Norwegian School of Economics
Bergen, Autumn 2022

Race to Return:

An Event Study of Race Performance and Share Price Reactions

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Master thesis, Economics and Business Administration

Major: Financial Economics

NORWEGIAN SCHOOL OF ECONOMICS

approval of this thesis – for the theories and methods used, or results and conclusions drawn in this work.

Preface

We are pleased to present our master's thesis, which marks the completion of our master's degree in Business and Administration with a major in financial economics at NHH.

We were drawn to this topic because of our interest in the intersection of sports and finance, and we wanted to explore how performance in Formula One Might affect the financial performance of the companies involved.

We would like to express our gratitude to our supervisor, Konrad Raff, for his guidance and support throughout the research process. We also wish to thank our friends and families for their support and understanding during the time we spent working on this project.

We hope that our research will contribute to a better understanding of the relationship between race performance in Formula One and the financial performance of the companies involved.

Abstract

This thesis investigates the relationship between race performance in Formula One and the immediate stock price reaction of the companies involved. Using event study and regression analysis, we examine the effect of race results on the abnormal returns of eight different companies. Our results show that race performance does not have an immediate statistically significant effect on abnormal returns. We also find that winning the Driver's Championship and Constructor's Championship does not lead to positive abnormal returns for companies associated with the winning team. Our findings suggest that companies do not add immediate shareholder value by their performance in Formula One.

Contents

1. Introduction

Do increased company exposure generated by race results in Formula One create brand value for the implied companies which lifts the companies' market value? And is the effect perceptible in stock prices immediately after a race is finished?

We use event study methodology to study the effect of Formula One race performance on the daily share price for the companies involved. By examining the performance of each team, we calculate the impact race events on a Sunday have on the stock value the following Monday. We include manufacturing companies as well as sponsoring companies. This gives us the possibility to see whether the market reacts differently to race performance for manufacturing and sponsoring companies. We also test whether winning the Driver's Championship or the Constructor's Championship leads to positive abnormal returns for companies associated with the winning team, and whether this effect differs for manufacturing and sponsoring companies. Analyzing the net changes in stock prices provides insights into how the market values the performance on the grid.

The performance of a Formula One team has a direct impact on the level of exposure the team's manufacturer and sponsors receive. Performing well and finishing on the podium generate increased media exposure. Conversely, a poor performance leads to reduced media coverage. According to Jensen & Cobbs (2014), a race win resulted in team exposure worth more than US$ 25,8 million. Exposure will translate into brand recognition, which ultimately drive sales and revenue for the manufacturing teams and their sponsors.

Sponsorship of sports events has a long history, dating back to the inception of organized sports. Earlier studies of sports performance and value added for sponsors have studied the effect of media on brand recognition and brand value. This research is vast, providing varying results (Bennet 1999, Quester & Fallerry 1998). Research on how sports events affect the sponsors' market value, however, has been limited. This study is even more focused: We look at the immediate effect on stock prices of sports results. The underlying hypothesis is that investors, aware that sports results cause media exposure and that media exposure causes brand recognition which will have an impact on sales and profits, reevaluate, if just marginally, the market value of implied companies in the immediate aftermath of a sporting event.

The sample consists of eight companies: four manufacturing companies and four sponsoring companies. The manufacturers are Mercedes, Ferrari, Williams, and Renault. The sponsors are Monster, Mapfre, UPS and Shell. In total 62 race events are analyzed during the period 2017-2019. Ordinary Least Square regression is used to study the abnormal returns on the first trading day after a race event.

We hope our analysis will contribute to the existing literature on the value of marketing activities in Formula One and provide insight into how the stock market on a short-term basis tracks each team's performance.

2. About the sport

In 2017 Liberty Media agreed to acquire Formula One for a fee of 4,6 billion dollars and took on the challenge of transforming the sport after it had experienced a downward trend starting in 2009. After the acquisition, Formula One has retained its position as one of the most successful sports in the world. Improved deals on TV rights led to a record-breaking cumulative audience of 1.922 billion in 2019, making the sport highly desirable in terms of a marketing perspective. The new Netflix documentary "Drive To Survive" gives viewers a closer look behind the scenes and has increased its popularity among the younger generation. The series has also created interest in new markets such as the US and Asia. Formula One generated $30 billion through sponsorship deals during a 15-year period, categorizing it as one of the “wealthiest” sports on the globe.

The modern era of Formula One originated in the 1950s. However, an earlier form of Grand Prix racing can be traced back to France in the 1890s (Tremayne, 2020**).** The races have evolved from primitive road races to professional circuit racing, with the first World Championship race held at the famous Silverstone (United Kingdom) in the 1950s (Tremayne, 2020). Throughout the years, Formula One has produced some of the world’s most-known sports icons, including Michael Schumacher, Ayrton Senna, and currently competing World Champion Lewis Hamilton.

Formula One consists of 10 teams. Each team is represented by two cars, with their respective drivers. The races are conducted throughout the year, called the “Formula One World Championship Season”. Each race is defined as a “Grand Prix,” in which they visit traditional racing hotspots like Monaco, the UK, Belgium, and Italy every season. Formula one has recently ventured into new territories due to its popularity in America, Singapore, Saudi Arabia, Azerbaijan, and the Netherlands (Sporting News, 2022.). The Grands Prix attracts massive worldwide attention and is a big event for the hosting nations. Formula One uses a league table format, with each driver collecting between 1-25 points through the season for themselves and the team. There are two possible titles to be won throughout the season. The first is the Formula One World Drivers Championship, which nominates the most successful race car driver based on points throughout the season. This championship is the most important among fans and its participants. The other is the World Constructors Championship, which determines the most successful Formula One team throughout the season based on points collected by both drivers in each team.

Due to the gained popularity in recent years, new contenders are considering entering the sport of Formula One. The German car-manufacture Audi has announced they will join the World Championship from the 2026 season and onwards, with a rumored entry of $450 million for acquiring the Sauber F1 team (Audi to Join Formula 1 from 2026, 2022). Porsche is looking to follow in Audi's footsteps (Noble, 2022).

There are not only car-manufactures that find Formula One attractive. According to Forbes, Scuderia Ferrari has received $2,1 billion in total sponsorship between the seasons 2009 to 2018. The sponsorship payments peaked in the 2010 season with a total payment of $249,5 million (Sylt, 2019). Team sponsorship accounted for 44,7% of Formula One total haul in 2018, where 38,9% came from team owners, with the rest coming from series partners. The average price of a team sponsorship deal is $3.3 million, with the most lucrative deals costing significantly more (Sylt, 2019).

3. Literature and previous research

In this section we look at previous research and literature on the topic of how sports performance affects the share price.

Grullon et al. (2004) show that the firm’s visibility has significant consequences for the stock market, since a firm’s visibility does have an impact on people’s familiarity with the company. Firm visibility can thus depend on the brand exposure created during a sporting event. Jensen and Cobbs (2014) investigated how race performance impacted the amount of exposure each team received. The paper measured the exposure on points gained in the Formula One World Championship and whether the team won or did not finish the race. As mentioned, for each point attained in the Championship, the team’s sponsors saw an increase in brand exposure worth US$ 822,157. A race win resulted in team exposure worth more than US$ 25,8 million. If a team did not finish the race, they saw a loss of US$ 5,6 million in sponsor exposure value (Jensen & Cobbs, 2014).

Brand exposure is the precursor to brand awareness and brand value, which means increased brand exposure leads to increased brand value. (Jensen & Cobbs, 2014) Increased brand value translates into more sales, more profits and higher stock prices. To quote the famous fund manager Warren Buffet, "Buy great brands" (Henry, 1998). Kirk et al. (2013) find evidence supporting that "brand value is found to be significantly associated with share prices above and beyond book value and earnings information." Their finding shows evidence that increased brand value obtained through sponsoring sports events does influence the company's share price. "As investors' perceptions of a firm's brand strength increase or decrease, the market reacts accordingly, adjusting the financial valuation of the firm by adjusting the stock price" (Kirk et al., 2013). Hence, race performance might cause excess returns for the sponsoring and manufacturing companies involved with the sport.

