Stock market performance of the retail industry under the COVID-19 pandemic

Author: Britt Annemie den Ouden
University of Twente
P.O. Box 217, 7500AE Enschede
The Netherlands

ABSTRACT,

The aim of this study was to find out if the COVID-19 pandemic had a negative impact on the firm performance of three subcategories in the retail industry in the United Kingdom. On the one hand, a negative impact was expected as physical stores had to close because of the lockdown. On the other hand, panic buying and the different buying behavior could have a positive impact on the firm performance. The impact was identified by using the abnormal returns of the stock prices. To measure the negative impact three different approaches were used, namely the Cumulative Abnormal Return (CAR), the Average Abnormal Return (AAR), and the Cumulative Average Abnormal Return (CAAR). All three subcategories had a negative firm performance because of the COVID-19 pandemic but in a different way. For the subcategories "Specialty Retail" and "Auto Dealers" the negative impact is significant in the longer term, so when a larger event window was taken. For the subcategory "Food Stores" the negative impact is significant in the shorter term, so when a smaller event window was taken. When all three subcategories are taken together, the negative impact was still significant in the longer term. Brexit was approved in the same period as this study. Future research is needed to state with certainty that the negative impact on the firm performance is from the COVID-19 pandemic and not from the Brexit.

Graduation Committee members:

Dr. X. Huang
Prof. Dr. R. Gutsche PHD

Keywords

Firm Performance, COVID-19, United Kingdom, Financial Management, Market Model, Abnormal Returns, Stock Market

1. INTRODUCTION

1.1 Topic Area

There have not been many studies around the topic of performance under the COVID-19 pandemic as it is a current theme and not much is known about the consequences the firms will face in the near future. In 2019, an acute life-threatening disease emerged in China (Ullah et al., 2021). The disease spread around the globe rapidly and became a serious threat to society. Also, the article of Shen et al (2020) says that "COVID-19 is a major health emergency worldwide". The infection rate was high and as a result, serious quarantine measures were taken, which also significantly affected the economy. The world's population has increased in urbanization and is much more concentrated in the big cities, which began to be a problem when the pandemic of COVID-19 started (Tisdell, 2020). Population mobility decreased fast which led to weakened spending power and a stagnant economy (Shen et al., 2020). Various industries could not sell their products or services anymore. A lot of shops were closed to decrease the number of contacts a person has on a day. Also, governments discourage going somewhere for fun, only necessary products can be bought. A lot of governments prohibited traveling to other countries for a vacation. It can be said that a lot of companies were negatively affected by the pandemic, but this is not true for all companies.

According to the article of Chen & Fu (2011), the retail industry is connecting manufacturers and customers in the final part of the distribution channel. They sell the products and services to the customers. This could be a problem when the COVID-19 pandemic started. Quarantine measures consisted of closing stores and preventing customer contact. As a result, sales dropped rapidly and companies needed help from the government to prevent going bankrupt. In the retail industry, there are both companies that profited and suffered from the pandemic. For example, stores that sold clothes or jewelry had to close. The companies that were forced to close tried to be creative and minimize their loss by selling their products online. As people were more at home, they began to have different priorities and spend money on different purposes. Companies that sold for example sports materials that people can use at home, increased their sales. This is not possible for companies that offer a service for example a barber, as this has to be done in person.

The buying behavior of consumers changed during the pandemic. People were forced to stay at home and because of this, people started to change their interests. People will buy things that they can use in the present or near future. When the pandemic started, it was not clear when everything would go back to normal. This was a reason for a lot of people to buy other things that could help them entertain in the pandemic. This is one part of the buying behavior that changed.

Also, according to the article of Ahmed et al. (2020), impulse buying behavior had an effect. Impulse buying occurs when consumers experience an urge to buy something immediately. People felt that with the announcement of the lockdown, products would become scarce and difficult to get. COVID-19 brought a lot of uncertainty as little was known about the virus and the consequences in the longer term. This impulse buying behavior resulted in empty shelves in the supermarkets as the supermarkets could not get as many products in as they sold. Another aspect that influenced the impulse buying behavior was the buying of peers. Also, according to the article of Untaru & Han (2021), people started panic buying as a result of the COVID-19 pandemic. Ahmet et al. (2020) mention that human purchase behavior is greatly influenced by the behaviors of others. Early it was known that the shelves would become empty as the impulse buying continued. This influenced consumers that at first were not contributing to this behavior. As a result, these consumers became afraid that they would not have enough products when the shelves become emptier. The consumers are influencing each other and more products are bought to prevent a shortage.

1.2 Purpose of this Study

The purpose of this study is to look at the corporate performance of companies in the retail industry under the COVID-19 pandemic. This research will look at the differences between subcategories within the retail industry. On the one hand, some companies profited from the COVID-19 pandemic, while on the other hand there are companies that were negatively affected by the pandemic as they had to close because of the quarantine measures. The aim of this study is to answer the research question:

RQ1: To what extent has COVID-19 influenced the corporate performance in the retail industry, and what are the differences in performance between companies within the retail industry?

1.3 Outline of the Paper

The remainder of this paper is built up of different sections. Section 2 explains the main literature and hypothesis surrounding firm performance and the application to the COVID-19 pandemic. Section 3 is the methodology. In that section it is shown how the hypothesis is explained. Section 4 is the section where the data gathered is given. Section 5 is the conclusion. In this section, the conclusion, limitations, and recommendations of the study are discussed. Section 6 are the acknowledgments that came with the study. At last, sections 7 and 8 are the references and the appendices.

2. LITERATURE REVIEW

This section includes a literature review that at first starts with a discussion of firm performance, with a subsection about the market efficiency theory and stock return. The next section is about firm performance in a crisis. After this, the relationship between COVID-19 and firm performance is discussed. Here, also the impact of COVID-19 in the retail industry is discussed. At last, the hypothesis applicable for the study is formulated.

2.1 Firm Performance

2.1.1 Market Efficiency Theory and Stock Return

"The Efficient Market Hypothesis states that all relevant information is fully and immediately reflected in a security's market price" (Vishwanath, 2009). This article also states that if new information is revealed about a firm, it will be incorporated into the share price immediately. In an efficient market, investors cannot profit from a return that is different from the fair return for the risk a security represents. In this way, the stock return represents the performance of the firm. The information about a firm becomes more transparent, so the stock prices represent the performance of the firm. In this research, the stock return is used to measure the performance. The article of Lin et al. (2015) states that the issue about the fluctuation of stock returns is for a lot of researchers still an open question. A method that is suggested by some researchers is that the information about future cash flows is the dominant factor driving firm-level stock returns. When some information about the future cash flow is known, more is known about the future stock return. The stock price fluctuates with the information that is known about the future cash flow and in this way, firms can predict the expected stock return. Also, Xie & Su (2011) state that information is an important factor of stock price formation. Figure 1 from Li et al. (2014) shows the flow of news articles and the impact on the stock prices. In this way, it can be explained how stock prices are formed. The figure says

that first at the left, an event happens. After the event, the event is reported and the reports are read by investors. The investors interpret the reports according to their knowledge and will take actions according to their interpretations, positions, and budgets. At last, the actions are translated into transactions and reflected in stock price movements.

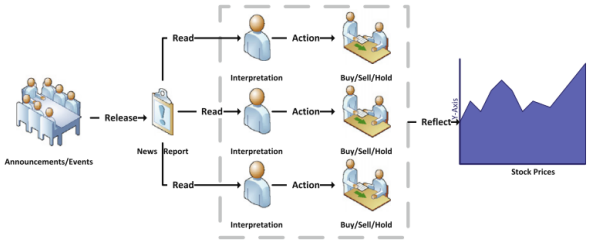

Figure 1. The general scenario that news impact takes effect on the market prices (Li et al. (2014)).

According to the article of McMillan (2016), they state that it is about the movements in asset prices and valuations in a market. In this research, the market is the retail market. To see the performance of a company, the stock return can tell if a company is profitable or not. El Ouadghiri et al. (2021) states that there can be a positive effect on the stock return when investors favor stocks of firms that had high public attention. Of course, this can also be vice versa, because it is also possible that the investors will avoid certain stocks. The stock price drops when the demand for a stock is low. By lowering the stock price, investors that like to take on a risk and buy a stock at a lower price are attracted.

2.2 Firm Performance in a Crisis

Previous studies discussed what impact a crisis has on the performance of firms. Studies from Cerrato et al. (2016) and Aldamen et al. (2020), state that an economic crisis can cause problems in the financial market that can lead to a reduction in capital available to firms. A previous crisis is the Global Financial Crisis which can be compared to the COVID-19 pandemic as they both had a global impact on the financial performance of firms. “The Global Financial Crisis exposed firms to significant shocks including low finance liquidity, overnight failure of customers and markets, downturns in revenue, spikes in uncertainty and pronounced negative sentiment”. A reduction in capital makes it difficult for firms to obtain sufficient resources. Also, debts can be difficult to pay back. Firms want to reduce the costs so they fire employees. As a result, the incomes of people can decrease and this causes a reduction of demand for products and services. It is a problem for customers and firms to have a reduction of demand, as jobs will keep disappearing and revenues of the firms will keep decreasing.

