ t}{number\ of\ shares\ outstanding\ for\ firm\ i\ in\ day\ t} \quad (19)$$

$$V_{it} = \alpha_i + \beta_i V_{mt} + \varepsilon_{it} \quad (20)$$

$$V_{mt} = \frac{number\ of\ shares\ traded\ for\ all\ EURO\ STOXX\ 50\ firms\ in\ day\ t}{number\ of\ shares\ outstanding\ for\ al\ EURO\ STOXX\ 50\ firms\ in\ day\ t} \quad (21)$$

Essentially:

$V_{mt}$ is the trading volume of the market portfolio for the period t

$\alpha_i$ and $\beta_i$ are the market model parameters

$\varepsilon_{it}$ is the zero mean disturbance term

Furthermore, $E(\varepsilon_{it} = 0)$ and $Var\ (\varepsilon_{it}) = \sigma_{\varepsilon_t}^2$ .

Thus, taking into consideration the previous formulas, the abnormal trading volume becomes:

$$AV_{it} = V_{it} - \hat{\alpha}_i - \hat{\beta}_i V_{mt} \quad (22)$$

When accounting for the analysis of N events, it is possible to compute the average abnormal trading volume and test the null hypothesis by using a similar estimator to the one computed for the abnormal returns analysis:

$$\overline{AV_t} = \frac{1}{N} \sum_{i=1}^{N} AV_{it} \quad (23)$$

$$\theta_3 = \frac{\overline{AV_t}}{Var(\overline{AV_t})^{\frac{1}{2}}} \sim N(0,1) \quad (24)$$

All the calculations, in this chapter, were made using the different functions of Microsoft Excel. Furthermore, the book by Kliger & Gurevich (2014) was followed, in order to understand how to apply the event study methodology for multiple companies on

Microsoft Excel.

Due to the majority of events, for each company, having an $\alpha_{it}$ that is not statistically significant for a 5% significance level, we decided to adopt the following model for the abnormal returns' analysis:

$$R_{it} = \beta_i R_{mt} + \varepsilon_{it}$$

# 5. Results

Firstly, it is important to state that this chapter will focus on the description and study analysis of abnormal returns and abnormal trading volume. Therefore, a variety of graphics and statistical tables will be provided after applying the different methodology aspects of the previous chapter. The main focus of the analysis will be in assessing the existence of abnormal returns and abnormal volume for the 50 companies in the study, understanding if the market is semi-strong efficient or not. If the market were semi-strong efficient, then the prices would reflect all publicly available information (per example, earnings announcements) and there would be no possibility to capture abnormal returns.

## 5.1 Abnormal Returns Analysis

The first step undertaken was to estimate the market model, according to the methodology provided by MacKinlay, of all 50 companies, at each event period t, listed in the Euro Stoxx 50 index between 15th August 2012 and 31st December 2017.

With this, Table 3 presents some key statistics about the market model estimation for each earnings announcement of all the companies in our study:

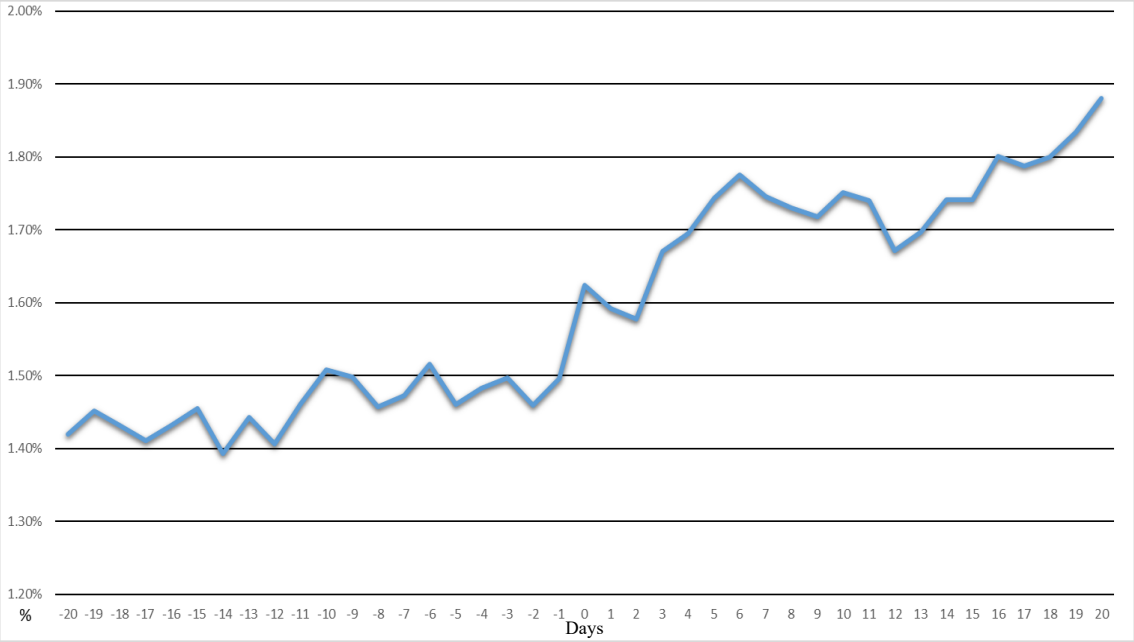
**Table 3 – Descriptive Statistics for the Market Model Estimation (Abnormal Returns)**

| | *Mean* | *Standard Deviation* |
|---|---|---|
| Daily Returns ($R_{it}$) | 0.04% | 1.70% |
| R-Squared ($R^2$) | 0.4868 | 0.2006 |
| Beta ($\beta_{it}$) | 0.9697 | 0.3419 |

The average $R^2$ obtained, during the data analysis, implies that only 20.14% of the stock's daily changes are explained by the EURO STOXX 50 index. Therefore, only a small part of the study company movements can be explained by movements of the index they are inserted in.

Subsequently, we determined the daily abnormal returns for every stock and event period as well as the cumulative abnormal returns. Afterwards, the averages of these two components were also computed in order to fully analyze the existence and impact of the post-earnings announcement drift on the European market. Consequently, Figure 2 represents the global average cumulative abnormal returns for all 944 earnings announcements in the study for the 20-day event window.

**Figure 2 – Global cumulative average abnormal returns**




Source: Author's elaboration

According to the results we obtained, it is possible to denote a stable positive CAAR growth throughout the event window, with the values ranging from 1.39% to 1.88%. Essentially, the global positive results indicate that earnings announcements, as a source of information, are valuable to investors and can lead to continuously positive cumulative abnormal returns.

Furthermore, the event day 0 represents the day that every investor gets access to the price sensitive event information, which is translated into the highest increase in CAAR when comparing to any other event day. The continuous increase in CAAR prior to the earnings announcement can be related to an increased number of insiders or analysts having information prior to the release. In regard to the $\overline{AR}$, the values obtained are in accordance with the values Gerard (2012) obtained for 20 days after the earnings announcement.