Using Ferrari as an example, here's how we think owning a Formula One team might increase shareholder value. As a luxury car manufacturer, their brand perception is important. Unlike most other car companies, Ferrari does not have commercials on TV or use mass advertising to reach the public (Bisso, 2021). Ferrari relies on good race performance to boost its brand image. By repeatedly exposure through race events Ferrari should see an increase in brand recognition compared to not participating, which leads to increased sales.

Focke et al. (2020) research finds that "advertising can create investor attention…, but the effect of advertising on investor attention is only a necessary condition for advertising to affect the capital market outcomes". They find no results supporting that advertising affects short-term returns. This indicates that share price is not easily manipulated by advertising, and "the belief that stock prices can be temporarily inflated via advertising is misguided."

Cornwell et al. (2001) investigated whether winning NASCAR races had an impact on the sponsor's share price. They concluded that sponsors who had no association with motorsport were unaffected by the outcome of the races, while the sponsors who had noticed a substantial effect on the share price. This result is supported by Mason (2005). He concludes that a good fit between sponsor and sport is important to properly reach the targeted market and create positive associations.

Scherr et al. (1993) studied how the performance of the Boston Celtics, the NBA team, affected the club's share price. A win increased the club's share price, and a loss resulted in a decrease in the club's share price. Their study was followed by Brown and Hartzell (1999), who found that investors do, in fact, account for game results when analyzing a potential investment. Brown and Hartzell (1999) conclude that "Basketball games significantly affect partnerships share returns, trading volume and volatility".

Barajas et al. (2005) conducted an event study of more than 134 football teams from the Spanish Primera and Segunda divisions between 1998 and 2002. They concluded that "sports performance has almost no explanatory power of economic results [for the owners of the teams]," which means that there is a very low linkage between game performance and share prices. Therefore, they were convinced that there must be other causes for share price fluctuation not included in their model, primarily sponsorships and TV rights.

In his paper, Mayer (2021) investigates the short-term effects of advertising on investor attention and financial market outcomes. His findings suggest that "product market advertising attracts investor attention and creates price pressure in firms' stock. However, the price pressure is temporary."

Palomino et al. (2005) looked at listed football clubs in the UK. They studied how share prices react to two types of public information, betting odds and game results.

Interestingly they find that the market does not react when betting odds are released, even though they are outstanding predictors of the outcomes. The market only reacts after the game is finished. Their results show a win is associated with a positive abnormal return of 0,53% and a loss of negative 0,57%. They did not get a significant result when a draw occurred.

Renneboog et al. (2000) come to the same conclusion in their paper about share price reactions to the sporting performance of football clubs. They investigate the effect of weekly sports performance on stock return using the event study method. A win is correlated with a positive abnormal return of 1%; draw and loss were penalized by negative returns of 1,4% and 0,6%, respectively.

There is an understanding that publicly announced and unanticipated firm-specific information influences share prices, such as earnings reports and dividends payment (Malkiel, 1989). Different studies have shown different results on whether investors use this information to operate on the stock market. The existing research is divided by the effects sports performance has on the share price.

4. Hypotheses

Since there is conflicting evidence regarding sports performance and its immediate effect on share prices, we want to test the following hypotheses:

Hypothesis one: *Race performance has a significant impact on the share price for the manufacturer team and its sponsors: finishing between 1st and 3rd correlates with a positive abnormal return and finishing between 4th and 20th correlates with a negative abnormal return.*

The first hypothesis is the foundation of our thesis and arises from our main research question "Is there a relationship between race performance in Formula One and the immediate stock price reaction of the companies involved". Earlier research regarding sport performance has primarily focused on other sports, such as Football. Studies performed by Renneborg et al. (2000) and Palomino et al. (2008) found a strong correlation between performance on the pitch and the stock price, where a win led to a significant increase in the stock price, while a draw or loss led to a significant decrease in the stock price. However, research on how performance in a Formula One race affects stock prices of the companies involved is limited.

Hypothesis two: *Winning the Constructor's Championship has a significant positive effect on the share price for the manufacturer of the winning team and its sponsors.*

The main goal for each team is to win the Drivers - and Constructors Championship. The Constructors Championship is awarded to the team with the most points. The Champion is rewarded with prestige and a higher share of the prize money. Winning generates a large amount of money, which the team can use to improve their car the following year, ultimately leading to them becoming Champions again. If we look at the data from 2010-2020, only two teams won the Constructor Championship. Red Bull Racing-Renault won it four consecutive years before Mercedes took charge in 2014, winning it for the next six years. Hence, rarely is a win followed by a disappointing season. Becoming Constructor Champion could reinsure investors that the team, and by extension, the owning company, is operating sensibly. Future income is expected to increase yearly, and the exposure associated with becoming Constructor Champion is massive. We have already discussed that brand exposure leads to increase brand value and that brand value influences share price. Jensen & Cobbs (2014) concludes that there is a correlation between winning and brand exposure worth millions of dollars.

Hypothesis three: *Winning the Drivers' Championship has a significant positive effect on the share price for the manufacturer of the winning team and its sponsors*.

The Drivers' Championship is the most prestigious of the two Championships. The winner is the race driver who accumulates the most point during a season. The driver represents a team, and his performance is linked to how the overall team performs. Hence, when the driver wins, the team also indirectly wins. The team will receive substantial publicity following the announcement of the winner. According to research provided by Grullon et al. (2004), evidence shows that the firm's visibility has significant consequences for the stock market. The theory is that on the Sunday the Championship concludes, the race team manufacturer and the sponsors affiliated with the winning driver will experience a positive abnormal return due to increased publicity and positive brand awareness.

Hypothesis four: *There is a higher impact on share price for manufacturers and sponsors when driving at its "home track".*

The objective of hypothesis four is to examine if racing at a team's home track affects the share price of the related companies more than in other races. Williams has Silverstone in the UK, Mercedes has Hockenheimring in Germany, Renault has Le Castellet in France and Ferrari has Monza in Italy.

We can use Ferrari as an example. Ferrari is the pinnacle of Italian engineering. When Ferrari race at the legendary Monza racetrack in Italy, its supporters come from all over the country to watch. Because Monza is their home track, the fans have high expectations for Ferrari's performance. One could think racing in one's home country generates more publicity and engagement from fans. Therefore, it is interesting to investigate if racing at a team's "home track" affects abnormal returns more than at other circuits.

Hypothesis five: *Race performance has a higher significant effect on share price for the manufacturing companies compared to the sponsoring companies.*

The manufacturers will more naturally be linked with the race performance. The car's performance is directly related to the quality of the manufacturing process. Sponsoring companies are not directly linked to the manufacturing process, so race performance may not be a good measure of the company's overall performance. According to Cornwell et al. (2001) "auto racing sponsorships involving products that are not closely linked to the automotive industry probably offer little chance of increasing overall corporate valuations, sponsors with logical or matched ties to the consumer automotive industry registered statistically and economically significant gains in their share price around the time of their sponsorship victories". Manufacturing companies would, in this case, be the sponsors with "logical or matched ties to the consumer automotive industry".

5. Data & Methodology

This section will describe the methods we used to conduct an event study. We use event study to examine the relationship between race performance and share price. We will begin by providing a brief overview of the data we collected. We will also include details about the sample of race teams and the sponsors we used, and the specific metrics used to evaluate race performance.

5.1 Formula One Data

We have chosen to examine eight companies between 2017 and 2019. Four companies own stakes in a Formula One team, whereas the last four are sponsoring a Formula One team. We chose these companies firstly because they were listed.