Previous literature in this field indicates that a crisis has a negative impact on the performance of firms. The studies state that revenues decrease, which results in lower profitability. Also, capital reduction puts firms in a more difficult position by making it difficult for investors to invest money into the company. There is great insecurity about the future impact of the crisis. This reflects in a form of a risk for investors. The insecurity for investors will be too large. Investors will not invest in large investments and are waiting until more is known (Wang & Young, 2020). As a result, the companies will have less money available to invest in the firm, which can make it more difficult to increase sales when they are in a crisis.

2.3 COVID-19 and Firm Performance

The COVID-19 pandemic is a first of a kind situation in every field (Atkinson-Clement & Pigalle, 2021). Never before has a similar situation occurred in which strong political decisions were made. These political decisions consisted of prohibiting human interactions. Also, governments introduced for the first time a lockdown. Ilinova et al. (2021) state that the COVID-19 pandemic had a significant impact on most industries. On the one hand, a lot of stores had to close which had a negative impact on the sales. On the other hand, companies profited from the situation and their sales increased rapidly. There are differences in firm performance between industries and even between companies within the industry.

The COVID-19 pandemic brought big risks which could affect companies in different industries. These risks consisted of deferring investments when uncertainties rise by managers, which lead to missing profitable projects (Shen et al., 2020). It was unsure what the future would look like and if the stores would open soon. As a consequence, a fear of coronavirus was established. Investors were uncertain about the consequences of the COVID-19 pandemic in the near future, which could be a financial crisis in the future. That is why they underreacted the stock market (Naidu & Ranjeeni, 2021). There was still not enough knowledge about the impact of the pandemic. That is why investors were unsure if it was the right time to make investments. The underreaction means that investors will wait to invest instead of investing the way they always did. This is because there is great uncertainty (Phan & Narayan, 2020). A decrease in demand for stocks was the result. Biktimirov (2004) states that a decline in demand for stocks is associated with a significant decline in stock price.

Behind the supply and demand, the driver of price movement is information. Information shortage comes with risks, so that is why the demand for a stock would decrease as the stock is unattractive to buy. Investors would wait and see if there is more information available soon. It is difficult to see if a stock is a good investment, if there is little information known. Governments are the lead investors, because their objective function is to minimize loss to businesses and households in that country (Phan & Narayan, 2020). This is the reason governments have a high impact on the market in that country. The article also states that a government in a crisis is going to overreact, because there is a fear generated by the crisis. The government tries to prevent the consequences a crisis brings by performing a lot of actions that will not always result in improving the situation. After a while, more information about the virus became available and governments knew more about dealing with the crisis and they corrected their reactions. As a result, the market also corrected which could be seen in the stock price. The demand for stocks increased and thus also the stock price.

2.3.1 Impact of COVID-19 in the Retail Industry

The retail industry has a lot of distinct types of companies that are differently affected by the COVID-19 pandemic. Deforche et al. (2021) state that the mobility of retail decreased. The decreased mobility was a result of the quarantine measures and for these retail companies, the sales of the company fell rapidly. Examples of this type of company are companies that offer services in which the employees of the firm had to be in the personal space of the customer. Also, firm performance decreases with the drop in retail (Mahajan et al., 2021). Measures from governments involved closing the firms that are in close personal contact with customers for some time. In this way, the spread of the virus was minimized. A consequence to these firms was that their sales dropped but the fixed costs stayed the same. On the other hand, for other companies, the sales rose rapidly in the pandemic. For example, in the introduction part, panic buying is mentioned. After governments took measures, people started to buy a lot of the same products. This resulted in an explosive

growth in sales for these companies. After the panic behavior, a drop in sales is followed once lockdowns are set and people's moods are cooled down (Vall Castelló & Lopez Casanovas, 2021). Also, people spent more time at home which meant they bought more products that could entertain them at home. So, due to COVID-19 the lifestyles of people, routines, and consumption patterns changed (Mahajan et al., 2021). This can result in an economic slowdown that could last a long time. A lot is still unknown about the impact on future economic activity. According to the article of Sharif et al. (2020), the COVID-19 pandemic is a source of systematic risk. The pandemic brings risk and uncertainty, which can lower the demand for stocks.

2.4 Hypothesis

Prior studies state that the pandemic is a crisis in which there was high uncertainty. High uncertainty is associated with high risks and as a result, investors are waiting until enough information is known about the consequences the pandemic has for the economy. This brings negative consequences for firms and it can result in a decrease in firm performance. All in all, the following hypothesis can be formed:

H_1: The COVID-19 pandemic has a negative impact on the firm performance.

3. METHODOLOGY

In this section, the approach of the research is explained. First, the methods used in this research and the motivation to study UK firms are mentioned. The event windows are set and the type of research is explained. Furthermore, the part "Measurement of Stock Return" explains the steps used to come up with data that can be used to compare the performance of the firms in the study due to the impact of the COVID-19 pandemic. Last, the part "Data" states what data is used in this study and what the different subcategories are.

3.1 Methods

The analysis will be an event study as it is an analysis of whether there is a reaction of performance to the COVID-19 pandemic. Quantitative data is used to compare the firms with each other. The firms will be analyzed within different event windows. The event is the COVID-19 outbreak, respectively the date on which the lockdown was introduced in the United Kingdom. The article of Naidu & Ranjeeni (2021) takes event windows of a day before the event and a day after the event. This research will follow this approach but will add some days before the event and after the event to also see the impact of the COVID-19 pandemic on the longer term. The event windows [-1, +1], [-3, +3], and [-5, +5] are analyzed. Taking the whole sample together, post-event windows are analyzed. These event windows are [0, +1], [0, +2], and [0, +5]. The days in the research are trading days. In the event windows, 0 is the date on which the event happened. Day -1 is one day before the event and day +1 is one day after the event. By taking different event windows, the impact of the COVID-19 pandemic on the firm performance can be seen. Mackinlay (1997) states that the power of the test increases when the sampling interval is reduced. The article also states that there is no specific advantage by reducing the sampling interval to below daily data. In this study, only a few days are used in the event window. In this way, it can be said that the power of the test in this study will be high as daily returns are used.

The estimation period is the period that is used to come at the normal returns of a particular company in the sample (Padmanabhan, 2018). The estimation period precedes the event window. This is done to make sure that the event does not affect returns during the estimation period. The estimation period is the normal period as it is before the event could have an impact on the returns.

At first, a lot was unknown about the coronavirus. By taking longer event windows, more was known about the pandemic and the consequences for the future. Of course, still, a lot was unknown but by taking a longer event window, more is known than just taking one day before and one day after the event. The lockdown in the United Kingdom started on the 23rd of March in 2020, so this will be day 0. Also, the 22nd of march will be day -1 and the 24th of March will be day 1. The same can be done for the other event windows. There are a lot of companies within the retail industry and there are also a lot of subcategories. Furthermore, the t-test is used to test the significance of the results.

3.1.1 Motivation of studying UK Firms

Previous literature has established the relevance of a country to firm performance (Ghemawat, 2003). Countries can make a difference in firm performance because countries differ on a wide range of attributes that have an impact on performance (Goldszmidt, 2011). Elango & Wieland (2015) also state that the location of the firm can influence the performance of the firm. Regulations, culture, and norms of behavior all have an impact. All countries have different rules and this can limit the freedom of companies and lead to lower profitability. Culture can be a limiting factor in a way that some countries have a culture that does not accept certain products (Halkos & Tzeremes, 2013). In this way, the demand for that product will decrease and the profitability of firms producing that product declines. So, firms need to be located in a country that fits their demand for customers.

This research analyzes the impact of the COVID-19 pandemic on firm performance using stock prices. To do this, the study focuses on UK firms because the literature shows that there is a major impact of the COVID-19 pandemic on economic activity in the UK (Griffith et al., 2020). Some subcategories are analyzed in the research which need a sufficient amount of samples. A sufficient amount is 25 to 50 companies and the UK satisfies this need.

3.2 Measurement of Stock Return

In this study, the market model is followed. Various articles already used the market model, so for this study different articles are used that can be followed. With the calculations of the abnormal returns, the hypothesis is tested.

3.2.1 Abnormal Return

A method to see how the corporate performance of companies in the retail industry changed, is to look at the abnormal returns. Hachicha et al. (2008) state that the abnormal return examines the behavior of firms' stock prices around an event. The event in this study is the COVID-19 pandemic. The abnormal return is the difference between the observed return and the predicted return (Herwany et al. (2021).