Table 4 presents, not only the exact global cumulative average abnormal returns for each event day, but also the respective econometric tests along with the global average abnormal returns results:

**Table 4 – Global average abnormal returns and cumulative average abnormal returns results**

| Event Day | $\overline{AR}$ | $\theta_1$ | $\overline{CAR}$ | $\theta_2$ |
|---|---|---|---|---|
| -20 | -0.06% | **-2.7843**** | 1.42% | **4.9962**** |
| -19 | 0.03% | 1.3408 | 1.45% | **5.0892**** |
| -18 | -0.02% | **-9.5499**** | 1.43% | **4.9981**** |
| -17 | -0.02% | **-7.8997**** | 1.41% | **4.9038**** |
| -16 | 0.02% | 1.1525 | 1.43% | **4.9591**** |
| -15 | 0.02% | 1.1860 | 1.46% | **5.0194**** |
| -14 | -0.06% | **-2.6830**** | 1.39% | **4.7848**** |
| -13 | 0.05% | 1.5134 | 1.44% | **4.9355**** |
| -12 | -0.04% | **-3.5719**** | 1.41% | **4.7930**** |
| -11 | 0.06% | 1.5531 | 1.46% | **4.9624**** |
| -10 | 0.05% | 1.4897 | 1.51% | **5.1007**** |
| -9 | -0.01% | **-3.0806**** | 1.50% | **5.0488**** |
| -8 | -0.04% | **-3.2739**** | 1.46% | **4.8924**** |
| -7 | 0.01% | 0.9695 | 1.47% | **4.9242**** |
| -6 | 0.04% | 1.4675 | 1.52% | **5.0521**** |
| -5 | -0.06% | **-2.8054**** | 1.46% | **4.8494**** |
| -4 | 0.02% | 1.1667 | 1.48% | **4.9054**** |
| -3 | 0.01% | **18.5163**** | 1.50% | **4.9322**** |
| -2 | -0.04% | **-3.5132**** | 1.46% | **4.7930**** |
| -1 | 0.04% | 1.3849 | 1.50% | **4.8931**** |
| 0 | 0.13% | 1.7795 | 1.62% | **5.2946**** |
| 1 | -0.03% | **-3.9526**** | 1.59% | **5.1712**** |
| 2 | -0.01% | **-13.8889**** | 1.58% | **5.1081**** |
| 3 | 0.09% | 1.7058 | 1.67% | **5.3881**** |
| 4 | 0.02% | 1.2212 | 1.69% | **5.4498**** |
| 5 | 0.05% | 1.5066 | 1.74% | **5.5869**** |
| 6 | 0.03% | 1.3311 | 1.78% | **5.6690**** |
| 7 | -0.03% | **-4.2503**** | 1.75% | **5.5541**** |
| 8 | -0.02% | **-43.2213**** | 1.73% | **5.4872**** |
| 9 | -0.01% | **-7.4108**** | 1.72% | **5.4292**** |
| 10 | 0.03% | **7.3980**** | 1.75% | **5.5171**** |
| 11 | -0.01% | **-4.6211**** | 1.74% | **5.4640**** |
| 12 | -0.07% | **-2.6070**** | 1.67% | **5.2321**** |
| 13 | 0.02% | 1.2217 | 1.70% | **5.2930**** |
| 14 | 0.04% | 1.4735 | 1.74% | **5.4145**** |
| 15 | 0.00% | -0.0257 | 1.74% | **5.3965**** |
| 16 | 0.06% | 1.5795 | 1.80% | **5.5641**** |
| 17 | -0.01% | **-8.9392**** | 1.79% | **5.5064**** |
| 18 | 0.01% | 0.8461 | 1.80% | **5.5249**** |
| 19 | 0.03% | 1.3661 | 1.83% | **5.6126**** |
| 20 | 0.05% | 1.4895 | 1.88% | **5.7370**** |

* Parameters statistically significant at a 5% significance level

**** Parameters statistically significant at a 1% significance level

The global results comprise every earnings announcement in our study, be it good news, bad news or no relevant news. With this, it is possible to denote that the event day 0, official day of the earnings announcement release, is statistically significant for the cumulative average abnormal returns. Thus, it rejects the null hypothesis that the event had no effect

on the company's security prices at a 95% significance level.

The most interesting result derives from the analysis of the cumulative average abnormal returns, which implies that the earnings announcements have a lasting impact prior to the disclosure and after the release of the earnings information for the companies, since for every event day the results are statistically significant for both 1% and 5% significance levels.

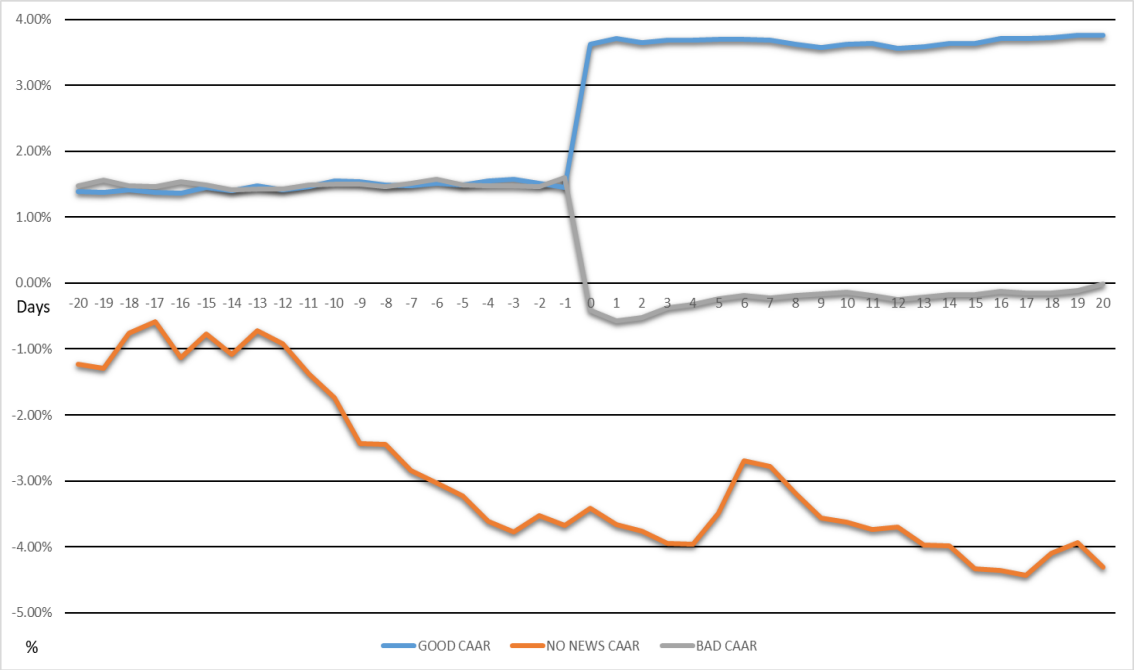
The values obtained are consistent with some of the reviewed literature such as Duque & Pinto (2004) and Parada (2011). In similarity with Parada (2011), there is a negative average abnormal return in day 1 after the event day that registered a positive return, which is an unexpected result. However, some of the negative returns, specifically, days 1 and 2 are immediately followed by positive consistent returns until day 7. Most of the significant returns take place in days with negative average abnormal returns.

The $\overline{AR}$ results corroborate Singal's (2006) investor behavior explanation for the PEAD. As investors slowly update their beliefs and start progressively reacting to the earnings announcement the average abnormal returns decrease, below the event day 0 result, but still positive as more people start incorporating the information into their portfolios by rebalancing.

In general, the results suggest that earnings announcements influence stock prices and that the post-earnings announcement drift is present on the European market as a whole. This is shown by the continuous positive average abnormal returns after the day the earnings announcement is released, with the market gradually integrating the information into the stock prices.

The previous graphic and table incorporated the results on a global scale, not discriminating the categories of earnings announcements. Therefore, Figure 3 diversifies the results and separates the analysis into three categories (good news, no news, bad news).

**Figure 3 – Cumulative average abnormal returns, by news category**




Source: Author's elaboration

After estimating the results on a global scale, we decided to adopt MacKinlay's (1997) news categorization, by dividing earnings announcements into good news, bad news and no news, where the latter is based on earnings events that do not display any information capable of affecting stock prices, since the return on event day is effectively 0. This method of distinctively classifying news events was first created by MacKinlay and later revolutionized by a different number of authors.

The $\overline{CAR}$ results obtained are either more positive, in the good news category, or less negative, in the bad news category, when compared to the results found by Vuorela (2018), whom found a maximum $\overline{CAR}$ of 1.33%, for good news, and a minimum $\overline{CAR}$ of -1.67% for bad news.

Subsequently, Tables 5, 6 and 7 exhibit a detailed description of the cumulative average abnormal returns shown in the above graphic, as well as the average abnormal returns and the respective tests separated by news categories (good news, bad news, no news).

Overall, the results obtained are in accordance with the expectations, despite some deviations and exceptions. The earnings announcement categorization allows for a deeper analysis of the post-earnings announcement drift anomaly since different observations can be made for different types of events, dictating whether or not all news events are important

and impactful onto security prices.