Secondly, they owned or sponsored a Formula One team during the three years of interest. Four out of the ten teams competing in the Formula One Championship are included. Those Formula One teams are Scuderia Ferrari, Williams, Mercedes, and Renault. The owning companies examined are Ferrari (owner of Scuderia Ferrari F1), Mercedes-Benz group (owner of Mercedes F1), Williams Grand Prix Holding (owner of Williams F1), and Renault (owner of Renault F1). The four sponsoring companies are as follows: Shell and UPS (sponsoring Ferrari F1), Monster Beverage Corporation (sponsoring Mercedes F1), and Mapfre (sponsoring Renault F1).

We only include the best finish obtained by the two drivers in each race. One reason for using the finish of the best driver is that it provides a more consistent and accurate measure of a team's overall performance. That is because a team's performance in a race is often determined by the performance of its best driver and using the finish of the best driver allows for more reliable comparisons between teams. Additionally, using the finish of the best driver can help control for potential confounding factors, such as differences in car performance or team strategy, that may affect a team's overall performance in a race.

Table 1: Race Position sorted by team
Summarizing the finishing position of best driver from each Formula One team, based on a total of 68 races across three consecutive seasons from 2017-2019. The placement of the best driver from each team is placed in into six categories where Win = 1st place, Low win = 2-3rd place, Middle = 4-7th place, High lose = 8-14th place, Lose ≥ 15th place, and DNF = did not finish the race.

2017 - 2019 season	Mercedes	Ferrari	Renault	Williams
Win	38	14	0	0
Lowwin	18	36	1	1
Middle	4	10	5	5
Highlose	1	0	31	31
Lose	0	0	23	23
Dnf	1	2	2	2

5.2 Stock Market Data

We gathered the daily share prices for each company on "finance.yahoo.com" for the period 01/06/2016 through 31/12/2019. In addition, "finance.yahoo.com" is where we gathered the index prices. All prices are adjusted for splits and dividends.
We utilized the index for where each company was listed. This approach allows us to account for market conditions that impact a company's share price and provide a more accurate and reliable measure of its performance. For example, for UPS, Shell, and Monster Beverage Company, we use Nasdaq (USA); for Williams Grand Prix Holding and Mercedes-Benz Group, we use DAX Performance (German); for Ferrari N.V. FTSE MIB (Italy); for Renault CAC40 (France), and Mapfre, we use IBEX 35 (Spain).

Table 2: Summary of the included companies and their market data.
This table presents the companies included in the event study and their characteristics. The second column "country" illustrate the exchange the stock data is retrieved from. The third column "IPO date" illustrates when the company had its initial public offering. The fourth column tells us what currency the company is listed in. The fifth column "closing price" illustrates the closing price on 31.12.19. The last column "market cap" tells us the total market value of the respective companies.

Company	Country	IPO Date	Currency	Shares outstanding 31.12.19	Closing price 31.12.19	Market Cap 31.12.19
Shell PLC	USA	31/10/1994	USD	2 221 186 441	59	131 050 000 000
Mercedes-Benz Group AG	Germany	27/10/1996	USD	1 131 357 553	52	59 170 000 000
Ferrari NV	Italy	21/10/2015	USD	249 636 363	165	41 190 000 000
Renault SA	France	02/01/2000	EUR	295 722 284	42	13 760 779 825
Williams Grand Prix HLDGS	England	27/02/2011	EUR	10 000 000	13	134 000 000
Mapfre	Spain	16/09/2001	EUR	3 079 553 273	2	7 300 081 034
Monster Beverage CORP	USA	09/12/1985	USD	537 165 354	64	43 110 000 000
United Parcel Service INC	USA	07/11/1999	USD	969 275 362	103	82 030 380 300

5.3 The Monday Effect

Formula One's return to Las Vegas in 2023 will become the 74th world championship race to be held on a day other than Sunday. This accounts for 7% of races held on another day during the week, with the remaining 93% occurring on Sunday (*Straw, 2022)*. However, during our estimation period, all the Grands Prix are taking place during the weekends, with the races being held on Sunday.

The Monday effect is a theory that refers to the tendency for stock markets to have lower returns on Mondays compared to other days of the week. According to the meta-study conducted by Pettengill (2003), findings support this claim. Furthermore, according to Cross (1973), evidence supports the Monday effect in which the stocks return increases significantly more on Fridays than on Mondays. However, more recent studies cast doubt over the magnitude of the Monday effect. According to Erickson et al. (1997), the Monday effect only occurs in the last two weeks per month. Pettengill (2003) states that the Monday effect became positive or even ceased to exist for large firms, in comparison to smaller firms where it continues to exist.

Due to the ambiguous results presented by research, we decided not to include the Monday effect in our thesis. Pettengill does not reach a satisfactory conclusion based on whether there is a significant effect or not. Furthermore, our sample consists only of larger firms, and thus according to Pettengill (2003), the Monday effect will likely stop existing or, in some cases, even become positive. There is not enough evidence supporting the theory, hence we did not include it.

5. 4 Methodology

Event studies can be used in various fields to measure the impact of single or multiple events. Given efficient markets, the event's effect will immediately be reflected in the security price. It can be constructed using security prices retrieved from a relatively short period, unlike direct productive measures, which often require data observed over a significantly longer period *(Mackinlay, 1997)*. Mackinlay (1997, p. 13) notes that one of the first studies was published in 1933 by James Dolley. In the decades following until late 1960, event study became increasingly more sophisticated by separating confounding events and removing general stock market price movements. According to Mackinlay (1997, p. 14), the seminal studies published by Fama et al. (1969) and Ray Ball & Phillip Brown (1969) introduced the modern methodology of event study, which is essentially similar to the ones used today.

When conducting our event study, we will use the three steps identified by de Jong (2007). De Jong (2007) based his three steps on the setup created by Bowman (1983).

1. *Identify the event of interest and the timing of the event.*
2. *Specify a "benchmark" model for normal stock return behavior.*
3. *Calculate abnormal returns around the event date.*

1. Identify the event of interest and the timing of the event.

The events of interest are all Formula One Grands Prix taking place in up to 21 countries and stretching over three seasons. Brown & Warner (1985) states that it is essential to have a precise and conclusive definition of the event date. Identifying the event date in our case is relatively simple because all the Grands Prix takes place during the weekend, and the race day is on Sunday. Furthermore, given the assumption of no race manipulation, the race's outcome is not known in advance. We have determined that there is no need to start the event window before race day. Therefore, we will focus our analysis on the trading day following each race, which is always on Monday.

According to Edmans et al. (2007), a limited amount of observation reduces statistical power. To prevent this reduction in statistical power, our examination period will start on the 14th of March 2017 and end on the 1st of December 2019. This period will provide us with 62 events of interest for each team over three seasons, with approximately 21 races each season. In addition, we have included abnormal return data from 01.06.2016 until 31.12.2019. More data will allow us to see how the returns change over time and provide a complete picture of the relationship between race performance and abnormal returns. Expanding the time period of our study past the 2019 season is not an option due to changes in sponsors and participating teams.

Event studies often utilize buy-and-hold abnormal returns (BHAR) or cumulative abnormal returns (CAR) to aggregate daily abnormal returns. However, due to the high frequency of events in our thesis, we do not see a reason to utilize this approach. We therefore maintain our conclusion of using a short event window.

2. Specify a "benchmark" model for normal stock return behavior

The second step states that we need to identify a benchmark model for normal stock return behavior, $NR_{i,t}$. We have decided to use the adjusted market model, the same as Schredelseker and Fidahic (2011) used in their study. The adjusted market model describes the relationship between the returns on a security and the returns on a market index. This model assumes that the returns on a market index determine the returns on a security. Hence, we will use different market indices depending on which country the company operates.