To calculate the abnormal returns during the event windows, the methods of Naidu & Ranjeeni (2021), Zeng (2021), and Liu et al. (2020) are used. In the article of Naidu & Ranjeeni (2021), they also analyze the stock returns in the event of the COVID-19 pandemic, but at the example of the country Australia. In this research, retail companies in the UK are used. To calculate R*it*, which is the actual stock return of firm *i* at time *t* during the event period, equation 1 is used (Zeng, 2021):

$$R_{it} = Ln(P_t) - Ln(P_{t-1}). \quad \textbf{(1)}$$

Here, R_{it} is the log change in the adjusted closing price of stock *i* from day t-1 to day t. According to the article of Padmanabhan (2018), the benefit of log transformed returns is that it improves the normality of the distribution and also eliminates negative

values. By improving the normality, the data set is well-modeled by a normal distribution so it increases the relevance of the t-test.

Second, the firm's expected return (ER_{it}) at time *t* during the event period using equation 2 is used (Naidu & Ranjeeni, 2021):

$$ER_{it} = \hat{\alpha}_i + \hat{\beta}_i R_{mt}. \quad \textbf{(2)}$$

Here, ER_{it} is the expected return for any firm *i* at time *t* during the event period. R_{mt} is the market return calculated as the log change in the adjusted closing price of the FTSE 100 from day *t*-1 to day *t*. A regression model can be formulated with the use of equation 2 to get the expected return, beta, and alpha. In the research, the correlation of the stocks' daily returns and the daily index values is analyzed (Ivanovski, 2016). The regression analysis is used to determine if there is a statistically significant relationship between the variables, which are in this study the stocks' daily returns and the daily index values of the FTSE 100 (Griffith et al., 2020). An estimation window of 90 days is used for every company (Pandey & Kumari, 2021). This means that the estimation window is from t_{-96} until t_{-6}. The estimation window is from the 6th of November in 2019 until the 13th of March in 2020. Stock prices are get from Yahoo! Finance and with the stock prices, the stock returns are calculated. Beta is the measure of volatility relative to a benchmark (Fu, 2018). Alpha is the risk premium. Equation 3 is needed to calculate beta and alpha. Beta and alpha are needed to calculate the expected return in equation 2. Beta is the slope of the regression model and alpha is the intercept. So, there will be at the end for every company a beta and an alpha. With the help of the beta and alpha, the expected return can be calculated in Excel. The expected return is calculated for every day within the event windows (Maitra & Dey, 2012):

$$ER_{it} = \hat{\alpha}_i + \hat{\beta}_i R_{mt} + \varepsilon \quad \textbf{(3)}$$

The actual stock return of firm *i* at time *t* during the event period and the expected return of firm *i* at time *t* is needed to calculate the abnormal return. The abnormal return is computed by using equation 4. Equation 4 is taken from the articles of Naidu & Ranjeeni (2021) and Liu et al. (2020):

$$AR_{it} = R_{it} - ER_{it}. \quad \textbf{(4)}$$

Here, AR_{it} is the abnormal return for any firm *i* at time *t* during the event period. In the research, for every company in the sample, the abnormal return is calculated for every day within the event windows. With the abnormal return, it is tested whether the abnormal return on the event day is smaller than zero as the hypothesis is that there is a negative impact because of the event. If there is no impact from the event, the abnormal return should be zero. If there is better performance of a firm, the event results in a positive abnormal return. On the other hand, the bad performance of a firm results in a negative abnormal return. (Stefanescu et al., 2012). For day one (ARi,1), the abnormal returns should be negative as in the literature review it is also stated that the pandemic had a negative impact on the firm performance. There are a lot of companies with different values for the abnormal return. To judge whether firms are affected, the average abnormal return, the cumulative abnormal return, and the cumulative average abnormal return are calculated.

3.2.2 Average Abnormal Return

After the abnormal return is calculated, the research can continue. The abnormal return can be used to calculate the average abnormal return. The average abnormal return of the days within the event windows can be calculated using equation 5 (Liu et al., 2020):

$$AAR_t = \frac{1}{N} \sum_{i=1}^{t_1} AR_{it} \quad \textbf{(5)}$$

Here, *t* = (-5, -4, … +4, +5), and N is the total number of samples within the event window. The average abnormal return is calculated from the different event windows. In this way, the differences in the average abnormal returns can be seen and compared. The statistical significance of the abnormal return should be tested because there should have been looked at a variation of the abnormal returns. This variation is the standard deviation. To test the hypothesis, it should be tested if the AAR is by chance smaller than zero or if this is statistically significant lower than zero. With equation 4, the abnormal returns for every company are calculated. It is not efficient to state for every company that it has a positive or negative return, because the sample is too large. The sample mean is used to talk about the features of the population as in this way, there can be a conclusion about the population (Dranev et al., 2019). In the research, it is tested whether the sample mean is smaller than zero, so it is a one-tailed test. To get the sample mean from the abnormal return, equation 5 is used. The calculation will be done for the days within the event windows. The t-test is used to test whether AAR is statistically smaller than zero.

3.2.3 Cumulative Abnormal Return

The cumulative abnormal return should also be calculated for every company in the event window, just as the average abnormal return. It will result in a lot of observations because for every company the cumulative abnormal return will be calculated. The cumulative abnormal return of firm *i* can be calculated with equation 6 (Lee & Connolly, 2010):

$$CAR_i = \sum_{i=1}^{t_1} AR_{it} \quad \textbf{(6)}$$

Here, CAR_i is the summation of the abnormal returns of every day within the event windows *t* of firm *i*. To test whether the cumulative abnormal return is significantly lower than zero, values for the t-test are calculated for the different subcategories within the event windows. Also, a value for the t-test is calculated for all the subcategories together.

3.2.4 Cumulative Average Abnormal Return

The cumulative average abnormal return is calculated for every subcategory and the subcategories together to get a feeling of the aggregate effect of the abnormal returns. To calculate the cumulative average abnormal return over the different event windows, equation 8 is used. The cumulative average abnormal return is the sum of the average abnormal returns (Ahnefeld et al., 2008):

$$CAAR_i = \frac{1}{N} \sum_{t=t_0}^{t_1} CAR_i \quad \textbf{(8)}$$

Here, CAAR is calculated for the event windows using the cumulative abnormal returns calculated with equation 6. With the values for cumulative average abnormal return, it is tested whether the cumulative average abnormal return is lower than zero. To do this, a t-test is needed. The statistical significance is the sample mean test. The cumulative average abnormal return states whether firms in the industry are affected given an event window. It can be that firms are only affected on the first day but if looked at a window of five days, there cannot be seen any effect. The calculation is used to show how long the effect lasts.

3.3 Data

In this part, it is explained how the hypothesis will be tested. Hypothesis 1 is about the relationship between firm performance and the COVID-19 pandemic. All companies that are located in the United Kingdom, within the different subcategories, are used for the research. By using the article of Hameli (2018), some subcategories are selected for the research. Publicly listed retail companies from the United Kingdom are selected from Yahoo! Finance. The heading screener is used to select the different types of subcategories for the research.

First, the criteria used in the screener are the region of the United Kingdom, the sector "Consumer cyclical", and the industry "Specialty Retail". So, the first subcategory is specialty retail and the search gives a sample of 28 companies. In this study, this subcategory is called "Specialty Retail". The reason this subcategory is selected is that a lot of firms in this sector had to close their stores. As a consequence, these firms did not have any profit. In this research, it will be tested whether the COVID-19 pandemic had a negative impact on the performance of UK firms in the subcategory "Specialty Retail".

Second, the criteria used in the screener are the region of the United Kingdom, the sector "Consumer Defensive", and the industries "Grocery stores", and "Packaged Foods". This is the second subcategory and gives a sample of 41 companies. In this study, this subcategory is called "Food stores". This subcategory is chosen as these stores could remain open. As is mentioned in the literature review, people started panic buying in supermarkets. To see if the COVID-19 pandemic had a negative impact on the performance of the UK firms, the subcategory "Food stores" is selected.

Third, the criteria used in the screener are the region of the United Kingdom, the sector "Consumer Cyclical", and the industries "Auto Parts", and "Auto Dealers". This is the third subcategory and gives a sample of 40 companies. In this study, this subcategory is called "Auto Dealers". The subcategory is chosen because it is expected that the behavior of people changed. People had to work at home, so they did not need a new car immediately if their old one stopped working. With this research, the negative impact of the COVID-19 pandemic is analyzed in the subcategory of "Auto Dealers".

In this research, the sample will be in total 109 companies divided over 3 subcategories. The AR, AAR, CAR, and CAAR are calculated to compare the different retail companies and to see the differences between the subcategories. The financial data needed for the calculations can be found on Yahoo! Finance.

4. RESULTS

In this section, the results are explained. Three subcategories are analyzed with the use of the calculations from section 3. The summary statistics of the CAR of the event windows are shown in Table 1, Table 2, and Table 3. Also, the values of the CAAR are in Table 4. In the next sections, the subcategories are analyzed and explained according to the results. Furthermore, the subcategories are taken together to see if there is a generally negative impact on the firm performance across the subcategories.