**Table 5 - Average abnormal returns and cumulative average abnormal returns, "Good News"**

| Event Day | $\overline{AR}$ | $\theta_1$ | $\overline{CAR}$ | $\theta_2$ |
|---|---|---|---|---|
| -20 | -0.04% | -1.2107 | 1.39% | **3.5579**** |
| -19 | 0.01% | -0.5991 | 1.38% | **3.5133**** |
| -18 | 0.03% | **34.3781**** | 1.41% | **3.5732**** |
| -17 | 0.03% | -1.0525 | 1.38% | **3.4814**** |
| -16 | 0.02% | -0.7153 | 1.36% | **3.4288**** |
| -15 | 0.08% | **3.0031**** | 1.45% | **3.6221**** |
| -14 | -0.04% | -1.2308 | 1.40% | **3.4977**** |
| -13 | 0.08% | **3.0668**** | 1.48% | **3.6811**** |
| -12 | -0.07% | -1.4267 | 1.41% | **3.4968**** |
| -11 | 0.05% | **4.7654**** | 1.46% | **3.6006**** |
| -10 | 0.09% | **2.8776**** | 1.55% | **3.8090**** |
| -9 | -0.02% | -0.7139 | 1.54% | **3.7571**** |
| -8 | -0.04% | -1.2094 | 1.49% | **3.6401**** |
| -7 | -0.02% | -0.7961 | 1.47% | **3.5821**** |
| -6 | 0.04% | **9.3805**** | 1.51% | **3.6537**** |
| -5 | -0.02% | -0.8595 | 1.49% | **3.5901**** |
| -4 | 0.06% | **3.7621**** | 1.55% | **3.7185**** |
| -3 | 0.03% | **18.1460**** | 1.58% | **3.7703**** |
| -2 | -0.07% | -1.4286 | 1.51% | **3.5922**** |
| -1 | -0.06% | -1.3518 | 1.45% | **3.4426**** |
| 0 | 2.17% | **2.0258**** | 3.62% | **8.5671**** |
| 1 | 0.09% | **2.8269**** | 3.71% | **8.7595**** |
| 2 | -0.07% | -1.4448 | 3.64% | **8.5600**** |
| 3 | 0.04% | **7.1508**** | 3.68% | **8.6199**** |
| 4 | 0.00% | 0.3440 | 3.68% | **8.5996**** |
| 5 | 0.02% | **2.3973**** | 3.70% | **8.6051**** |
| 6 | 0.00% | 0.1715 | 3.70% | **8.5808**** |
| 7 | -0.02% | -0.8872 | 3.68% | **8.5010**** |
| 8 | -0.06% | -1.3582 | 3.62% | **8.3379**** |
| 9 | -0.05% | -1.2687 | 3.57% | **8.2002**** |
| 10 | 0.05% | **5.0294**** | 3.62% | **8.2778**** |
| 11 | 0.02% | **3.2527**** | 3.63% | **8.2895**** |
| 12 | -0.07% | -1.4427 | 3.56% | **8.1000**** |
| 13 | 0.02% | **9.4521**** | 3.59% | **8.1252**** |
| 14 | 0.04% | **5.4975**** | 3.63% | **8.1969**** |
| 15 | 0.01% | 0.9214 | 3.64% | **8.1902**** |
| 16 | 0.07% | **3.2358**** | 3.71% | **8.3261**** |
| 17 | 0.00% | 0.0758 | 3.71% | **8.3020**** |
| 18 | 0.01% | 1.0481 | 3.72% | **8.2970**** |
| 19 | 0.04% | **8.3800**** | 3.76% | **8.3516**** |
| 20 | 0.00% | 0.2402 | 3.76% | **8.3322**** |

* Parameters statistically significant at a 5% significance level

**** Parameters statistically significant at a 1% significance level

**Table 6 - Average abnormal returns and cumulative average abnormal returns, "No News"**

| Event Day | $\overline{AR}$ | $\theta_1$ | $\overline{CAR}$ | $\theta_2$ |
|---|---|---|---|---|
| -20 | -0.14% | -0.9034 | -1.23% | -0.4027 |
| -19 | -0.06% | -0.2992 | -1.29% | -0.4195 |
| -18 | 0.53% | 1.0968 | -0.76% | -0.2458 |
| -17 | 0.17% | 0.5638 | -0.59% | -0.1895 |
| -16 | -0.55% | **-9.8537**** | -1.14% | -0.3650 |
| -15 | 0.37% | 0.9168 | -0.77% | -0.2451 |
| -14 | -0.32% | **-5.4946**** | -1.09% | -0.3463 |
| -13 | 0.37% | 0.9107 | -0.72% | -0.2289 |
| -12 | -0.20% | -1.7508 | -0.93% | -0.2925 |
| -11 | -0.46% | **-44.9140**** | -1.38% | -0.4356 |
| -10 | -0.35% | **-8.3922**** | -1.74% | -0.5447 |
| -9 | -0.70% | **-5.3443**** | -2.44% | -0.7611 |
| -8 | -0.02% | -0.0813 | -2.45% | -0.7636 |
| -7 | -0.39% | **-17.2442**** | -2.84% | -0.8823 |
| -6 | -0.18% | -1.3907 | -3.02% | -0.9345 |
| -5 | -0.20% | -1.7381 | -3.23% | -0.9937 |
| -4 | -0.39% | **-15.7261**** | -3.61% | -1.1091 |
| -3 | -0.15% | -1.0763 | -3.77% | -1.1518 |
| -2 | 0.24% | 0.7027 | -3.53% | -1.0755 |
| -1 | -0.15% | -1.0379 | -3.68% | -1.1170 |
| 0 | 0.27% | 0.7678 | -3.41% | -1.0306 |
| 1 | -0.25% | **-2.7513**** | -3.66% | -1.1033 |
| 2 | -0.10% | -0.5769 | -3.76% | -1.1289 |
| 3 | -0.19% | -1.4754 | -3.94% | -1.1805 |
| 4 | -0.01% | -0.0489 | -3.96% | -1.1795 |
| 5 | 0.46% | 1.0274 | -3.49% | -1.0382 |
| 6 | 0.79% | 1.2893 | -2.70% | -0.7996 |
| 7 | -0.08% | -0.4584 | -2.78% | -0.8210 |
| 8 | -0.41% | -1.4500 | -3.19% | -0.9377 |
| 9 | -0.37% | **-11.4142**** | -3.56% | -1.0437 |
| 10 | -0.06% | -0.3308 | -3.62% | -1.0583 |
| 11 | -0.11% | -0.6863 | -3.73% | -1.0874 |
| 12 | 0.04% | 0.1621 | -3.69% | -1.0726 |
| 13 | -0.28% | **-3.6569**** | -3.98% | -1.1510 |
| 14 | -0.01% | -0.0453 | -3.99% | -1.1500 |
| 15 | -0.35% | **-7.7552**** | -4.33% | -1.2463 |
| 16 | -0.02% | -0.0782 | -4.35% | -1.2471 |
| 17 | -0.08% | -0.4442 | -4.43% | -1.2658 |
| 18 | 0.34% | 0.8699 | -4.09% | -1.1659 |
| 19 | 0.15% | 0.5195 | -3.94% | -1.1187 |
| 20 | -0.37% | **-10.1467**** | -4.31% | -1.2186 |