The return of the market index, R_{mk}, will be our benchmark. This gives us the following:

(1) $$NR_{i.t} = R_{i.t}^{mk}$$

3. Calculate the abnormal returns

We define the Abnormal returns (AR) as the difference between actual return, $R_{i.t}$, and expected return, which in our case will be $R_{i.t}^{mk}$. To calculate the abnormal return, we first calculate the actual returns for each company. We calculate the actual returns by dividing the closing price on t by the closing price on $t-1$ and then subtracting by one. The actual returns:

(2) $$R_{i.t} = \frac{P_{i.t}}{P_{i.t-1}} - 1.$$

$P_{i.t}$ is the share price of company i at the end of period t and $P_{i.t-1}$ is the share price of company i at the end of period $t-1$.

To calculate the $R_{i,t}^{mk}$ we use the same formula as above (1).

(3) $$R_{i,t}^{mk} = \frac{P_{i.t}}{P_{i.t-1}} - 1$$

The closing price of the index, $P_{i,t}$, divided by the closing price of the index $P_{i,t-1}$, subtracted by one. Using formulas two and three, we get the numbers needed to calculate the abnormal return for each company.

The abnormal returns ($AR_{i.t}$) are defined as the return (R) minus the benchmark return ($NR_{i.t} = R_{i.t}^{mk}$)

(4) $$AR_{i.t} = R_{i.t} - NR_{i.t}$$

We use the last race weekend in our sample as an example (see table 3): Mercedes-Benz Group's returns are calculated by dividing the closing price on Monday (42.66) by the closing price on Friday (43.82) and subtracting one. This gives a return of -2,647%. We then do the same for the Dax Performance, which gives a return of -2,052%. Finally, subtracting Mercedes-Benz Group's return from the return on Dax Performance, we get an abnormal return of -0,574%.

Table 3: Mercedes Benz Group's abnormal return calculation.
This table presents the closing price of Mercedes-Benz group on the last trading day of the weekend (Friday) and the first trading day of the weekend (Monday). These two variables are used to calculate the variable "Mercedes Return". The same approach is being used in the variable "Dax Close" to calculate "Dax Return". The variable "Mercedes Abn. Return" describes the obtained abnormal return.

Day	Date	Mercedes Close	Mercedes Return	Dax Close	Dax Return	Mercedes Abn. Return
Friday	29/11/2019	43,82		13236		
Monday	02/12/2019	42,66	-2,47%	12964	-2,053%	-0,595%

The prices used in the calculations are closing prices. This price represents the last transaction that occurred for the security during that trading day. We used Microsoft Excel to calculate the abnormal returns for every company.

5.5 Regression

After calculating the abnormal returns for our companies, it is time to conduct the regression analysis.

$$AR_{i.t} = \alpha + \beta_1 Win_{i.t} + \beta_2 Lowwin_{i.t} + \beta_3 Middle_{i.t} + \beta_4 Highlose_{i.t} + \beta_5 Lose_{i.t} + \beta_6 Dnf_{i.t} + \varepsilon_{\mathrm{i.t}}$$

Our dependent variable will be the abnormal return, $AR_{i,t}$ of stock i over time-period t, calculated in the previous step. The independent variables will be various dummy variables denoting the position of the race result. The dummy variables will take the value 1 or 0, depending on the result of the race. For example, if Mercedes finished a race in 1st place, the dummy variable "Win" gets 1, and the other dummy variables get 0. We use the following dummies: Win = 1st place, Low win = 2-3rd place, Middle = 4-7th place, High lose = 8-14th place, Lose ≥ 15th place, and DNF = did not finish the race. ε is the error term, and β_{1-6} is the regression coefficient for each respective dummy variable.

5.6 OLS assumptions

To conduct our regression analysis, we used the software "StataSE", which provides various options for correcting and adjusting for potential errors or biases in the data. StataSE allows us to create reliable regression outputs and conduct a robust analysis of the relationship between race performance and daily share price in Formula One racing. Since we are using an ordinary least squares (OLS) regression in our analysis, we must ensure that the five OLS assumptions, according to the Gauss-Markov theorem, hold to obtain valid and reliable results.

The five assumptions are as follows:

1. Linearity. The dependent and independent variables share a linear relationship.
2. Normality. The residuals are normally distributed.
3. Independence. The residuals are independent of each other.
4. Constant Error Variance. The residuals have constant variance.
5. Multicollinearity. The independent variables are not perfectly correlated. *(Burton, 2021)*

The relationship between the dependent variable and the independent variables must be linear. We use the command "test" in StataSE after running our regression to test for this. This gives probability > F-value of 0,0297. This F-value is considered statistically significant, and we can reject the null hypothesis that the linear model does not fit the data.

Since we are dealing with binary variables (dummy variables), there is no need to test for non-normality because the binary variables cannot be normal.

We run the Hausman test to determine whether we have a heteroscedasticity problem. After conducting the Hausman test, we saw that heteroscedastic was present in the data set. We therefore used the command "vce(robust)" to correct for heteroscedasticity. The vce(robust) command creates robust standard errors, producing more reliable estimates of the model parameters and fixing the problem of heteroscedasticity.

"Multicollinearity exists in an OLS regression model when two or more independent variables share a near-perfect linear relationship" *(Burton, 2021)*.
We run a Durbin-Watson test to check whether autocorrelation exists, i.e., "if error terms in the regression model are uncorrelated" (*Burton, 2021*). The results obtained from the test display low positive autocorrelation, with the average result being 1,7. A result of two indicates no autocorrelation. Values closer to zero or four indicate the presence of positive or negative autocorrelation, respectively. Hence, there is no autocorrelation in our variables.

Lastly, we use the command "VIF" to test for multicollinearity. As displayed in table 22, there is no multicollinearity among our variables. This is to be expected due to the nature of our variables.

6. Results

In this section we will present the result and discuss them according to our five hypotheses. The first hypothesis is whether race performance has a significant impact on the share price for the companies involved. The other four hypotheses will build upon the first hypothesis and give us more insight into how race performance affects abnormal returns using different variables.

6.1 Regression Analysis

Hypothesis one: *Race performance has a significant impact on the share price for the manufacturer team and its sponsors: finishing between 1st and 3th correlates with a positive abnormal return, and finishing between 4th and 20th correlates with a negative abnormal return.*

Table 4 incorporates the results for hypothesis one retrieved from this regression:

$$AR_{i.t} = \alpha + \beta_1 Win_{i.t} + \beta_2 Lowwin_{i.t} + \beta_3 Middle_{i.t} + \beta_4 Highlose_{i.t} + \beta_5 Lose_{i.t} + \beta_6 Dnf_{i.t} + \varepsilon_{i.t}$$

Table 4: Combined abnormal return

This table presents the combined abnormal return of all eight companies investigated in this event study from 2017 - 2019. The abnormal return is analyzed by using Ordinary Least Square regression with robust standard errors. The dependent variable "AR" is explained by the following dummy variables: Win = 1st place, Lowwin = 2-3rd place, Middle = 4-7th place, Highlose = 8-14th place, Lose ≥ 15th place, and Dnf = did not finish the race, taking the value of 1 if it did happen, or the value of 0 if it did not happen. The variable "Coef." represents the estimated effect of each independent variable on the dependent variable. The standard errors indicate the uncertainty in the coefficients, and the t-values and p-values are used to test whether the coefficients are significantly different from zero. The R-squared value is a measure of the amount of variance in the dependent variable that is explained by the independent variables. The F-test and Prob > F values are used to test the overall fit of the model. The symbols "***", "**", and "*" indicates if the coefficient is significant at the respective 10%, 5% and 1% level.