4.1 The Impact of COVID-19 on Specialty Retail

In this part, the subcategory "Specialty Retail" is analyzed. This subcategory consists of 28 companies. To see if there is a negative impact on the firm performance under the COVID-19 pandemic, the values for CAR, and CAAR should be significantly lower than zero.

Firstly, the abnormal returns were calculated for the subcategory "Specialty Retail". Appendix A shows the values for the different companies. By looking at this table, it is difficult to make a general statement as no company has consistent negative or positive values for the abnormal returns.

With the abnormal returns, the CAR is calculated for every company. CAR can be analyzed using the different event windows. The summary statistics of CAR are in Table 1, Table 2, and Table 3. In the event window [-5, +5], 23 of the 28 companies have a negative CAR. This is a large percentage of 82,1%. As explained earlier by Stefanescu et al. (2012), a negative number for abnormal return means a negative firm performance. On the other hand, there are some positive numbers which indicate that they had an increase in firm performance in that specific period according to the information used for this research. Comparing event window [-5, +5] to event window [-3, +3], there are some differences. Only 12 of the 28 companies have a negative CAR in event window [-3, +3]. This is a percentage of 42,9%. Half of the companies that were negative in event window [-5, +5] became positive when taking event window [-3, +3]. Furthermore, when looking at event window [-1, +1], 10 of the 28 companies have a negative CAR. This is a percentage of 35,7%. These negative CAR are not all for the same companies as in event windows [-5, +5] and [-3, +3]. It can be said that the larger the event window, the more companies have a negative CAR. Furthermore, as can be seen in Table 1 until 3, the average CAR increases when the event window becomes smaller. The minimum and maximum show this spread around the mean. The difference between the minimum and maximum decreases when a smaller event window is taken. Looking at the significance, it can be stated that the CAR of event windows [-5, +5] and [-1, +1] are significant and the CAR of event window [-3, +3] is not significant. Only event window [-5, +5] is significant and negative, so for this event window it can be stated that there is enough evidence to state that the CAR is significant below zero. So, there is a negative impact for the CAR of the subcategory "Specialty Retail" in event window [-5, +5].

Furthermore, the AAR is calculated with the abnormal returns. Figure 2 shows the trend of the AAR of the subcategory "Specialty Retail". The negative returns correspond to negative firm performance. One day before the event date, the AAR rose rapidly. on the event day, the AAR is close to zero. After the event day, the AAR became negative. Furthermore, the AAR is only positive on day$_{-1}$, day$_3$ and day$_4$. The other days, the AAR is negative, which corresponds to a negative firm performance for the companies of the subcategory "Specialty Retail".

Figure 2. AAR of subcategory "Specialty Retail". Returns are raw percentages.

Table 1 – Summary Statistics CAR of event window [-5, +5]

Subcategory	Averages	Standard Deviation	Minimum	Maximum	#	T-value
Specialty Retail	-0,188*	0,247	-0,959	0,381	28	-4,017
Food Stores	0,031	0,155	-0,357	0,409	41	1,300
Auto Dealers	-0,051*	0,154	-0,653	0,150	40	-2,094
All subcategories	**-0,055***	**0,200**	**-0,959**	**0,409**	**109**	**-2,870**

a. * is significant at 5% level.
b. # is the number of observations.

Table 2 – Summary Statistics CAR of event window [-3, +3]

Subcategory	Averages	Standard Deviation	Minimum	Maximum	#	T-value
Specialty Retail	-0,010	0,231	-0,776	0,333	28	-0,230
Food Stores	0,032	0,141	-0,141	0,553	41	1,431
Auto Dealers	0,012	0,116	-0,210	0,434	40	0,398
All subcategories	**0,012**	**0,161**	**-0,776**	**0,553**	**109**	**0,777**

a. * is significant at 5% level.
b. # is the number of observations.

Table 3 – Summary Statistics CAR of event window [-1, +1]

Subcategory	Averages	Standard Deviation	Minimum	Maximum	#	T-value
Specialty Retail	0,049*	0,120	-0,146	0,271	28	2,160
Food Stores	-0,030*	0,091	-0,169	0,177	41	-2,094
Auto Dealers	0,052*	0,092	-0,150	0,228	40	3,552
All subcategories	**0,020***	**0,106**	**-0,169**	**0,271**	**109**	**2,002**

a. * is significant at 5% level.
b. # is the number of observations.

Table 4 - $CAAR_i$

Subcategory	Event window [-5, +5]	Event window [-3, +3]	Event window [-1, +1]
Specialty Retail	-0,017*	-0,001	0,016*
Food Stores	0,003	0,005	-0,010*
Auto Dealers	-0,005*	0,001	0,017*
All subcategories	**-0,005***	**0,002**	**0,007***

a. *** is significant at 5% level.**

At last, CAAR is calculated with the use of equation 8. The results are in Table 4. Comparing the results to the different event windows, it states that the bigger the event window, the lower the CAAR. For event windows [-5, +5] and [-3, +3], the CAAR is negative and for event window [-1, +1] it is positive. Also, event windows [-5, +5] and [-1, +1] are statistically significant. Only event window [-5, +5] is negative and statistically significant. Here, it can be said that there is enough evidence to state that there is a negative impact on the firm performance under the COVID-19 pandemic. For the other event windows, there is not enough evidence to make this statement.

4.2 The Impact of COVID-19 on Food Stores

In this part, the subcategory "Food Stores" is analyzed. The sample consists of 41 companies. First, the results of the abnormal returns are calculated, which are in Appendix A. Looking at the abnormal returns, there are both positive and negative values. Just by looking at the abnormal returns, it is impossible to make a conclusion as every company has different values which are either positive or negative but this also changes across the days within a company. More can be said when calculating the CAR, AAR, and CAAR of the subcategory.

The abnormal returns are used to calculate the CAR. The summary statistics are in Table 1 until 3. Looking at Table 1, which is event window [-5, +5], it can be seen that the average is above zero. Here, 15 of the 41 companies have a negative CAR. This is only 36,6% of the total companies in the subcategory "Food Stores". On the other hand, 26 of the 41 companies have a positive CAR which is 63,4%. There are more companies with a positive CAR which explains the above zero average. Next, Table 2 shows the summary statistics for the event window [-3, +3]. The average CAR is positive in this event window. 24 of the 41 companies have a negative CAR which is 58,5%. The other 17 companies are all positive (41,5%). There are more negative than positive CARs but the average CAR is above zero. This means that the positive values are further away from zero than the negative values. The third event window [-1, +1] is analyzed in Table 3. The average CAR is negative. It has a negative CAR for 25 of the 41 companies (61,0%). The other 16 companies have a positive CAR (39,0%). Also, this explains the negative average for the CAR in this event window. All in all, it can be stated that the smaller the event window around the event date, the more negative CAR values there are and the more negative the average becomes. It can also be stated that less negative CAR values are measured when a larger event window is taken. Also, the average CAR will become positive. In this way, companies in the subcategory "Food Stores" are most negatively affected close around the event date. Looking at the significance, only the smallest event window is significant. It can be stated that for the CAR of event window [-1, +1] there is enough evidence to state that there is a negative impact due to the COVID-19 pandemic. For the other event windows, there is not enough evidence to make this statement.

Figure 3 shows the trend for the AAR of the subcategory "Food Stores". Before the event date, there is a large increase in AAR. In the literature review, panic buying was mentioned. The days before the lockdown can be explained by this. People bought more than they needed, which resulted in a positive AAR. Around the event date, the AAR is close to zero which means that there is no difference in firm performance due to the COVID-19 pandemic. One day after the event date, there was a large drop in return. Also, this can be explained by the panic buying principle. People bought a lot before the event date, so they were satisfied for some time. Customers did not need more food from supermarkets as they bought a lot before. The days after, the return increased again. The big negative drop on day_1 can be the consequence of the announcement of the lockdown on the event date.

Figure 3. AAR of subcategory "Food Stores". Returns are raw percentages.

Lastly, the CAAR is calculated. The results for the subcategory "Food Stores" are in Table 4. Here, event windows [-5, +5] and [-3, +3] have a positive CAAR and the event window [-1, +1] has a negative CAAR. It can be stated that close to the event date, the negative impact on the firm performance is highest as here the CAAR is negative. Furthermore, event window [-1, +1] is statistically significant. This means that there is enough evidence to state that there is a negative impact on the firm performance under the COVID-19 pandemic. The other event windows [-5, +5] and [-3, +3] are not statistically significant

which means that for these event windows this statement cannot be done.

4.3 The Impact of COVID-19 on Auto Dealers

Next, the subcategory "Auto Dealers" is analyzed. The sample consists of 40 companies. The abnormal returns that are calculated for this subcategory are in Appendix A. Looking at the abnormal returns at day 0, so the event day, only 13 companies have a negative return. On the other hand, on day 3, 35 of the 40 companies have a negative return. There has been a rise in negative returns, so it is possible that the subcategory "Auto Dealers" is not affected on the event day but the impact arose a couple of days after the event day, as from that day all physical stores and showrooms had to close because of the lockdown. To see if this is true, the CAR, AAR, and CAAR are calculated.