* Parameters statistically significant at a 5% significance level

**** Parameters statistically significant at a 1% significance level

**Table 7 - Average abnormal returns and cumulative average abnormal returns, "Bad News"**

| Event Day | $\overline{AR}$ | $\theta_1$ | $\overline{CAR}$ | $\theta_2$ |
|---|---|---|---|---|
| -20 | -0.07% | **-10.3079**** | 1.48% | **4.0000**** |
| -19 | 0.08% | 1.1666 | 1.56% | **3.7281**** |
| -18 | -0.08% | **-7.4109**** | 1.48% | **3.5273**** |
| -17 | -0.01% | -0.6334 | 1.47% | **3.4805**** |
| -16 | 0.07% | 1.0789 | 1.53% | **3.6241**** |
| -15 | -0.04% | **-6.0421**** | 1.49% | **3.5091**** |
| -14 | -0.08% | **-7.1314**** | 1.41% | **3.3098**** |
| -13 | 0.01% | 0.4161 | 1.43% | **3.3318**** |
| -12 | 0.00% | -0.0141 | 1.42% | **3.3179**** |
| -11 | 0.07% | 1.0972 | 1.49% | **3.4654**** |
| -10 | 0.00% | 0.1568 | 1.50% | **3.4633**** |
| -9 | 0.00% | **-7.6900**** | 1.50% | **3.4588**** |
| -8 | -0.04% | **-4.6893**** | 1.46% | **3.3544**** |
| -7 | 0.05% | 0.9759 | 1.52% | **3.4656**** |
| -6 | 0.06% | 0.9884 | 1.57% | **3.5792**** |
| -5 | -0.09% | **-5.4162**** | 1.48% | **3.3617**** |
| -4 | -0.01% | -0.5088 | 1.47% | **3.3233**** |
| -3 | 0.00% | 0.0324 | 1.47% | **3.3134**** |
| -2 | -0.01% | -0.2570 | 1.46% | **3.2869**** |
| -1 | 0.14% | 1.4091 | 1.60% | **3.5781**** |
| 0 | -2.01% | **-2.0583**** | -0.41% | -0.9066 |
| 1 | -0.16% | **-3.0791**** | -0.57% | -1.2633 |
| 2 | 0.05% | 0.9109 | -0.52% | -1.1538 |
| 3 | 0.15% | 1.4552 | -0.37% | -0.8151 |
| 4 | 0.05% | 0.9077 | -0.32% | -0.7085 |
| 5 | 0.08% | 1.1645 | -0.24% | -0.5327 |
| 6 | 0.05% | 0.9767 | -0.19% | -0.4125 |
| 7 | -0.04% | **-4.0222**** | -0.23% | -0.4936 |
| 8 | 0.03% | 0.7512 | -0.19% | -0.4179 |
| 9 | 0.03% | 0.6652 | -0.16% | -0.3553 |
| 10 | 0.02% | 0.5560 | -0.14% | -0.3071 |
| 11 | -0.04% | **-4.5591**** | -0.18% | -0.3908 |
| 12 | -0.07% | **-13.9321**** | -0.25% | -0.5314 |
| 13 | 0.03% | 0.7010 | -0.22% | -0.4643 |
| 14 | 0.05% | 0.8990 | -0.17% | -0.3642 |
| 15 | -0.01% | -0.2242 | -0.18% | -0.3752 |
| 16 | 0.05% | 0.9121 | -0.13% | -0.2734 |
| 17 | -0.03% | -1.8032 | -0.16% | -0.3292 |
| 18 | 0.01% | 0.3099 | -0.15% | -0.3063 |
| 19 | 0.03% | 0.7059 | -0.12% | -0.2406 |
| 20 | 0.10% | 1.2584 | -0.02% | -0.0388 |

* Parameters statistically significant at a 5% significance level

**** Parameters statistically significant at a 1% significance level

When analyzing the average abnormal returns, it is possible to notice that the event day 0 is only statistically significant for bad news (-2.01%) and good news (2.17%), since no

news is generally associated with earnings announcements that have no relevant information and cannot influence stock prices. Essentially, most of the earnings announcements that offer no critical information (no news) are linked with negative statistically significant average abnormal returns, at least in some days of the event window. The cumulative average abnormal returns for the no news category, despite consistently negative, are not statistically significant and, thus, it is not possible to draw a conclusion from the result. Furthermore, since the sample for the no news category is considerably small, with only 5 earnings announcements being classified as having no impact on stock prices, the results do not allow to fully infer whether or not the effect is relevant.

The statistically significant results obtained, under the good and bad news categorization, imply that the post-earnings announcement drift is present and that earnings announcements are a useful source of information, in terms of determining stock price changes.

In accordance with the literature, there is a substantial rise in the average abnormal returns from day -1 to day 0, under the good news category, which suggests prior knowledge of the announcement, since news events are normally released after the market has closed for the day. This infers some sort of market inefficiency, given that the only substantial abnormal returns are earned in day 0 (2.17%), with the market being somewhat stable and the prices corrected after day 0. The same effect takes place when the earnings event information is negative, with a large downtrend in the abnormal returns to -2.01%, the result of investors rebalancing and adjusting their portfolios, with the market immediately correcting the price the day after (-0.16%).

These results are consistent with some of the findings by Atiase (1985) and Grant (1980), which linked the post-earnings announcement drift anomaly to different levels of pre-disclosure information. Thus, information asymmetry could be one of the causes of the results we obtained in our analysis.

Although earnings announcements are published after the market closes for the day, they can simply be understood as a tool of correcting any pre-disclosure information that was not totally truthful or that was lacking. Therefore, the price on day 0 was already under the influence of the earnings event content prior to its release, further corroborating the link between the post-earnings announcement drift and the different outputs of pre-disclosure information.

The cumulative average abnormal returns for the good news follow the same pattern

as the global $\overline{CAR}$ results, since every event day presents a statistically significant return, implying the event caused an impact on the stock prices for the 41 days of the study. Furthermore, the $\overline{CAR}$ obtained are higher compared to the overall results, which suggests the earnings surprise had a positive impact on the security prices.

Subsequently, when analyzing the bad news $\overline{CAR}$, it is perceptible that every day prior to the event day 0 is statistically significant, with the values ranging from 1.41% to 1.60%. Overall, the results are high but once the bad news are disclosed a substantial drop in the $\overline{CAR}$ can be observed.

Lastly, the strategy to assume a long position on "good news" stocks, fully owning these stocks, and a short position on "bad news" stocks with the intention to buy them back when the price falls after the earnings announcement is relevant to consider. Considering 20 days after the earnings announcements, a long position on stocks classified as "good" should not be profitable when it comes to $\overline{AR}$ since it can only offer a substantial profit on the day of the earnings announcement, which is to be expected due to the liquidity of the stocks included in our sample. Subsequently, a short position on "bad" stocks follows the same pattern with $\overline{AR}$ being profitable only on the day of the release of earnings information.

### 5.2 Abnormal Trading Volume Analysis

Firstly, we opted to follow Beaver's (1968) abnormal trading volume model, by collecting shares traded and shares outstanding for each day in our study period. With this, we computed the daily trading volume (%) and proceeded to calculate the expected trading volume and abnormal trading volume, through the market model estimation as was done in the abnormal return's analysis chapter.

Table 8 offers a global perspective of the descriptive statistics for the market model estimated in order to complete the abnormal trading volume analysis:

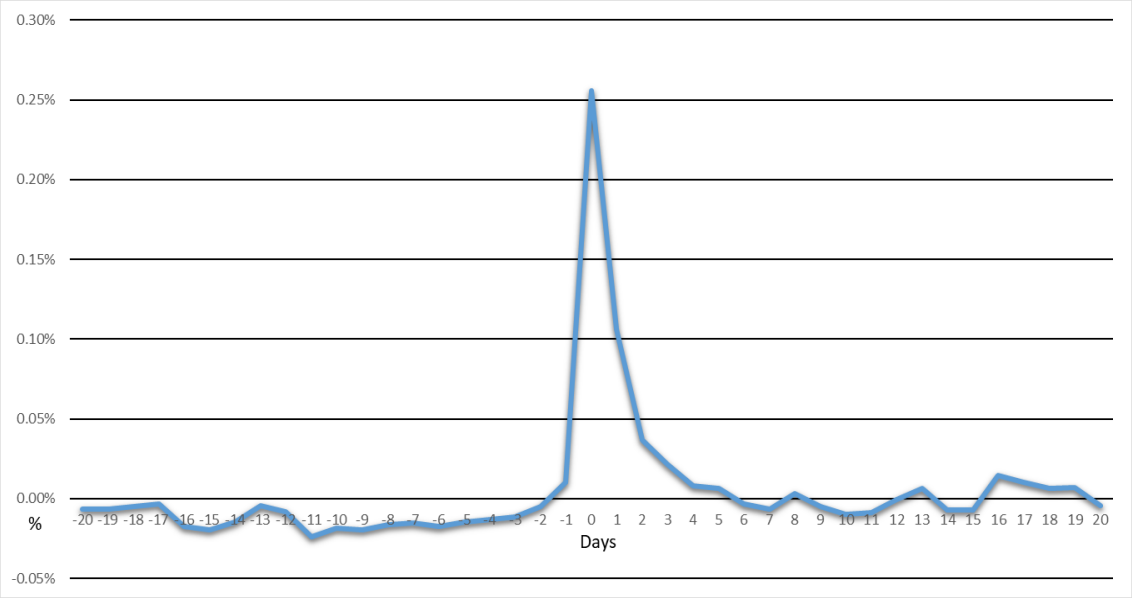
**Table 8 – Descriptive Statistics for the Market Model Estimation (Abnormal Trading Volume)**