AR	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Win	-.0001	.001	-0.13	.9005	-.0021	.0019	
Wowwin	-.0003	.0009	-0.34	.7308	-.002	.0014	
Middle	.004	.0013	3.00	.0028	.0014	.0066	***
Highlose	.0035	.0017	2.05	.0399	.0002	.0069	**
Lose	.0026	.003	0.86	.3894	-.0033	.0084	
Dnf	.0002	.0017	0.10	.9217	-.0032	.0036	
Constant	-.0002	.0002	-1.17	.2425	-.0005	.0001	

Mean dependent var	-0.0001	SD dependent var	0.0125
R-squared	0.0023	Number of obs	7258
F-test	2.3339	Prob > F	0.0297

**** p<.01, ** p<.05, * p<.1*

Here we include the total sample of all eight companies, 7258 trading days, and 62 event days. The dependent variable is the abnormal return, $AR_{i.t}$, and the independent variables are the dummy variables described in section 5.5. Each dummy variable is linked with one of our event windows. Only two variables display statistically significant results. The dummy variable "Middle" is statistically significant at the 1% level, and the dummy variable "Highlose" is statistically significant at the 5% level. They both showcase a positive abnormal return. According to the regression, finishing in the middle has a significant positive abnormal return of 0,4%, and finishing between 8^{th} and 14^{th} has a positive abnormal return of 0,35%. We can see from the table that the standard error is 0,13% and 0,17%, respectively, which in this case is extensive. A large standard error suggests that there is a significant amount of variance in the estimate of these coefficients. This variance is true for all variables in the regressions.

Something we did not expect, based on previous research by Palomino et al. (2005), Renneborg et al. (2000) and Scherr et al. (1993), is that the variables "Win" and "Lowwin" variable has a negative abnormal return, and every race position below variable "Lowwin" has a positive abnormal return. We expected the opposite to be true. In the previous research mentioned above, they all conclude that a win correlates with a positive abnormal return and a loss with a negative abnormal return. In our case, this is not true. As displayed in table four, R^2 equals only 0,0023. Low R^2 indicates that the variables included in the regression have low explanatory power over the independent variable. However, it must be noted that because share prices depend on numerous variables, we did not expect the included variables to have a high explanatory power.

Table 5: Summary of regressions conducted separately for all companies.

This table represents the estimated effect of each independent variable on the abnormal return of the eight companies participating in the event study from 2017 to 2019. The independent variables are the following: Win = 1st place, Lowwin = 2-3rd place, Middle = 4-7th place, Highlose = 8-14th place, Lose ≥ 15th place, and Dnf = did not finish the race, taking the value of 1 if it did happen, or the value of 0 if it did not happen. The symbols "***", "**", and "*" indicates if the coefficient is significant at the respective: 10%, 5% and 1% level.

	Ferrari	*UPS*	*Shell*	*Mercedes*	*Monster*	*Mapfre*	*Renault*	*William*
Win	0	.001	**.003***	0	-.002	-	-	-
	(.003)	(.003)	(.002)	(.002)	(.002)			
Lowwin	-.002	.001	.001	-.001	-.001	-	-	**-.002*****
	(.002)	(.002)	(.002)	(.002)	(.002)			(0)
Middle	.001	**.013*****	**.008****	-.003	**.01****	.001	.003	.003
	(.007)	(.003)	(.003)	(.004)	(.005)	(.002)	(.003)	(.004)
Highlose	-	-	-	**.002*****	**.008*****	.002	.006	.003
				(0)	(.001)	(.002)	(.004)	(.002)
Lose	-	-	-	-	-	0	**.004*****	.003
						(0)	(0)	(.003)
Dnf	.005	**-.006*****	-.003***	**.014*****	**-.002*****	-.002	.003	-.001
	(.009)	(.002)	(0)	(0)	(.001)	(.003)	(.003)	(.002)
R-Squared	.002	.015	.006	.004	.003	.002	.008	.003

**** p<.01, ** p<.05, * p<.1*

Looking at regressions separately displays ambiguous results. We conduct regression on each company with the abnormal return as the dependent variable and the dummy variables as independent variables. Table 5 shows a significant positive abnormal return for some of the dummy's representing finishing below the middle. That is the case for Mercedes, Monster, and Renault. These results might be due to different expected performances. A finish between 7th and 13th place might be considered a good performance for Renault but a terrible performance for Mercedes. However, William is seldom expected to finish a race better than 10th place, yet the table displays a negative abnormal return when Williams finishes 2nd or 3rd (Lowwin). The results are difficult to interpret because there is a high degree of uncertainty.

With overall few statistically significant results, combined with close to zero R^2 and unexpected returns, we must reject the hypothesis. Our result suggests that good race performance does not correlate with positive abnormal returns and vice versa.

Hypothesis two: *Winning the Constructor's Championship has a significant positive effect on the share price for the manufacturer of the winning team and its sponsors*

Mercedes won the Constructors' Championship in all three years of our study. They dominated the sport, finishing well above runner-up Ferrari every single year. We therefore examine only the two companies affiliated with Mercedes: Mercedes-Benz Group (owner) and Monster Beverage Corporation (sponsor). To test the effect of winning the Constructors' Championship, we created a new dummy variable named "Constructor". The Constructor dummy takes the value of 1 on the first trading day after a Champion is confirmed and zero on all other days. Mercedes won the Construction Championship on 12/11/2017, 21/10/2018, and 13/10/2019, all Sundays. Hence, our event day of interest is the following Monday. This gives us the following regression:

$$AR_{i.t} = \alpha + \beta_1 Win_{i.t} + \beta_2 Lowwin_{i.t} + \beta_3 Middle_{i.t} + \beta_4 Highlose_{i.t} + \beta_5 Lose_{i.t} + \beta_6 Dnf_{i.t} + \beta_7 Constructor + \varepsilon_{i.t}$$

Table 6: Linear Regression Mercedes-Benz Group including "Constructor" dummy.
This table presents the abnormal return of the Mercedes-Benz Group when winning the Constructor championship in the period from 2017 to 2019. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. The dependent variable "ARmercedes" is explained by the dummy variables. The dummy variables take a value of 1 if the event did happen, or 0 if it did not happen. The variable of interest is the dummy variable "Constructor", which illustrates the generated abnormal return when the winner of the championship is announced. The variable "Coef." represents the estimated effect of each independent variable on the dependent variable. The standard errors indicate the uncertainty in the coefficients, and the t-values and p-values are used to test whether the coefficients are significantly different from zero. The R-squared value is a measure of the amount of variance in the dependent variable that is explained by the independent variables. The F-test and Prob > F values are used to test the overall fit of the model. The symbols "***", "**", and "*" indicates if the coefficient is significant at the respective: 10%, 5% and 1% level

ARmercedes	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Win	0	.002	-0.21	.836	-.003	.003	
Lowwin	-.001	.002	-0.62	.536	-.005	.003	
Middle	-.003	.004	-0.70	.486	-.011	.005	
Highlose	.002	0	8.21	0	.002	.003	***
Dnf	.014	0	47.62	0	.013	.014	***

Constructor	-.001	.003	-0.35	.729	-.007	.005
Constant	0	0	-0.82	.414	-.001	0

Mean dependent var	-0.000	SD dependent var	0.009
R-squared	0.004	Number of obs	908
F-test	.	Prob > F	.

**** p<.01, ** p<.05, * p<.1*

Table 6 displays the regression results for the Mercedes-Benz Group. Including the dummy variable "Constructor" has not made any significant difference. The variables "Highlose" and "Lose" are still significant at the 1% level, with a positive abnormal return of 0,2% and 0,4%, respectively. Interestingly, the coefficient for the "constructor" variable has a negative abnormal return of 0,1%. This suggests that winning the Constructors' Championship may have a negative impact on a company's abnormal returns. The "Constructor" variable is, however, not statistically significant and has a relatively large standard error of 0,3%. The regression has the same R^2 even when including the new dummy variable. The results for Mercedes-Benz Group are not in favor of keeping the hypothesis, but we will have a look at Monster Beverage Corporation before concluding.