After the calculations of the abnormal returns, the abnormal returns are used to calculate the CAR. Event window [-5, +5] shows that 22 of the 40 companies have a negative CAR, this is a percentage of 55%. Only 17 of the 40 companies have a positive CAR in this event window (42,5%). Table 1 shows that there is a negative average for the CAR. This CAR is statistically significant, so here there is enough evidence to state that there is a negative impact on the firm performance. Next, for event window [-3, +3] 19 of the 40 companies have a negative CAR, this is a percentage of 47,5%. This is lower than event window [-5, +5]. Table 2 shows that there is a positive average. This CAR is not statistically significant so there is not enough evidence to state that in this event window there is a negative impact on the firm performance. Furthermore, event window [-1, +1] has for 12 of the 40 companies a negative CAR, this is a percentage of 30,0%. It can be stated that the smaller the event window, the smaller the number of negative CARs for the subcategory "Auto Dealers". Also, the average CAR became more positive in this event window but this event window is statistically significant. There is a trend in the average CAR, because the smaller the event window, the higher the average CAR.

Next, AAR is calculated for the subcategory "Auto Dealers". The results for the different event days are shown in Figure 4. It can be stated that the AAR fluctuated heavily for this subcategory. Only on day$_{-1}$ and day$_0$ are approximately at the same level. Before day$_{-1}$ there is every time a decrease and an increase in AAR. On day$_1$, which is one day after the event day, the AAR dropped again. A clear trend cannot be seen in Figure 4.

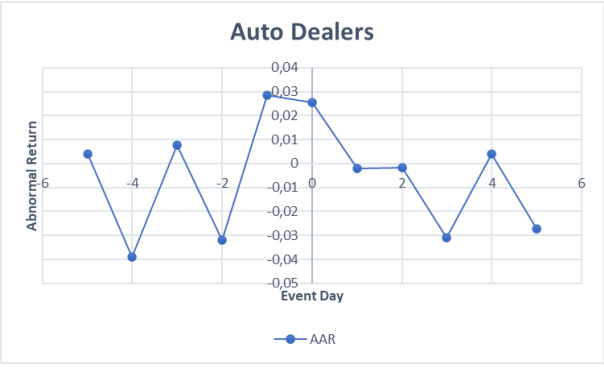

Figure 4. AAR of subcategory "Auto Dealers". Returns are raw percentages.

At last, the CAAR is calculated. The results for the CAAR of the subcategory "Auto Dealers" are in Table 4. Here, it can be seen that the CAAR increases if the event window becomes smaller. This is the same as for the subcategory "Specialty Retail". Also, it can be observed that there is a negative impact for event window [-5, +5]. This event window has a negative CAAR. Event windows [-3, +3] and [-1, +1] have a positive CAAR which means that there is no negative impact in this event window. Event windows [-5, +5] and [-1, +1] are statistically significant, but only event window [-5, +5] is negative and significant. There is also a negative value for CAAR. For this event window, it means that there is enough evidence to state that there is a negative impact on the subcategory "Auto Dealers". This statement cannot be said about the other event windows as these are not statistically significant.

4.4 The Impact of COVID-19 in General

Appendix B shows the graph of the averages of the abnormal returns per subcategory per day. It can be stated that for the subcategories "Specialty Retail" and "Auto Dealers", there is a large increase one day before the lockdown. This is also the case when all subcategories are taken together. The graph also shows that before the lockdown, the abnormal returns per subcategory deviate more than after the lockdown as the lines of the graph are closer to each other after the lockdown. In line with this statement, there are more extreme values before the lockdown than after the lockdown.

In Table 1, the CAR for event window [-5, +5] is mentioned. The average CAR is negative which can indicate a negative performance when the CAR for this event window is significant. In Table 2 the CAR of event window [-3, +3] is shown and in Table 3 the CAR of event window [-1, +1] is mentioned. The CAR of event windows [-3, +3] and [-1, +1] are positive. It can also be stated here that the CAR increases when the event window is smaller. The CAR of event windows [-5, +5] and [-1, +1] are statistically significant. Only event window [-5, +5] is negative and significant. Here, there is enough evidence to state that there is a negative impact on the firm performance of the firms in general. The other event windows are not statistically significant.

The standard deviation becomes smaller if a smaller event window is taken for the CAR. This means that the smaller the event window, the more companies are clustered around the mean. It can be stated that for a smaller event window, the spread around the mean becomes smaller. This smaller standard deviation is the case for the category "All subcategories" but also for every independent subcategory.

The graph in figure 5 shows the trend of the AAR when all three subcategories are taken together. Before the event day, the AAR fluctuates every day from positive to negative and vice versa. Day$_{-1}$ has a large peak and after this day, the AAR decreases. After the event day, there is a large drop to a negative AAR. Here, it shows that due to the lockdown, physical stores had to close. Because of this, the demand for products on the day of the event and one day after the event day decreased. After the drop, there is slowly an increase in AAR to a positive number.

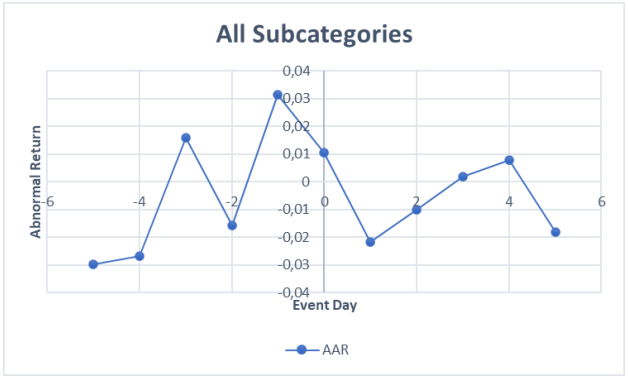

Figure 5. AAR of all subcategories. Returns are raw percentages.

For this part, the CAAR is calculated and analyzed for the three subcategories together. Table 4 shows the results of the CAAR. There is a difference in the subcategories. Namely, the subcategories "Specialty Retail" and "Auto Dealers" have an increasing CAAR when the event window becomes smaller. On the other hand, the subcategory "Food Stores" has the opposite effect. Here, the CAAR decreases as the event window becomes smaller. It can be stated that the CAAR increases when the event windows are becoming smaller. Also, event window [-5, +5] has a negative CAAR if all subcategories are taken together. All this can indicate that the impact is larger further away from the event day instead of close to the event day. The CAAR of event windows [-5, +5] and [-1, +1] are statistically significant but only event window [-5, +5] has a negative value. This means that there is enough evidence to state that there is a negative impact on the firm performance under the COVID-19 pandemic in the event window [-5, +5].

Furthermore, post-event analysis is mentioned in Appendix C and Appendix D. It can be stated that the further away from the event date, the more negative the CAR becomes. Also, the two largest event windows [0, +2] and [0, +5] are statistically significant for the CAR and the CAAR. So, for these event windows it can be stated that there is enough evidence to say that there is a negative impact due to the COVID-19 pandemic. Just as for the regular event windows [-5, +5], [-3, +3], and [-1, +1], it can be stated that the further away from the event date, the larger the negative impact.

5. CONCLUSION

The COVID-19 pandemic influenced the lives of people all over the world. It is a global crisis that also influences the financial performance of firms as there are restrictions for physical contact. Many countries introduced a lockdown which made it obligatory for physical stores to close for a particular time. This can have huge consequences for the sales of their products and services. This study aimed to look at the negative impact of the COVID-19 pandemic on the firm performance, which is hypothesis 1. It addressed the question of whether there is a negative impact on the firm performance within the three subcategories "Specialty Retail", "Food Stores", and "Auto Dealers. This study also analyzed if there was a negative impact when all three subcategories are taken together. The three subcategories were from the retail industry and the location on which this study focused was the United Kingdom. The impact was measured by calculating the abnormal returns with the stock returns of the companies within the different subcategories. The abnormal returns tell more about a specific company instead of a whole industry or subcategory within an industry. That is why the abnormal returns were used to calculate the CAR, AAR, and CAAR. This study had three event windows for the subcategories, which were [-5, +5], [-3, +3] and [-1, +1]. For every subcategory, the CAR, AAR, and CAAR were calculated for each event window. In this way, not only was looked at if there was a negative impact but also how long the negative impact lasted or in which event window the impact was mostly negative. Taking the subcategories together, also post-event analysis is done using three extra event windows. These event windows were [0, +1], [0, +2], and [0, +5].

Firstly, the subcategory "Specialty Retail" is analyzed. It can be stated that there is a negative impact on the firm performance under the COVID-19 pandemic. The CAR and CAAR of event window [-5, +5] show that the negative value is statistically significant for this event window. For the other event windows [-3, +3] and [-1, +1] this is not the case. In conclusion, it can be stated that there is a negative impact when a larger event window is taken. So, the negative impact is highest further away from the event day. The AAR also confirms this trend. The further away from the event day, the lower the AAR is.