| | *Mean* | *Standard Deviation* |
|---|---|---|
| Daily Trading Volume ($R_{it}$) | 0.38% | 0.31% |
| R-Squared ($R^2$) | 0.4106 | 0.1979 |
| Beta ($\beta_{it}$) | 0.8930 | 0.5914 |
| Alpha ($\alpha_{it}$) | 0.0003 | 0.0016 |

The obtained average R-Squared from the market model estimation is inferior to the one obtained on the abnormal return's analysis (0.4868). The average $\beta_{it}$ follows this same pattern and is lower compared to the one computed previously (0.9697). Thus, it means that compared to the abnormal returns, the companies trading volume drifts can be explained to an even lesser degree by the Euro Stoxx 50 trading volume changes.

Successively, we determined the average abnormal trading volume for each day of the predefined event window. The global results can be observed in Figure 4, which depicts the behaviour of the average abnormal trading volume:

**Figure 4 – Global average abnormal trading volume**




Source: Author's elaboration

The average abnormal trading volume is consistently underwhelming until day -1, but spikes on the event day 0, stabilizing its previous downward trend again after the event has taken place. Essentially, the information content on the earnings announcements normally provokes a clear impact on the abnormal trading volume, the day the information is released.

This can be observed with detailed, by analyzing the following table which provides not only the abnormal average trading volume but also its respective econometric test:

**Table 9 – Global average abnormal trading volume results**

| Event Day | $\overline{AVOL}$ | $\theta_3$ |
|---|---|---|
| -20 | -0.01% | -0.1758 |
| -19 | -0.01% | -0.1699 |
| -18 | -0.01% | -0.1322 |
| -17 | 0.00% | -0.0826 |
| -16 | -0.02% | -0.4364 |
| -15 | -0.02% | -0.5028 |
| -14 | -0.01% | -0.3718 |
| -13 | 0.00% | -0.1085 |
| -12 | -0.01% | -0.2102 |
| -11 | -0.02% | -0.5965 |
| -10 | -0.02% | -0.4567 |
| -9 | -0.02% | -0.4788 |
| -8 | -0.02% | -0.4004 |
| -7 | -0.02% | -0.3713 |
| -6 | -0.02% | -0.4227 |
| -5 | -0.01% | -0.3576 |
| -4 | -0.01% | -0.3210 |
| -3 | -0.01% | -0.2714 |
| -2 | 0.00% | -0.1193 |
| -1 | 0.01% | 0.2431 |
| 0 | 0.26% | **6.1232**** |
| 1 | 0.11% | **2.5290**** |
| 2 | 0.04% | 0.8808 |
| 3 | 0.02% | 0.5112 |
| 4 | 0.01% | 0.1856 |
| 5 | 0.01% | 0.1492 |
| 6 | 0.00% | -0.0762 |
| 7 | -0.01% | -0.1564 |
| 8 | 0.00% | 0.0683 |
| 9 | 0.00% | -0.1105 |
| 10 | -0.01% | -0.2308 |
| 11 | -0.01% | -0.2045 |
| 12 | 0.00% | -0.0122 |
| 13 | 0.01% | 0.1450 |
| 14 | -0.01% | -0.1579 |
| 15 | -0.01% | -0.1573 |
| 16 | 0.01% | 0.3361 |
| 17 | 0.01% | 0.2373 |
| 18 | 0.01% | 0.1503 |
| 19 | 0.01% | 0.1577 |
| 20 | 0.00% | -0.1021 |

* Parameters statistically significant at a 5% significance level

****** Parameters statistically significant at a 1% significance level

According to the results, there is not any significant abnormal trading volume prior to the earnings release. However, on the day the earnings announcement is published there is a clear surge in the abnormal trading volume (0.26%), which goes down the following day, despite it still being higher than any other event day (0.11%). Both event days 0 and 1 are statistically significant at distinct significance levels 1% and 5%.

Overall, the results are in accordance with the literature, specifically with Duque & Pinto (2004) and Parada (2011), who also registered statistically significant $\overline{AVOL}$ in days 0, 1, 2 and 3. Despite event days 2 and 3 not being statistically significant in our study, the market recognizes the impact of the earnings information and slowly adapts returning to its previous behavior ($\overline{AVOL}$ around 0.01%) which can be seen in Table 9.

The values obtained convey the existence of the post-earnings announcement drift, at a trading volume degree, since significant increases in $\overline{AVOL}$ were registered on the day the earnings announcements were released and on the following day. Furthermore, the results are in harmony with the book published by Singal (2006) who alerts to the precision of the information quality. Since most of the information released is published via public sources, its precision is guaranteed, resulting in high trading volume as investors update their positions.

In general, earnings information tends to provoke changes in both variables studied, trading volume and stock prices, further proving there is evidence of the PEAD effect between 2012 and 2017 on the European market. In conformity with Beaver (1968), we expected a considerable impact on the abnormal trading volume when new information was released, which was confirmed throughout our analysis.

# 6 Conclusion

Information content and information availability are some of the strongest indicators of the post-earnings announcement drift. Efficient markets will immediately correct any price discrepancies that are present after the release of an earnings announcement and any type of news event. However, in reality, this does not happen frequently otherwise phenomenon's like post-earnings announcement drift would not exist and there would be no evidence of its continuous presence throughout different markets.

One of the questions brought by Bernard & Thomas (1989) still carries a lot of weight in scientific research, "Why the market would appear to react with surprise to earnings information that is predictable, based on earnings for the prior quarter?", which is what happened with most of the practical literature and our study. Despite, past information being made available, which makes future earnings information more predictable, there is still evidence of a clear impact in stock prices and trading volume in the days leading to and around the news events. Thus, most markets are not reacting quickly and correctly to new information, with semi-strong form of market efficiency being questioned in most of the literature.

Market efficiency is key in maintaining an equilibrium in the finance sector since investors can take advantage of information, whether due to obtaining it early from other sources or by understanding opportunities to earn abnormal returns prior to the price correction made by most of the market. With this, we decided to analyze the European market in order to identify a possible presence of the post-earnings announcement drift anomaly, since there is a lack of literature in this specific global market.

During the study, some companies were removed from our analysis due to either low liquidity or missing critical data, which resulted in only 50 companies being studied instead of the original 54 companies. We also decided to change the timeline of the study, from 1st January 2012 – 31st December 2017 to 15th August 2012 – 31st December 2017, due to missing data which would compromise the efficiency of our analysis if we were to maintain the original window.

The event studies methodology refined by MacKinlay (1997) was fundamental for our abnormal return's analysis, which was complemented with the abnormal trading volume methodology published by Beaver (1968). Furthermore, the categorization of the different news events (good, bad, neutral) allowed for deeper research into how present the post-earnings announcement drift is and how significant it is for different earnings news

outcomes.