Table 7: Linear regression Monster Beverage Company including "Constructor" dummy.
This table presents the abnormal return of Monster Beverage Corporation when Mercedes is winning the Constructor championship from periods 2017 to 2019. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. The dependent variable "ARmonster" is explained by the dummy variables. The dummy variables take a value of 1 if the event did happen, or 0 if it did not happen. The variable of interest is the dummy variable "Constructor", which illustrates the generated abnormal return when the winner of the championship is announced. The variable "Coef." represent the estimated effect of each independent variable on the dependent variable. The standard errors indicate the uncertainty in the coefficients, and the t-values and p-values are used to test whether the coefficients are significantly different from zero. The R-squared value is a measure of the amount of variance in the dependent variable that is explained by the independent variables. The F-test and Prob > F values are used to test the overall fit of the model. The symbols "***", "**", and "*" indicates if the coefficient is significant at the respective: 10%, 5% and 1% level.

ARmonster	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Win	-.002	.002	-0.83	.406	-.006	.003	
Lowwin	-.001	.002	-0.76	.445	-.005	.002	
Middle	.01	.005	2.16	.031	.001	.019	**
Highlose	.008	.001	14.28	0	.007	.009	***
Dnf	-.002	.001	-4.65	0	-.004	-.001	***
Constructor	.003	.003	1.27	.204	-.002	.008	
Constant	0	.001	-0.51	.609	-.001	.001	

Mean dependent var	-0.000	SD dependent var	0.015
R-squared	0.003	Number of obs	901
F-test	.	Prob > F	.

****p<.01, **p<.05, *p<.1*

Similarly, as the regression for Mercedes-Benz Group, the "Constructor" dummy is not statistically significant. The coefficient displays a positive abnormal return of 0,3% and a standard error of 0,3%. The explanation power is unchanged compared to the previous regression, displayed in table 24. The remaining variables are also unchanged compared the table 24.

Given the results from the regression above, there is no significant evidence that winning the Constructors' Championships has positive abnormal returns for the share price of the affiliated companies. Hence, we must reject our hypothesis.

It is, however, essential to note that Mercedes was expected to win the Contractors' Championship all three years. When conducting an event study, we must look at the date the information of interest went public, which is difficult in our case. Already after a handful of races, Mercedes usually had a significant lead. For investors, their perceived outcome of the Constructors' Championship could have been decided way before it was mathematically decided. Hence, due to the nature of the sport, it is difficult to pinpoint the exact moment investors expect Mercedes to be the Champion. We must therefore approach the result with some caution. This is also the case for Mercedes in the Drivers' Championship.

Hypothesis three: *Winning the Drivers' Championship has a significant positive effect on the share price for the manufacturer of the winning team and its sponsors.*

Similarly, as with the Constructor Championship, only Mercedes won the Drivers' Championship during the three seasons. Hence, we only analyze Mercedes-Benz Group and Monster Beverage Company. We have incorporated a new dummy variable named "drivers", representing the date the Drivers' Championship is concluded each season. Mercedes won the Drivers' Championship on the following dates: 30/10/2017, 29/10/2018, and 04/11/2019. The event window is the same as before: the Monday after the race on Sunday. We create the following regression:

$$AR_{i.t} = \alpha + \beta_1 Win_{i.t} + \beta_2 Lowwin_{i.t} + \beta_3 Middle_{i.t} + \beta_4 Highlose_{i.t} + \beta_5 Lose_{i.t} + \beta_6 Dnf_{i.t} + \beta_7 Driver + \varepsilon_{i.t}$$

Table 8: Linear regression Mercedes-Benz Group including "Driver" dummy

This table presents the abnormal return of the winning team in the Driver championship from the period 2017 – 2019. The abnormal return is calculated using Ordinary Least Square regression with robust standard errors. The dependent variable "ARmercedes" is explained by the dummy variables. The dummy variables take a value of 1 if the event did happen, or 0 if it did not happen. The variable of interest is the dummy variable "Constructor", which illustrates the generated abnormal return when the winner of the championship is announced. The variable "Coef." represent the estimated effect of each independent variable on the dependent variable. The standard errors indicate the uncertainty in the coefficients, and the t-values and p-values are used to test whether the coefficients are significantly different from zero. The R-squared value is a measure of the amount of variance in the dependent variable that is explained by the independent variables. The F-test and Prob > F values are used to test the overall fit of the model. The symbols "***", "**", and "*" indicates if the coefficient is significant at the respective 10%, 5% and 1% level.

ARmercedes	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Win	0	.002	-0.29	.773	-.004	.003	
Lowwin	-.002	.002	-0.81	.419	-.006	.002	
Middle	-.004	.003	-1.16	.245	-.01	.003	
Highlose	.002	0	8.21	0	.002	.003	***
Dnf	.014	0	47.62	0	.013	.014	***
Driver	.004	.004	0.96	.337	-.004	.012	
Constant	0	0	-0.82	.414	-.001	0	

Mean dependent var	-0.000	SD dependent var	0.009
R-squared	0.005	Number of obs	908
F-test	.	Prob > F	.

**** p<.01, ** p<.05, * p<.1*

Table 8 illustrates the regression result obtained for the Mercedes-Benz Group. Incorporating the dummy variable "drivers" into our regression has resulted in minor changes compared to the original regression presented in hypothesis one. The explanatory power increases from 0,004 to 0,005, which is not a significant amount. An interesting observation is that the coefficient of the variables "Lowwin" and "Middle" have decreased after implementing the new dummy variable. However, these independent variables remain insignificant according to their p-value. The variables "Highlose and "Dnf" remain significant at a 1% level and have the same abnormal return of 0,2% and 0,4%, respectively.

"Driver" has a positive abnormal return of 0,4% for Mercedes-Benz Group. This is in line with our hypothesis that winning the Drivers' Championship results in a positive abnormal return. However, the dummy variable "Driver" is insignificant according to its p-value and contains a high standard error. Hence, there is high uncertainty regarding the result.

Table 9: Linear Regression Monster Beverage Company including drivers dummy.
This table presents the abnormal return of Monster Beverage Corporation when Mercedes is winning the Drivers' Championship from the period 2017 to 2019. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. The dependent variable "ARmercedes" is explained by the dummy variables. The dummy variables take a value of 1 if the event did happen, or 0 if it did not happen. The variable of interest is the dummy variable "Constructor", which illustrates the generated abnormal return when the winner of the championship is announced. The variable "Coef." represent the estimated effect of each independent variable on the dependent variable. The standard errors indicate the uncertainty in the coefficients, and the t-values and p-values are used to test whether the coefficients are significantly different from zero. The R-squared value is a measure of the amount of variance in the dependent variable that is explained by the independent variables. The F-test and Prob > F values are used to test the overall fit of the model. The symbols "***", "**", and "*" indicates if the coefficient is significant at the respective 10%, 5% and 1% level

ARmonster	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Win	-.002	.002	-0.89	.376	-.006	.002	
Lowwin	-.002	.002	-0.99	.322	-.005	.002	
Middle	.008	.004	2.01	.045	0	.015	**
Highlose	.008	.001	14.28	0	.007	.009	***
Dnf	-.002	.001	-4.65	0	-.004	-.001	***
Driver	.009	.007	1.29	.197	-.004	.022	
Constant	0	.001	-0.51	.609	-.001	.001	

Mean dependent var	-0.000	SD dependent var	0.015
R-squared	0.004	Number of obs	901
F-test	.	Prob > F	.

*** *p*<.01, ** *p*<.05, * *p*<.1

Table 9 illustrates the regression result obtained for the sponsoring company Monster. Including the dummy variable "Drivers" in the regression results in changes in the coefficient linked to the independent variables. The coefficient "Lowwin" is increased by 0,1% but remains insignificant. The independent variables "Middle", "Highlose," and "Dnf" remains significant at the same levels after the implementation of the new dummy variable. However, the coefficient of "Middle" has increased from 0,8% to a positive abnormal return of 1%. Implementing the dummy variable “Driver” has also slightly increased the model's explanatory power from 0,003 to 0,005.