Secondly, the subcategory "Food Stores" is analyzed. For this subcategory, it can be stated that it is the opposite of the subcategory "Specialty Retail". There is a negative impact on the firm performance under the COVID-19 pandemic, but for the subcategory "Food Stores", the CAR and CAAR of event window [-1, +1] is negative. These negative values are statistically significant for this event window. For the other event windows [-5, +5] and [-3, +3], this is not true. In conclusion, it can be stated that there is a negative impact on the firm performance when a smaller event window is taken. The impact is most negative close to the event day. The AAR shows that shortly after the event day, there is a very negative value which also proves this conclusion.

Thirdly, the subcategory "Auto Dealers" is analyzed. This subcategory is in line with the subcategory "Specialty Retail". The CAR and CAAR for event windows [-5, +5] and [-1, +1], a are statistically significant but only event window [-5, +5] has a negative value. This means that there is enough evidence to state that there is a negative impact on the firm performance in event window [-5, +5]. The other event window [-3, +3] is not statistically significant. In conclusion, it can be stated that there is a negative impact for the subcategory "Auto Dealers" when a larger event window is taken. Just as for the subcategory "Specialty Retail", the negative impact is highest further away from the event day. This can also be confirmed by the measurement of the AAR. The AAR shows that the further away from the event day, the more negative the values become.

Lastly, this study also analyzed all the three subcategories together. Taking the three subcategories together, it will follow the same trend as subcategories "Specialty Retail" and "Auto Dealers". The CAR and CAAR are statistically significant for event windows [-5, +5], [-1, +1], [0, +2], and [0, +5], but only event windows [-5, +5], [0, +2], and [0, +5] have a negative value. So, for these event windows there is enough evidence to state that there is a negative impact on the firm performance. The other event windows [-3, +3] and [0, +1] are not statistically significant which means that there is not enough evidence to state that there is a negative impact on the firm performance. In conclusion, it can be stated that there is a negative impact for all the subcategories together when a larger event window is taken, so when it is further away from the event date. The AAR of all the subcategories together fluctuates a lot so this is not in line with the statement about the CAR and CAAR.

5.1 Limitations and Recommendations

In this study, there are some limitations. Firstly, the financial data that is used for the study is gotten from Yahoo! Finance. The stock prices of the companies and the stock market prices are used in this research. The study assumes that the stock prices fully reflect all information and that the stock prices are adjusted immediately after the information becomes available. Due to market inefficiency, it is possible that the stock prices do not reflect all the information. Secondly, as can be seen in the results, some subcategories were more affected when the event window was larger. To see how long before the event date the negative performance started and until how long it lasted, a bigger event window should have been taken. Also, this research only took three subcategories from the United Kingdom. This is not a big sample. The results can be more precise when more countries are compared with each other and more subcategories are analyzed. Lastly, according to the website of Ministerie van Buitenlandse Zaken (2020), the UK left the European Union on the 31st of January in 2020, which could have led to a negative impact on the firm performance of British firms. The conclusion we made

about the negative impact of the COVID-19 pandemic on the firm performance could also be caused by the Brexit.

In future research, more analysis can be done regarding the impact of the firm performance because of the COVID-19 pandemic. Firstly, more subcategories can be analyzed and compared to each other to see if there is an impact across the whole industry or if it could have been a different cause for a specific subcategory. Also, more countries should be analyzed as the COVID-19 pandemic is a global crisis. All countries should be affected by this pandemic, that is why the countries should be compared to each other in future research. Secondly, more research should be done about the negative impact of the Brexit on firm performance. The date of the Brexit is in the estimation period of this study, which means that it could have been influencing the results.

6. ACKNOWLEDGMENTS

I want to thank dr. X. Huang for the opportunity to analyze the impact of the COVID-19 pandemic on the firm performance of companies in the retail industry. Last year, a lot of restrictions made it difficult for students to have a social life. Also, going to the University of Twente was not possible. The COVID-19 pandemic influenced the lives of everyone, that is why this subject was really interesting. COVID-19 is not an event that happened long ago, that is why there is still not a lot of research about this subject. I also want to thank dr. X. Huang for all the support during the thesis. Furthermore, I want to thank my friends for the discussions that helped seeing problems in a different way. We could help each other with the problems we were facing. I also want to thank my family for the support as I had to do the thesis completely at home due to the COVID-19 pandemic.