Subsequently, with the results, we obtained, it is possible to affirm that there is evidence of the post-earnings announcement drift effect on the European market between August 2012 and December 2017, since the global cumulative average abnormal returns are constantly positive throughout the event window with the values ranging from 1.39% to 1.88%, whilst being statistically significant for every day in the event window, as shown in Table 4. Furthermore, there is a clear increase in the average abnormal returns earned on the day the earnings information is released. Due to that, if the market was semi-strong form efficient, it would immediately correct its prices and there would not exist a possibility to earn returns higher than the norm since the market would reflect all public information onto the stock prices and correct any discrepancies.

The news categorization allows for a multi-layered analysis, that is not possible to achieve when aggregating every earnings announcement. Overall, the results are in accordance with most of the literature, since there is evidence of a positive rise in $\overline{AR}$ and $\overline{CAR}$ when events are classified as good news and a considerable decline in $\overline{AR}$ and $\overline{CAR}$ when events are associated with bad news. Additionally, news that do not convey any relevant information capable of altering stock prices are normally linked with negative $\overline{AR}$ throughout the event window.

Due to the liquidity of the stocks included in our sample, long positions on "good news" stocks and short positions on "bad news" stocks cannot be profitable for, at least, 20 days holding periods since the $\overline{AR}$ obtained suggest that only the day of the earnings announcement can be considered as profitable.

In addition to the results found on the abnormal returns analysis, we encountered more evidence when studying the abnormal trading volume that further supports the continuation of the PEAD effect on the European market. The $\overline{AVOL}$ is kept consistent prior to the release of earnings information, however, on the day of and the following day there is an evident growth on the abnormal trading volume registered, which returns to its previous levels two days after the earnings announcement publishing date.

In general, whenever an earnings announcement takes place there is a surge in both abnormal trading volume and abnormal returns, which are clear signs the market is not rapidly correcting stock prices, leading to the presence of the PEAD phenomenon. Our findings are in concordance with European studies on this financial phenomenon, such as Gerard (2012) and Vuorela (2018), and although the anomaly intensity is not as high as expected, it

is still a problem that jeopardizes market efficiency.

Moreover, at the beginning of this report, we set out to find if the PEAD phenomenon is still present on the European market after the latest study by Gerard (2012) and if it is, how significant the phenomenon is, by analyzing data that has not been studied in the past. With the results we obtained, it is evident that the PEAD effect has not subsided and persists on the European market. Likewise, we intended to discover if this drift has slowed down or accelerated ever since the latest study, but it is hard to measure given that different methodologies were used and distinct limitations were set upon the data used to infer the results.

Lastly, it is important to suggest different ideas for future research on this topic, such as defining a different event window taking into account newer data (2017-2020), linking investor behaviour with trading volume and stock price data, comparing results not only from earnings announcements but also dividend announcements for the European market and understand if the effect is more significant in distinct types of announcements.

## 7. References


Abarbanell, J. S., & Bernard, V. L. (1992). Tests of Analysts overreaction underreaction to earnings information as an explanation for anomalous stock-price behavior. *Journal of Finance, 47*(3), 1181-1207. doi:10.2307/2328982

Atiase, R. K. (1985). Predisclosure information, firm capitalization, and security price behavior around earnings announcements. *Journal of Accounting Research*, 21-36.

Atiase, R. K., & Bamber, L. S. (1994). Trading volume reactions to annual accounting earnings announcements: The incremental role of predisclosure information asymmetry. *Journal of accounting and economics, 17*(3), 309-329.

Bachelier, L. (1900). *Théorie de la spéculation.* Paper presented at the Annales scientifiques de l'École normale supérieure.

Ball, R., & Brown, P. (1968). An empirical evaluation of accounting income numbers. *Journal of accounting research*, 159-178.

Ball, R. (1978). Anomalies in relationships between securities' yields and yield-surrogates. *Journal of Financial Economics, 6*(2-3), 103-126.

Battalio, R. H., & Mendenhall, R. R. (2005). Earnings expectations, investor trade size, and anomalous returns around earnings announcements. *Journal of Financial Economics*, *77*(2), 289-319.

Bartov, E. (1992). Patterns in unexpected earnings as an explanation for post-announcement drift. *Accounting Review*, 610-622.

Bartov, E., Radhakrishnan, S., & Krinsky, I. (2000). Investor sophistication and patterns in stock returns after earnings announcements. *The Accounting Review*, *75*(1), 43-63.

Beaver, W. H. (1968). The information content of annual earnings announcements. *Journal of accounting research*, 67-92.

Berezovskis, P., Visnapuu, V., & Högholm, K. (2010). Post-earnings announcement drifts on the baltic stock exchanges. *SSE Riga Student Research Papers*, *8*.

Bernard, V. L., & Thomas, J. K. (1989). Post-Earnings-Announcement Drift - Delayed price response or risk premium. *Journal of Accounting Research, 27*, 1-36. doi:10.2307/2491062

Bernard, V. L., & Thomas, J. K. (1990). Evidence that stock prices do not fully reflect the implications of current earnings for future earnings. *Journal of accounting and economics, 13*(4), 305-340.

Bhushan, R. (1994). An informational efficiency perspective on the post-earnings announcement drift. *Journal of Accounting and Economics*, *18*(1), 45-65.

Brown, S. J., & Warner, J. B. (1985). Using daily stock returns: The case of event studies. *Journal of financial economics*, *14*(1), 3-31.

Campbell, C. J., & Wasley, C. E. (1996). Measuring abnormal daily trading volume for samples of NYSE/ASE and NASDAQ securities using parametric and nonparametric test statistics. *Review of Quantitative Finance and Accounting*, *6*(3), 309-326.

Chordia, T., & Shivakumar, L. (2006). Earnings and price momentum. *Journal of financial economics*, *80*(3), 627-656.

Chung, D. Y., & Hrazdil, K. (2011). Market efficiency and the post-earnings announcement drift. *Contemporary Accounting Research*, *28*(3), 926-956.

Cowles 3rd, A. (1933). Can stock market forecasters forecast?. *Econometrica: Journal of the Econometric Society*, 309-324.

DellaVigna, S., & Pollet, J. M. (2009). Investor inattention and Friday earnings announcements. *The Journal of Finance*, *64*(2), 709-749.

Dolley, J. C. (1933). Characteristics and procedure of common stock split-ups. *Harvard Business Review*, *11*(3), 316-326.

Duque, J. & Pinto, I. (2004), "How sensitive are price sensitive events?", Working Papper 4/2004, Instituto Superior de Economia e Gestão, Universidade Técnica de Lisboa

Freeman, R. N., & Tse, S. Y. (1992). A nonlinear model of security price responses to unexpected earnings. *Journal of Accounting research*, *30*(2), 185-209.

Frost, C. A., & Pownall, G. (1994). A comparison of the stock price response to earnings disclosures in the United States and the United Kingdom. *Contemporary Accounting Research*, *11*(1), 59-83.~

Garfinkel, J. A., & Sokobin, J. (2006). Volume, opinion divergence, and returns: A study of post–earnings announcement drift. *Journal of Accounting Research*, *44*(1), 85-112.

Gerard, X. (2012). Information Uncertainty and the Post–Earnings Announcement Drift in Europe. *Financial Analysts Journal*, *68*(2), 51-69.

Grant, E. B. (1980). Market implications of differential amounts of interim information. *Journal of Accounting Research*, 255-268.

Jensen, M. C. (1978). Some anomalous evidence regarding market efficiency. *Journal of Financial Economics, 6*(2/3), 95-101.

Kallunki, J. P. (1996). Stock returns and earnings announcements in Finland. *European*

*Accounting Review*, *5*(2), 199-216.

Kendall, M. G., & Hill, A. B. (1953). The analysis of economic time-series-part i: Prices. *Journal of the Royal Statistical Society. Series A (General)*, *116*(1), 11-34.

Kliger, D., & Gurevich, G. (2014). *Event studies for financial research: A comprehensive guide*. Springer.

Livnat, J., & Mendenhall, R. R. (2006). Comparing the post–earnings announcement drift for surprises calculated from analyst and time series forecasts. *Journal of accounting research*, *44*(1), 177-205.

MacKinlay, A. C. (1997). Event studies in economics and finance. *Journal of economic literature*, *35*(1), 13-39.