Winning the Drivers’ Championship results in a positive abnormal return of 0,9% for Monster. The dummy variable “Driver” is, however, not significant. Similar to the results we see in table 8, the uncertainty is too high.

Similarly, as with the Constructors’ Championship, Mercedes is expected to win the Drivers’ Championship every year in the sample included in our study. Hence, it is difficult to pinpoint the exact moment investors expect Mercedes to be Champions. It is therefore important to be cautious when interpreting the result.

We find no evidence supporting our hypothesis that winning the Driver’s Championship affects abnormal returns significantly for the affiliated companies. Therefore, we reject our hypothesis.

Hypothesis four: *There is a higher impact on share price for manufacturer and sponsors when driving in its “home track”.*

We created a new dummy variable “Country”, which represent the date a team race at its home track. For example, when analyzing Mercedes, the dummy variable "country" is substituted with "Germany". The total number of observations for each regression ranges from 901 to 916. The abnormal return is the dependent variable, and the independent variable is the dummies. The dummy variable of interest is "country" to determine if racing at their home track results in any abnormal return.

The regressions are run separately for each respective Formula One team, and we use the following regression:

$$AR_{i.t} = \alpha + \beta_1 Win_{i.t} + \beta_2 Lowwin_{i.t} + \beta_3 Middle_{i.t} + \beta_4 Highlose_{i.t} + \beta_5 Lose_{i.t} + \beta_6 Dnf_{i.t} + \beta_7 Country + \varepsilon_{i.t}$$

Table 10: Summary of all regressions conducted separately, including "Country" dummy

This table represent the estimated effect of each independent variable on the abnormal return of the 8 companies participating in the event study from 2017 to 2019. The variable of interest is the dummy "Country", which illustrates the generated abnormal return when the Formula One team races in their home country. The R-squared value is a measure of the amount of variance in the dependent variable that is explained by the independent variables. The symbols "***", "**", and "*" indicates if the coefficient is significant at the respective 10%, 5% and 1% level.

	Ferrari	Mercedes	Renault	Mapfre	Williams	UPS	Monster	Shell
Win	0	-.001	-	-	-	0	-.002	.003
	(.003)	(.002)				(.002)	(.002)	(.002)
Lowwin	-.002	-.001	-	-	**.002*** **	0	-.001	0
	(.002)	(.002)			(0)	(.002)	(.002)	(.002)
Middle	.001	-.003	.003	.001	.003	**.013*** **	**.01** **	**.008*** **
	(.007)	(.004)	(.003)	(.002)	(.004)	(.003)	(.005)	(.003)
Highlose	-	**-.008*** **	**.007*** **	.002	.004*	-	**.018*** **	-
		(.002)	(.005)	(.002)	(.002)		(.002)	
Lose	-	-	.004	0	.003	-	-	-
			(0)	(0)	(.003)			
Dnf	.005	**.014*** **	**.003*** **	-.002	-.001	**-.006*** **	-.002***	**-.003*** **
	(.009)	(0)	(.003)	(.003)	(.002)	(.002)	(.001)	(0)
France	-	-	**-.014** **	-	-	-	-	-
			(-.001)					
UK	-	-	-	**.004* **	-.007	-	-	-
				(.002)	(.013)			
Germany	-	**.01*** **	-	-	-	-	**-.011*** **	-
		(.002)					(.002)	
Italy	**-.007*** **	-	-	-	-	**.012*** **	-	**.01*** **
	(.005)					(.003)		(.003)
R SQUARED	.002	.006	.010	.002	.004	.018	.003	.009

**** p<.01, ** p<.05, * p<.1*

Ferrari has three races at their home track throughout the three seasons. According to our regression table, the dummy variable "Italy" is significant at 1% level for both Ferrari and its sponsors: UPS and Shell. The results suggest there is an effect caused by racing in one's home country. However, the effect contains high variation due to a large standard error.

One might think increased publicity and fan engagement could result in positive abnormal returns. One logical explanation for this could be Ferrari's performance on the grid. The investors expect Ferrari to finish first due to their heritage and prior achievement in Italy. Anything worse might be perceived as "bad" performance and violates investors' expectations, resulting in harmful exposure to the team. Ferrari finished 3rd and 2nd the two first years and 1st the last year, indicating that the race performance wasn't bad compared to expectations. UPS and Shell got positive abnormal returns when Ferrari raced well in Italy. Due to ambiguous results, it's difficult to conclude what causes this effect.

The results we see for Mercedes and Monster are significant. Mercedes finished 1st in 2018 and 9th in 2019 when racing in Germany, and gets a positive abnormal return of 1%, yet Monster has a negative abnormal return of 1,1%. The difference in positive and negative outcomes could be due to unreliable results, or that there indeed is a difference between manufacturing company and sponsoring company. We get similar results when looking at Renault, Williams and Mapfre. Renault did an overall good performance when racing in France, finishing 8th in 2018 and 2019. Renault has a negative abnormal return of 1,4%. Williams and sponsoring company Mapfre have an abnormal return of -0,7% and 0,4%, respectively. Williams did not finish above 10th when racing in UK.

The overall results are irregular and uncertain. There is some evidence that bad performance affects share prices negatively and vice versa. Nevertheless, due to ambiguous result, relatively large standard errors, and poor explanatory power, we cannot support this causal effect. There is not enough evidence, and we therefore reject the hypothesis.

Hypothesis five: *Race performance has a higher significant effect on share price for the manufacturer's companies share price compared to the sponsoring companies share price.*

We have separated the companies into two groups: Manufacturers and sponsors. We can then use regression analysis to test whether investors react differently to the two groups, based on race performance. The manufacturing companies are Williams, Ferrari, Mercedes-Benz Group, and Renault, and the sponsoring companies are UPS, Monster, Shell, and Mapfre. We run two regressions, one for each group. Let us start by looking at the regression results for manufacturing companies.

Table 11: Linear Regression Manufacturing Companies.
This table presents the combined abnormal return of the four manufacturing companies (Mercedes, Ferrari, Renault, and Williams) investigated in this event study from 2017 - 2019. The abnormal return is analyzed by using Ordinary Least Square regression with robust standard errors. The variable "Coef." represent the estimated effect of each independent variable on the dependent variable. The standard errors indicate the uncertainty in the coefficients, and the t-values and p-values are used to test whether the coefficients are significantly different from zero. The R-squared value is a measure of the amount of variance in the dependent variable that is explained by the independent variables. The F-test and Prob > F values are used to test the overall fit of the model. The symbols "***", "**", and "*" indicates if the coefficient is significant at the respective 10%, 5% and 1% level.

AR	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Win	0	.001	-0.05	.963	-.003	.003	
Lowwin	-.001	.002	-0.77	.439	-.004	.002	
Middle	.002	.002	0.71	.475	-.003	.006	
Highlose	.004	.002	1.68	.093	-.001	.009	*
Lose	.003	.003	0.83	.405	-.004	.009	
Dnf	.003	.003	1.21	.228	-.002	.008	
Constant	0	0	-0.57	.568	-.001	0	

Mean dependent var	-0.000	SD dependent var	0.013
R-squared	0.002	Number of obs	3639
F-test	1.013	Prob > F	0.415

**** p<.01, ** p<.05, * p<.1*

Only one of the variables in table 11 is significant. Highlose is significant at the 10% level. However, the standard error is too high (0,002), compared to the coefficient (0,004). Overall, the result suggests a weak relationship between the abnormal return and the variables.

Table 12: Linear Regression Sponsoring Companies.
This table presents the combined abnormal return of the four sponsoring companies (Shell, UPS, Mapfre, and Monster) investigated in this event study from 2017 - 2019. The abnormal return is analyzed by using Ordinary Least Square regression with robust standard errors. The variable "Coef." represent the estimated effect of each independent variable on the dependent variable. The standard errors indicate the uncertainty in the coefficients, and the t-values and p-values are used to test whether the coefficients are significantly different from zero. The R-squared value is a measure of the amount of variance in the dependent variable that is explained by the independent variables. The F-test and Prob > F values are used to test the overall fit of the model. The symbols "***", "**", and "*" indicates if the coefficient is significant at the respective 10%, 5% and 1% level.