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8. APPENDICES

Appendix A

Table 5 – Abnormal Returns per company per day

Company	Subcategory	AR-5	AR-4	AR-3	AR-2	AR-1	AR0	AR+1	AR+2	AR+3	AR+4	AR+5
JD Sports Fashion pl	Specialty Retail	-0,168	-0,222	-0,117	0,074	0,166	-0,006	0,095	0,145	-0,024	-0,030	-0,047
Frasers Group plc	Specialty Retail	-0,095	-0,034	0,105	-0,031	0,005	0,055	-0,114	-0,013	0,004	-0,121	-0,133
Dunelm Group plc	Specialty Retail	-0,139	0,008	-0,053	-0,136	0,048	-0,029	-0,014	0,016	0,032	-0,029	-0,063
WH Smith PLC	Specialty Retail	-0,014	-0,173	-0,131	-0,079	0,290	0,033	-0,108	0,091	0,029	0,009	-0,036
Pets at Home Group Plc	Specialty Retail	-0,110	0,046	-0,029	0,154	-0,023	0,081	-0,053	0,030	0,011	-0,043	0,035
Dixons Carphone plc	Specialty Retail	-0,064	0,073	0,038	-0,146	0,157	0,018	0,031	-0,013	0,095	-0,056	-0,145
Halfords Group plc	Specialty Retail	-0,181	-0,042	-0,291	-0,138	0,237	-0,182	0,059	0,198	0,141	-0,056	-0,095
IG Design Group plc	Specialty Retail	-0,317	-0,284	-0,142	-0,012	0,240	-0,076	0,048	0,108	0,119	0,010	-0,027
Card Factory plc	Specialty Retail	-0,051	-0,387	0,013	0,002	0,043	-0,035	0,036	-0,017	0,081	-0,010	-0,042
Studio Retail Group plc	Specialty Retail	-0,019	0,003	-0,025	0,004	-0,029	-0,021	-0,078	-0,039	-0,031	0,051	-0,012
UP Global Sourcing Holdings plc	Specialty Retail	-0,219	-0,195	-0,152	0,014	0,219	-0,040	0,092	-0,076	-0,016	0,019	0,014
ScS Group plc	Specialty Retail	-0,141	-0,053	0,108	-0,005	0,066	-0,080	-0,132	-0,018	0,035	-0,034	0,016
Hornby PLC	Specialty Retail	-0,168	-0,033	-0,063	0,057	0,087	0,010	0,026	0,004	0,002	-0,008	0,016
Angling Direct plc	Specialty Retail	-0,115	-0,095	0,031	-0,039	0,083	-0,021	-0,052	-0,041	0,007	0,072	-0,002
Mothercare plc	Specialty Retail	-0,051	-0,015	-0,057	-0,333	-0,040	0,035	-0,073	-0,248	-0,061	0,042	-0,159
TheWorks.co.uk plc	Specialty Retail	-0,106	-0,215	0,137	-0,078	0,109	-0,002	-0,026	-0,028	0,006	0,072	-0,020
The Stanley Gibbons Group plc	Specialty Retail	-0,114	-0,122	-0,018	-0,004	-0,002	-0,020	-0,059	-0,013	-0,006	0,033	0,014
Scholium Group Plc	Specialty Retail	0,003	0,000	-0,056	-0,078	0,001	0,003	-0,002	-0,000	0,000	0,003	0,001
XXL ASA XXL ORD SHS	Specialty Retail	-0,144	-0,040	0,039	-0,022	-0,038	0,074	-0,079	-0,440	0,014	0,085	-0,012
ZOOPLUS AG ZOOPLUS ORD SHS	Specialty Retail	0,050	0,118	0,155	0,117	0,028	0,127	-0,110	-0,210	-0,023	0,085	0,046
FIELMANN AG FIELMANN ORD SHS	Specialty Retail	0,036	-0,020	-0,067	-0,054	0,064	0,025	0,029	0,019	-0,015	-0,027	0,015
GRANDVISION NV GRANDVISION BV O	Specialty Retail	-0,077	-0,135	-0,032	-0,060	0,294	-0,010	-0,028	0,053	-0,018	0,034	-0,034
FNAC DARTY SA FNAC DARTY ORD SH	Specialty Retail	-0,065	-0,054	0,086	0,022	0,027	0,061	-0,029	-0,038	0,015	0,079	-0,024
UNIEURO SPA UNIEURO ORD SHS	Specialty Retail	0,067	-0,005	0,046	-0,018	-0,009	0,019	-0,029	-0,005	-0,018	0,002	-0,007
MATAS A/S MATAS ORD SHS	Specialty Retail	0,031	0,007	0,006	-0,064	-0,018	-0,036	0,004	0,007	0,019	-0,001	-0,010
CLAS OHLSON AB CLAS OHLSON ORD	Specialty Retail	0,000	0,000	-0,051	-0,079	-0,039	0,033	-0,036	-0,048	-0,033	0,039	-0,008
DUFRY AG DUFRY ORD SHS	Specialty Retail	-0,097	-0,158	0,081	0,159	0,063	0,035	-0,064	-0,001	-0,064	0,020	-0,033
METRO AG METRO ORD SHS	Specialty Retail	-0,030	-0,052	-0,078	-0,070	-0,092	0,017	0,035	-0,043	0,023	-0,030	-0,053
Associated British Foods plc	Food Stores	-0,027	0,024	-0,066	0,003	0,047	-0,050	-0,071	0,112	0,017	-0,019	-0,041
Tesco PLC	Food Stores	0,009	0,022	0,038	-0,022	-0,041	-0,004	-0,038	-0,009	0,039	0,028	-0,006
Ocado Group plc	Food Stores	0,062	0,084	0,104	-0,038	-0,070	-0,041	-0,057	-0,031	-0,009	0,022	-0,007
J Sainsbury plc	Food Stores	0,033	0,044	0,147	-0,040	-0,028	-0,005	-0,044	-0,038	0,003	0,058	-0,007
Wm Morrison Supermarkets PLC	Food Stores	-0,017	0,077	0,123	-0,053	-0,034	-0,033	-0,024	-0,060	0,020	0,034	0,006
Tate & Lyle plc	Food Stores	-0,018	-0,004	-0,040	-0,037	0,043	-0,042	0,015	-0,011	0,022	0,035	0,013
Greggs plc	Food Stores	-0,092	-0,099	0,052	-0,021	0,013	-0,054	0,045	0,036	0,014	0,012	0,010
Cranswick plc	Food Stores	-0,008	0,015	0,020	-0,092	0,307	-0,226	-0,003	0,069	0,071	-0,105	0,034
Hilton Food Group plc	Food Stores	-0,133	-0,003	-0,018	0,030	0,127	0,001	0,014	-0,003	0,092	0,001	-0,023
Premier Foods plc	Food Stores	-0,075	-0,025	0,028	-0,083	0,059	0,107	0,011	-0,041	0,050	0,025	-0,031
Greencore Group plc	Food Stores	-0,254	-0,069	0,116	0,203	-0,000	0,054	0,049	0,003	0,128	-0,038	-0,068
Bakkavor Group plc	Food Stores	-0,246	0,073	-0,028	0,150	-0,014	0,035	-0,123	0,087	0,341	0,029	-0,070
Devro plc	Food Stores	-0,057	-0,026	-0,007	-0,043	0,037	0,026	-0,049	0,010	0,158	-0,041	0,079
Kerry Group plc	Food Stores	0,030	0,025	0,052	0,062	-0,050	0,012	-0,123	-0,027	-0,007	0,013	0,035
Anpario plc	Food Stores	-0,142	-0,183	0,047	-0,011	0,154	0,023	-0,057	-0,030	0,055	0,067	0,025
Finsbury Food Group Plc	Food Stores	-0,062	-0,107	-0,090	-0,009	0,067	-0,039	-0,020	0,024	0,067	0,018	-0,007
Cake Box Holdings Plc	Food Stores	-0,083	-0,208	-0,085	0,048	0,013	-0,060	-0,096	0,118	0,042	0,010	-0,057
Science in Sport plc	Food Stores	-0,130	-0,017	0,042	-0,008	-0,004	0,010	-0,054	-0,027	0,032	0,035	-0,005
McColl's Retail Group plc	Food Stores	-0,290	0,205	0,007	0,040	0,022	0,132	-0,032	0,059	-0,086	0,098	-0,026
Glanbia plc	Food Stores	0,085	-0,041	-0,042	-0,117	0,096	-0,044	0,005	0,011	0,038	-0,017	0,017
Zambeef Products PLC	Food Stores	0,018	-0,009	0,018	-0,003	-0,001	0,017	-0,032	0,009	0,005	0,012	-0,002
Ukrproduct Group Limited	Food Stores	0,006	0,123	0,102	0,310	0,053	-0,049	-0,170	-0,063	0,002	0,002	0,091
BONDUELLE SAS BONDUELLE ORD SHS	Food Stores	0,141	-0,023	0,087	0,018	0,028	0,037	-0,057	-0,054	0,010	0,018	-0,065
GRIEG SEAFOOD ASA GRIEG SEAFOOD	Food Stores	-0,092	-0,080	0,022	0,039	-0,054	0,051	0,008	-0,079	-0,003	-0,019	-0,037
SLIGRO FOOD GROUP NV SLIGRO FOO	Food Stores	-0,096	-0,086	-0,047	0,038	0,077	0,024	-0,069	0,023	0,036	-0,037	0,003
AAK AAB (PUBL) AAK ORD SHS	Food Stores	0,011	0,028	0,062	0,030	-0,047	-0,015	-0,065	-0,020	0,013	0,027	-0,008
NESTLE SA NESTLE ORD SHS	Food Stores	-0,069	0,057	0,069	0,014	-0,009	-0,020	-0,051	0,000	-0,016	0,013	0,001
LEROY SEAFOOD GROUP ASA LEROY S	Food Stores	-0,082	-0,067	0,040	0,003	-0,063	0,035	-0,014	-0,047	-0,016	-0,017	0,007
KONINKLIJKE AHOLD DELHAIZE NV K	Food Stores	0,097	0,065	0,062	-0,058	0,012	0,018	-0,057	-0,025	-0,035	0,081	0,001
ORKLA ASA ORKLA ORD SHS	Food Stores	-0,034	0,042	0,002	-0,034	-0,041	0,002	-0,011	0,011	0,035	-0,036	0,032
RALLYE SA RALLYE ORD SHS	Food Stores	0,062	0,217	0,049	-0,012	-0,012	0,166	-0,068	-0,036	-0,044	0,034	-0,008
ICA GRUPPEN AB ICA GRUPPEN ORD	Food Stores	0,024	0,126	0,105	0,036	-0,041	-0,045	-0,083	-0,035	-0,032	0,035	-0,007
ETABLISSEMENTEN FRANZ COLRUYT N	Food Stores	0,070	0,134	0,216	-0,137	-0,026	-0,001	-0,017	-0,030	0,047	-0,034	-0,026
DANONE SA DANONE ORD SHS	Food Stores	0,095	0,049	0,098	0,001	-0,052	-0,027	-0,083	-0,007	0,015	-0,015	0,014
EBRO FOODS SA EBRO FOODS ORD SH	Food Stores	0,099	0,023	0,045	-0,007	-0,038	0,009	-0,056	-0,013	-0,003	0,009	0,036
KESKO OYJ KESKO ORD SHS	Food Stores	0,003	0,040	0,120	-0,175	-0,062	-0,045	-0,007	0,019	0,010	0,014	-0,007
KRAFT HEINZ CO KRAFT HEINZ ORD	Food Stores	0,078	0,025	0,097	-0,036	-0,029	0,012	-0,042	-0,016	-0,016	0,029	0,010
SUEDZUCKER AG SUEDZUCKER AG ORD	Food Stores	0,117	0,081	-0,005	-0,028	-0,011	0,039	-0,034	-0,044	-0,001	0,039	0,027
CASINO GUICHARD PERRACHON SA CA	Food Stores	0,120	0,100	0,049	-0,038	0,011	0,025	-0,019	-0,033	-0,012	0,031	-0,014
CARREFOUR SA CARREFOUR ORD SHS	Food Stores	0,085	0,074	0,098	-0,044	-0,049	0,023	-0,069	-0,040	-0,006	0,025	-0,024
ARYZTA AG ARYZTA ORD SHS	Food Stores	-0,338	0,001	0,242	0,029	-0,032	0,009	-0,001	-0,194	0,027	0,011	0,004