Malkiel, B. G., & Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance, 25*(2), 383-417.

Mendenhall, R. R. (1991). Evidence on the possible underweighting of earnings-related information. *Journal of Accounting Research*, *29*(1), 170-179.

Mendenhall, R. R. (2004). Arbitrage risk and post-earnings-announcement drift. *The Journal of Business*, *77*(4), 875-894.

Nesteruk, V. (2018). *Post-earnings-announcement drift: evidence from the Euro Area during and after the financial crisis* (Doctoral dissertation, Instituto Superior de Economia e Gestão).

Parada, S. Sofia Madalena. (2011). Portuguese Market Reaction to Earnings and Dividend Announcements, Universidade de Aveiro

Pellicer, M. J. A., & Rees, W. P. (1999). Regularities in the equity price response to earnings announcements in Spain. *European Accounting Review*, *8*(4), 585-607.

Roberts, H. V. (1959). Stock-market" patterns" and financial analysis: methodological suggestions. *The Journal of Finance*, *14*(1), 1-10.

Singal, V. (2006). *Beyond the random walk: A guide to stock market anomalies and low-risk investing*: Oxford University Press on Demand.

Watts, R. L. (1978). Systematic 'abnormal'returns after quarterly earnings announcements. *Journal of Financial Economics, 6*(2-3), 127-150.

Working, H. (1934). A random-difference series for use in the analysis of time series. *journal of the American Statistical Association*, *29*(185), 11-24.

Sadka, R. (2006). Momentum and post-earnings-announcement drift anomalies: The role of liquidity risk. *Journal of Financial Economics, 80*(2), 309-349. doi:10.1016/j.jfineco.2005.04.005

Singal, V. (2006). *Beyond the random walk: A guide to stock market anomalies and low-risk investing*: Oxford University Press on Demand.

Vega, C. (2006). Stock price reaction to public and private information. *Journal of Financial Economics, 82*(1), 103-133. doi:10.1016/j.jfineco.2005.07.011

Vuorela, S. (2018). Post-Earnings Announcement Drift-European evidence on market efficiency and how firm size and economic sector affect the anomaly.

# 8. Annexes

**Appendix 1 - Summary Statistics for the EURO STOXX 50 Companies, Closing Prices (EUR) between 1st January 2012 and 31st December 2017**

| *Companies* | *Mean* | *Maximum* | *Minimum* | *Standard Deviation* |
|---|---|---|---|---|
| LVMH | 148,1 | 259,6 | 98,1 | 38,0 |
| L'OREAL | 141,7 | 195,4 | 80,0 | 30,9 |
| TOTAL | 43,4 | 54,5 | 33,6 | 4,1 |
| AB INBEV | 88,7 | 123,3 | 46,4 | 19,7 |
| ASML HOLDING | 80,3 | 158,5 | 32,8 | 28,6 |
| SANOFI | 76,5 | 100,7 | 53,5 | 9,4 |
| AIRBUS | 51,5 | 88,9 | 24,2 | 15,1 |
| INDITEX | 25,4 | 36,7 | 12,6 | 6,2 |
| ENEL | 3,7 | 5,6 | 2,0 | 0,8 |
| BANCO SANTANDER | 5,0 | 7,0 | 3,0 | 1,0 |
| BNP PARIBAS | 49,8 | 68,9 | 25,0 | 9,7 |
| VINCI | 53,6 | 88,2 | 31,6 | 14,6 |
| AXA | 19,0 | 26,2 | 8,8 | 4,6 |
| IBERDROLA | 4,4 | 6,5 | 1,9 | 1,2 |
| ESSILORLUXOTTICA | 93,3 | 123,6 | 54,6 | 18,6 |
| AIR LIQUIDE | 79,0 | 101,3 | 61,7 | 9,9 |
| SAFRAN | 53,8 | 93,3 | 22,9 | 17,2 |
| ENI | 15,9 | 20,4 | 10,9 | 2,0 |
| DANONE | 57,9 | 71,8 | 46,0 | 6,3 |
| SCHNEIDER ELECTRIC | 60,0 | 75,5 | 40,1 | 8,0 |
| ING GROEP | 10,6 | 16,0 | 4,5 | 3,2 |
| ORANGE | 12,3 | 16,9 | 7,1 | 2,7 |
| PHILIPS | 23,3 | 35,9 | 11,8 | 5,2 |
| TELEFONICA | 10,0 | 13,3 | 7,4 | 1,2 |
| BBVA | 6,7 | 9,1 | 3,8 | 1,3 |
| ENGIE | 16,4 | 21,8 | 10,9 | 2,5 |
| VIVENDI | 18,4 | 24,6 | 12,0 | 2,6 |
| AHOLD | 15,3 | 22,1 | 9,1 | 3,8 |
| NOKIA | 4,8 | 7,8 | 1,4 | 1,5 |
| SOCIETE GENERALE | 36,5 | 51,9 | 15,0 | 9,1 |
| ALLIANZ | 133,1 | 204,0 | 70,0 | 30,1 |
| BAYER | 94,8 | 143,9 | 47,2 | 21,8 |
| BMW | 81,1 | 122,6 | 51,8 | 12,6 |
| DAIMLER | 61,0 | 95,8 | 33,4 | 13,8 |
| BASF | 75,1 | 97,5 | 51,9 | 9,9 |
| FRESENIUS | 48,9 | 80,0 | 23,8 | 17,6 |
| SAP | 66,3 | 100,3 | 40,9 | 14,0 |
| ADIDAS | 97,8 | 200,0 | 50,3 | 42,5 |
| DEUTSCHE POST | 24,8 | 41,0 | 11,9 | 6,6 |
| DEUTSCHE TELEKOM | 13,0 | 18,0 | 7,7 | 3,1 |
| MUENCHENER RUCK | 157,1 | 205,9 | 92,0 | 24,0 |
| SIEMENS | 93,5 | 133,2 | 61,1 | 16,1 |
| CRH | 22,4 | 34,5 | 13,0 | 6,2 |
| VOLKSWAGEN | 156,9 | 255,2 | 92,4 | 33,2 |
| REPSOL | 11,6 | 15,3 | 6,6 | 1,9 |
| ARCELORMITTAL | 22,7 | 40,8 | 6,1 | 6,4 |
| UNICREDIT | 20,2 | 32,3 | 8,8 | 6,4 |
| RWE | 22,7 | 36,9 | 9,2 | 7,6 |
| CARREFOUR | 23,2 | 32,8 | 13,1 | 4,5 |
| GENERALI | 14,5 | 19,1 | 8,2 | 2,3 |

**Appendix 2 - Summary Statistics for the EURO STOXX 50 Companies, Shares Traded (Thousands of Shares per trading day) between 1st January 2012 and 31st December 2017**