Toyota Motor Corporation	Auto Dealers	0,033	-0,016	0,047	-0,014	0,000	-0,017	-0,037	0,109	-0,015	0,011	-0,020
Aston Martin Lagonda Global Holdings plc	Auto Dealers	-0,317	0,151	0,122	-0,096	-0,091	0,249	0,070	0,249	-0,069	0,083	-0,208
TI Fluid Systems plc	Auto Dealers	-0,099	0,017	-0,060	0,025	0,114	0,011	0,028	0,006	0,084	-0,135	-0,128
AB Dynamics plc	Auto Dealers	-0,133	-0,120	-0,245	0,192	-0,005	-0,078	0,027	-0,013	-0,004	0,026	-0,020
Surface Transforms Plc	Auto Dealers	0,055	-0,034	0,069	-0,040	0,051	-0,060	-0,063	-0,094	-0,017	0,038	-0,008
Carclo plc	Auto Dealers	0,122	-0,539	0,138	-0,037	0,217	-0,061	-0,038	-0,052	-0,048	0,074	0,044
Transense Technologies plc	Auto Dealers	0,013	-0,028	0,013	-0,020	0,027	0,013	-0,058	-0,139	0,044	0,016	-0,010
Autins Group plc	Auto Dealers	-0,028	-0,208	-0,036	-0,083	0,001	0,003	-0,003	-0,001	-0,091	-0,097	-0,111
BAYERISCHE MOTOREN WERKE AG BMW	Auto Dealers	-0,017	-0,033	0,060	-0,068	0,073	0,021	0,022	-0,008	-0,014	0,005	-0,012
BAYERISCHE MOTOREN WERKE AG BMW	Auto Dealers	0,081	-0,037	0,060	-0,014	0,086	-0,015	-0,059	-0,002	-0,058	0,058	-0,035
FERRARI NV FERRARI ORD SHS	Auto Dealers	0,098	0,017	0,074	-0,025	0,009	-0,001	-0,004	-0,012	-0,016	0,009	-0,000
STELLANTIS NV STELLANTIS NV ORD	Auto Dealers	-0,059	-0,077	-0,032	-0,073	0,019	0,036	-0,025	-0,003	-0,030	0,014	-0,052
FAURECIA SA FAURECIA ORD SHS	Auto Dealers	-0,017	-0,053	-0,016	-0,030	0,124	0,108	-0,066	-0,088	-0,044	0,033	-0,006
FRENI BREMBO SPA FRENI BREMBO O	Auto Dealers	-0,008	-0,011	0,116	0,080	0,031	-0,023	-0,034	-0,105	-0,051	0,005	-0,069
RENAULT SA RENAULT PAR SHS	Auto Dealers	-0,016	0,040	0,068	-0,006	0,001	0,032	0,015	-0,015	0,014	0,011	-0,058
TESLA INC TESLA ORD (CDI)	Auto Dealers	-0,021	-0,135	-0,041	0,056	0,021	0,132	-0,089	-0,001	-0,103	-0,012	-0,022
ELRINGKLINGER AG ELRINGKLINGER	Auto Dealers	0,024	0,035	0,096	-0,043	0,067	0,031	-0,026	0,006	-0,092	0,001	-0,017
BERTRANDT AG BERTRANDT ORD SHS	Auto Dealers	0,010	-0,014	0,034	-0,002	-0,060	0,013	0,080	-0,046	-0,017	0,059	-0,040
NOKIAN TYRES PLC NOKIAN RENKAAT	Auto Dealers	0,046	-0,026	0,078	-0,063	0,020	-0,007	-0,062	0,015	-0,082	0,009	0,056
VALEO SA VALEO ORD SHS	Auto Dealers	0,005	-0,041	0,008	0,055	0,113	0,132	-0,019	-0,019	-0,029	0,005	-0,077
CONTINENTAL AG CONTINENTAL ORD	Auto Dealers	0,037	-0,012	0,021	-0,083	0,036	0,064	0,018	-0,009	-0,014	0,006	-0,026
GENERAL MOTORS CO GENERAL MOTORS	Auto Dealers	0,003	-0,080	-0,163	0,071	0,028	0,010	0,068	0,009	-0,041	-0,027	-0,003
CIE AUTOMOTIVE SA CIE AUTOMOTIV	Auto Dealers	0,054	-0,071	-0,062	-0,124	0,088	0,135	-0,017	0,033	-0,044	0,038	0,000
VOLKSWAGEN AG VOLKSWAGEN ORD SH	Auto Dealers	0,032	-0,002	0,004	0,007	-0,033	0,036	0,009	0,023	-0,015	-0,012	-0,022
BYD CO LTD BYD ORD SHS H	Auto Dealers	0,056	-0,003	0,035	-0,018	-0,010	0,008	-0,014	0,001	-0,016	-0,012	-0,008
GEELY AUTOMOBILE HOLDINGS LTD G	Auto Dealers	-0,064	-0,011	-0,043	-0,011	0,012	-0,006	0,021	0,007	0,030	0,019	-0,005
COMPAGNIE PLASTIC OMNIUM SA COM	Auto Dealers	0,100	-0,038	0,009	-0,086	0,049	0,028	-0,010	0,022	-0,069	-0,025	-0,076
SCHAEFFLER AG SCHAEFFLER PREF S	Auto Dealers	0,112	-0,054	-0,012	-0,086	0,040	0,081	-0,030	-0,050	-0,049	0,008	-0,005
COMPAGNIE GENERALE DES ETABLISS	Auto Dealers	0,038	0,007	0,048	0,010	-0,011	0,011	-0,045	0,013	-0,020	-0,010	0,002
PIRELLI & C SPA PIRELLI & C ORD	Auto Dealers	0,013	0,030	0,136	0,029	-0,073	0,023	-0,101	-0,068	-0,069	0,043	-0,025
HALDEX AB HALDEX ORD SHS	Auto Dealers	-0,072	-0,103	-0,111	0,033	0,031	-0,061	-0,049	0,025	-0,003	0,069	-0,013
GESTAMP AUTOMOCION SA GESTAMP A	Auto Dealers	0,101	-0,019	0,072	0,043	0,016	0,008	-0,040	0,029	-0,065	0,002	-0,025
VOLKSWAGEN AG VOLKSWAGEN NON-VO	Auto Dealers	-0,013	-0,008	-0,046	-0,024	0,053	0,037	0,074	-0,005	-0,047	-0,025	-0,016
PORSCHE AUTOMOBIL HONDING SE PO	Auto Dealers	0,015	-0,036	-0,066	-0,038	0,098	0,008	0,039	0,006	-0,016	-0,015	-0,018
DAIMLER AG DAIMLER ORD SHS	Auto Dealers	0,009	0,022	0,015	-0,048	0,019	0,069	0,106	-0,034	-0,041	-0,010	-0,016
HELLA KGAA HUECK & CO HELLA KGA	Auto Dealers	0,068	-0,106	0,039	-0,078	0,067	0,062	-0,018	0,004	-0,005	-0,028	-0,004
EXOR NV EXOR ORD SHS	Auto Dealers	-0,001	-0,007	-0,081	-0,031	-0,018	-0,001	0,085	0,033	0,022	0,032	-0,031
FORD MOTOR CO FORD MOTOR ORD (C	Auto Dealers	0,008	-0,002	-0,061	-0,034	-0,022	0,020	0,080	0,097	-0,091	-0,043	-0,006
SAF HOLLAND SA SAF-HOLLAND ORD	Auto Dealers	-0,019	0,044	0,060	-0,068	-0,067	-0,006	0,005	0,028	-0,038	-0,038	0,008
AUTOLIV INC AUTOLIV SDR	Auto Dealers	-0,090	-0,003	-0,040	-0,041	0,020	-0,028	0,079	-0,023	-0,009	-0,031	-0,002

Appendix B

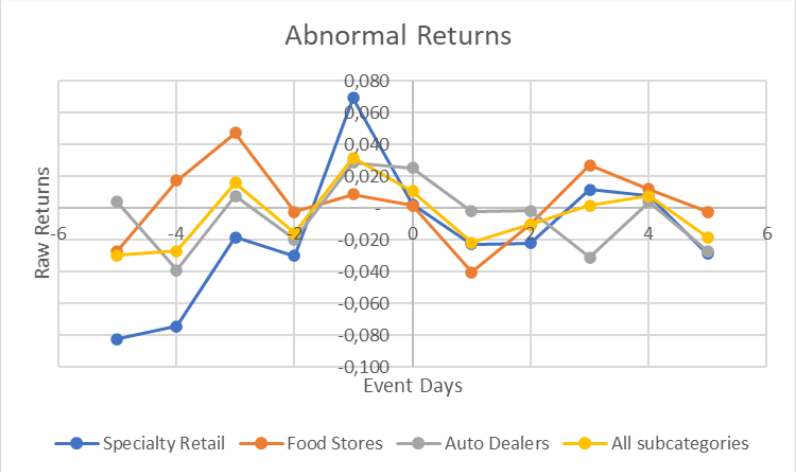

Figure 6. Graph with the Abnormal Returns per subcategory.

Appendix C

Table 6 - Cumulative Abnormal Returns post-event analysis

CAR_i	Averages	Standard Deviation	T-value	Minimum	Maximum
[0, +1]	-0,011	0,080	-1,452	-0,229	0,319
[0, +2]	-0,021*	0,116	-1,919	-0,444	0,568
[0, +5]	-0,030*	0,117	-2,666	-0,463	0,374

a. * is significant at 5% level.

Appendix D

Table 7 – Cumulative Average Abnormal Returns post-event analysis

$CAAR_i$	Averages	Standard Deviation	T-value	Minimum	Maximum
[0, +1]	-0,006	0,040	-1,452	-0,114	0,160
[0, +2]	-0,007*	0,039	-1,919	-0,148	0,189
[0, +5]	-0,005*	0,020	-2,666	-0,077	0,062

a. * is significant at 5% level.