| *Companies* | *Mean* | *Maximum* | *Minimum* | *Standard Deviation* |
|---|---|---|---|---|
| LVMH | 866,8 | 3997,8 | 74,4 | 398,9 |
| L'OREAL | 659,6 | 3714,0 | 72,5 | 281,4 |
| TOTAL | 5778,7 | 30126,7 | 734,4 | 2621,7 |
| AB INBEV | 1653,8 | 8241,2 | 127,7 | 744,1 |
| ASML HOLDING | 1405,7 | 16224,9 | 111,0 | 871,5 |
| SANOFI | 2788,9 | 15922,5 | 417,1 | 1221,6 |
| AIRBUS | 2360,4 | 26900,0 | 263,3 | 1560,6 |
| INDITEX | 3937,4 | 46563,2 | 306,1 | 2372,9 |
| ENEL | 42497,3 | 256350,3 | 9995,1 | 19776,2 |
| BANCO SANTANDER | 62036,9 | 495157,6 | 7086,6 | 33535,0 |
| BNP PARIBAS | 4569,5 | 21339,2 | 438,0 | 2176,5 |
| VINCI | 1677,1 | 6320,8 | 180,1 | 724,3 |
| AXA | 7489,8 | 33849,9 | 563,8 | 3296,1 |
| IBERDROLA | 26635,1 | 159765,5 | 3095,1 | 15550,7 |
| ESSILORLUXOTTICA | 558,6 | 8259,1 | 40,8 | 316,8 |
| AIR LIQUIDE | 1072,6 | 4585,4 | 93,2 | 469,9 |
| SAFRAN | 981,2 | 21750,8 | 38,3 | 737,2 |
| ENI | 16818,8 | 73800,6 | 4917,0 | 8714,1 |
| DANONE | 1718,9 | 9514,0 | 103,0 | 737,5 |
| SCHNEIDER ELECTRIC | 1647,5 | 7412,4 | 135,1 | 739,6 |
| ING GROEP | 19545,0 | 97104,9 | 1730,3 | 8915,9 |
| ORANGE | 8436,3 | 47709,8 | 801,5 | 4091,7 |
| PHILIPS | 3582,0 | 14289,0 | 331,1 | 1609,3 |
| TELEFONICA | 18763,2 | 80389,7 | 2969,8 | 9153,7 |
| BBVA | 30782,1 | 169898,7 | 5217,4 | 16995,3 |
| ENGIE | 5597,5 | 38086,0 | 745,0 | 2570,2 |
| VIVENDI | 4777,3 | 31987,6 | 454,6 | 2396,8 |
| AHOLD | 3734,1 | 67770,4 | 195,7 | 2668,9 |
| NOKIA | 22995,5 | 426532,0 | 3293,5 | 20688,5 |
| SOCIETE GENERALE | 5006,2 | 27050,1 | 229,6 | 2422,2 |
| ALLIANZ | 1730,9 | 9971,7 | 397,2 | 829,8 |
| BAYER | 2278,5 | 12210,0 | 470,8 | 1115,7 |
| BMW | 1872,2 | 10938,3 | 372,2 | 864,0 |
| DAIMLER | 4173,6 | 18125,8 | 1084,7 | 1872,2 |
| BASF | 2885,4 | 11106,1 | 709,6 | 1287,1 |
| FRESENIUS | 1267,4 | 24969,8 | 276,6 | 857,4 |
| SAP | 2850,3 | 16189,8 | 652,2 | 1429,4 |
| ADIDAS | 966,1 | 11984,8 | 181,0 | 654,5 |
| DEUTSCHE POST | 3773,2 | 59078,4 | 700,4 | 2208,4 |
| DEUTSCHE TELEKOM | 12053,1 | 45536,3 | 2482,9 | 5678,0 |
| MUENCHENER RUCK | 698,6 | 3075,8 | 167,7 | 307,7 |
| SIEMENS | 2527,9 | 12352,0 | 590,8 | 1278,4 |
| CRH | 1222,4 | 46993,7 | 43,0 | 1732,7 |
| VOLKSWAGEN | 1249,5 | 14197,4 | 288,9 | 850,6 |
| REPSOL | 9231,6 | 97871,5 | 1481,6 | 5959,8 |
| ARCELORMITTAL | 5749,8 | 27406,6 | 355,2 | 3194,6 |
| UNICREDIT | 18594,2 | 84412,5 | 3058,3 | 8613,1 |
| RWE | 3980,5 | 41881,1 | 833,0 | 2532,8 |
| CARREFOUR | 3025,7 | 31610,3 | 278,4 | 1692,5 |
| GENERALI | 7836,5 | 82220,9 | 2491,5 | 4217,2 |

**Appendix 3 – Number of Earnings Announcements, per company, between 1st January 2012 and 31st December 2017**

| *Companies* | *Earnings Announcements* |
|---|---|
| LVMH | 10 |
| L'OREAL | 11 |
| TOTAL | 21 |
| AB INBEV | 21 |
| ASML HOLDING | 21 |
| SANOFI | 22 |
| AIRBUS | 21 |
| INDITEX | 7 |
| ENEL | 21 |
| BANCO SANTANDER | 21 |
| BNP PARIBAS | 21 |
| VINCI | 10 |
| AXA | 10 |
| IBERDROLA | 21 |
| ESSILORLUXOTTICA | 16 |
| AIR LIQUIDE | 11 |
| SAFRAN | 10 |
| ENI | 21 |
| DANONE | 10 |
| SCHNEIDER ELECTRIC | 10 |
| ING GROEP | 21 |
| ORANGE | 21 |
| PHILIPS | 21 |
| TELEFONICA | 21 |
| BBVA | 24 |
| ENGIE | 17 |
| VIVENDI | 22 |
| AHOLD | 22 |
| NOKIA | 21 |
| SOCIETE GENERALE | 21 |
| ALLIANZ | 19 |
| BAYER | 21 |
| BMW | 21 |
| DAIMLER | 21 |
| BASF | 21 |
| FRESENIUS | 43 |
| SAP | 20 |
| ADIDAS | 21 |
| DEUTSCHE POST | 21 |
| DEUTSCHE TELEKOM | 21 |
| MUENCHENER RUCK | 20 |
| SIEMENS | 21 |
| CRH | 9 |
| VOLKSWAGEN | 21 |
| REPSOL | 21 |
| ARCELORMITTAL | 22 |
| UNICREDIT | 20 |
| RWE | 22 |
| CARREFOUR | 11 |
| GENERALI | 21 |

**Appendix 4 - Summary Statistics for the EURO STOXX 50 Companies, Daily Stock Returns (%) between 1st January 2012 and 31st December 2017**

| *Companies* | *Mean* | *Standard Deviation* |
|---|---|---|
| LVMH | 0.06% | 1.50% |
| L'OREAL | 0.05% | 1.26% |
| TOTAL | 0.01% | 1.42% |
| AB INBEV | 0.04% | 1.34% |
| ASML HOLDING | 0.10% | 1.66% |
| SANOFI | 0.01% | 1.41% |
| AIRBUS | 0.08% | 1.76% |
| INDITEX | 0.05% | 1.47% |
| ENEL | 0.03% | 1.72% |
| BANCO SANTANDER | 0.02% | 2.03% |
| BNP PARIBAS | 0.04% | 1.97% |
| VINCI | 0.06% | 1.41% |
| AXA | 0.06% | 1.81% |
| IBERDROLA | 0.04% | 1.41% |
| ESSILORLUXOTTICA | 0.05% | 1.40% |
| AIR LIQUIDE | 0.03% | 1.24% |
| SAFRAN | 0.08% | 1.45% |
| ENI | -0.01% | 1.55% |
| DANONE | 0.02% | 1.20% |
| SCHNEIDER ELECTRIC | 0.03% | 1.70% |
| ING GROEP | 0.06% | 2.00% |
| ORANGE | 0.01% | 1.64% |
| PHILIPS | 0.05% | 1.41% |
| TELEFONICA | -0.03% | 1.59% |
| BBVA | 0.01% | 1.95% |
| ENGIE | -0.03% | 1.50% |
| VIVENDI | 0.02% | 1.49% |
| AHOLD | 0.04% | 1.31% |
| NOKIA | 0.00% | 2.64% |
| SOCIETE GENERALE | 0.06% | 2.36% |
| ALLIANZ | 0.06% | 1.35% |
| BAYER | 0.05% | 1.52% |
| BMW | 0.03% | 1.61% |
| DAIMLER | 0.05% | 1.61% |
| BASF | 0.03% | 1.41% |
| FRESENIUS | 0.06% | 1.34% |
| SAP | 0.05% | 1.23% |
| ADIDAS | 0.08% | 1.54% |
| DEUTSCHE POST | 0.08% | 1.41% |
| DEUTSCHE TELEKOM | 0.03% | 1.42% |
| MUENCHENER RUCK | 0.04% | 1.21% |
| SIEMENS | 0.03% | 1.32% |
| CRH | 0.04% | 1.79% |
| VOLKSWAGEN | 0.02% | 2.00% |
| REPSOL | -0.01% | 1.91% |
| ARCELORMITTAL | -0.02% | 2.65% |
| UNICREDIT | -0.02% | 3.00% |
| RWE | -0.03% | 2.19% |
| CARREFOUR | 0.00% | 1.74% |
| GENERALI | 0.02% | 1.83% |