AR	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Win	0	.001	-0.11	.91	-.003	.003	
Lowwin	0	.001	0.25	.801	-.002	.002	
Middle	.006	.001	4.40	0	.003	.009	***
Highlose	.002	.002	1.39	.165	-.001	.006	
Lose	.001	0	3.43	.001	0	.001	***
Dnf	-.003	.002	-1.33	.183	-.007	.001	
Constant	0	0	-1.09	.276	-.001	0	

Mean dependent var	-0.000	SD dependent var	0.012
R-squared	0.004	Number of obs	3619
F-test	.	Prob > F	.

*** *p*<.01, ** *p*<.05, * *p*<.1

In table 12, both "Middle" and "Lose" are statistically significant at the 10% level. Yet, similarly to table 11, the regression is too unreliable. The explanatory power is low. The result does not support Cornwell et al. (2001) finding. They find evidence stating that companies with direct ties to the automotive industry benefit statistically and economically based on sponsorship.

We find no statistical evidence when testing our hypothesis. Race performance has not a higher significant effect on abnormal return for the manufacturer's companies share price compared to the sponsoring companies share price.

7. Discussion

The results have shown little evidence supporting our five hypotheses. There seems to be little to no share price reaction on a Monday following a race. Based on share price reaction, exposure generated through race performance does not increase or decrease investors perception of a firm's brand after a race. What could be the explanation for that?

Previous event studies conducted on the relationship between football performance and listed football clubs' share price reaction find significant effect. As mentioned in section 4.0, Palomino et al. (2005) find correlation between victory and positive abnormal return, and vice versa for listed football clubs. Why is it not similar for Formula One? Listed football club's main financial purpose is directly linked to their sport performance. Hence, sport performance is an important indicator of future income. Whether or not a club qualifies for big European tournaments has a huge economic impact. In Formula One, team owners are usually big corporations. For instance, Mercedes' Formula One budget in 2020 was somewhere between $400-$500 million (*Kumar, 2022*). Comparing this to Mercedes-Benz Groups revenue of $180 billion, indicates that their involvement in Formula One is a relatively minor part of their overall business operation (Companiesmarketcap.com, 2022). Which could explain that the racetrack results on Sunday have no immediate effect on share price.

Edmans (2011) argues that the stock market does not fully value intangible assets. It is possible that investors undervalue key components linked to race performance. Race performance is an indication of the teams intellectual and technical expertise. According to the CEO of Audi regarding their entry into Formula One in 2026 "The combination of high performance and competition is always a driver of innovation and technology transfer in our industry" (Audi to Join Formula 1 from 2026, 2022). These attributes can be crucial for manufacturing companies, since a lot of the innovation and technology used in Formula One cars will eventually find their way to commercial cars. Similarly with brand reputation and partnerships. Companies can use their brand reputation to command higher prices and build stronger partnerships with sponsors. These intangible assets can have a positive impact on free cash flow. The company can use the innovation and technology developed in Formula One to improve its production cars. Providing them with a competitive edge, which in turn can justify higher margins and result in more sales. According to

Audi’s CEO, Formula One is a global stage for them to showcase their brand and develop their technology. “A close link between our Formula 1 project and AUDI AG’s Technical Development department will enable synergies.” (Audi to Join Formula 1 from 2026, 2022). However, it might seem like investors don’t value these intangible assets related to race performance.

Cobbs et al. (2012) research how global financial markets evaluate commercial sponsorships in Formula One. They report that “the market value of the firms entering into F1 sponsorship decline upon announcement”. Cobbs et al. (2012) states that Formula One affiliation may be a drain on the sponsoring firms’ resources. The cost of sponsoring Formula One may not outweigh the benefit. The motivation for sponsorship might not be to maximize shareholder value. Perhaps it’s the prestige of competing that is most important to these companies. In their study Clark et al. (2002) describe a principal-agent problem, in which managers invest in sponsorship due to the offer of them receiving gods such as front-row sports tickets and contact with the rich and famous. This agent problem can influence sponsorship decisions because the promotion of personal agendas motivates top executives.

Overall, we found little evidence to support the hypothesis that Sunday race results immediately influence investors' perception of a firm's brand value and expected future income. Our event study suggests that race performance does not significantly impact the perceived value of the firm. Therefore, we conclude that race performance does not have a notable effect on share prices.

The result of this study might be less precise because we don’t incorporate the market expectation. This is because market expectation can influence the share price reaction of a Formula One team, even if the team's actual race performance is the same. For example, if the market expects a team to do very well in a race, but the team ends up performing poorly, the share price reaction might be more negative than if the market had not had such high expectations.

Using betting odds as a measure of market expectation is one way to account for this factor. By using the betting odds prior to each race, the study could have incorporated the market's expectations of the team's performance and see how these expectations affect the share price reaction. This could have helped to provide a more accurate picture of the relationship between race performance and brand value.

We contacted numerous betting companies, but they were unable to provide us with historical betting information. Future research could try to get this information and use it in the analysis.

8. Conclusion

We use an event study to investigate the immediate share price reaction caused by Formula One race performance. We formulate five hypothesis and examine them using regression analysis.

We find that race performance does not have a significant positive effect when finishing between 1st and 3rd. There is also no immediate negative effect on the share price when finishing between 4th and 20th. The regression results are unreliable due to high standard errors and has a low explanatory power over the independent variable "abnormal return".

Winning the Constructors' Championship and the Drivers' Championship does not positively affect the share price for the company affiliated with the winning team. The results are not significant, and the hypothesis is rejected.

We test whether share price reaction is higher for the affiliated companies when their team races in its home country. The results do show that there is a significant abnormal return. However, due to high standard errors and low explanatory power, we cannot conclude that there is an effect.

We divide the eight companies into two groups, car manufacturers and sponsors, and look for differences in share price reaction. We can't find any statistical evidence for such a difference.

Our main conclusion is that race performance on a Sunday has little to no price reaction on the following Monday. The investors' immediate perception of the firm's brand value and expected future income does not seem to change based on the teams result on race day.

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10. Appendices

Table 13: Summary of all the race result for each team.

This table presents how each team and their sponsors performed in a total of 68 across three seasons from 2017 to 2019. Each season is represented separately, with the total performance across all three seasons presented at the end of the table. A Win = 1st place, Low win = 2-3rd place, Middle = 4-7th place, High lose = 8-14th place, Lose ≥ 15th place, and DNF = did not finish the race, taking the value of 1 if it did happen, or the value of 0 if it did not happen.

	Mercedes (Monster)	**Ferrari (Shell, UPS)**	**Renault (Mapfre)**	**Williams**
2017 season				
Win	12	5	0	0
Low Win	7	10	1	1
Middle	1	4	5	5
High lose	0	0	14	14
Lose	0	0	0	0
Did not finish	0	1	0	0
2018 season				
Win	11	6	0	0
Low Win	8	12	0	0
Middle	1	3	0	0
High lose	0	0	13	13
Lose	0	0	7	7
Did not finish	1	0	1	1
2019 season				
Win	15	3	0	0
Low Win	3	14	0	0
Middle	2	3	0	0
High lose	1	0	4	4
Lose	0	0	16	16
Did not finish	0	1	1	1
Total				
Win	38	14	0	0
Low Win	18	36	1	1
Middle	4	10	5	5
High lose	1	0	31	31
Lose	0	0	23	23
Did not finish	1	2	2	2

Table 14: Linear regression Shell including country dummy
This table presents the abnormal return of Shell, the sponsoring team of Ferrari, in the three consecutive seasons from 2017 to 2019, including the dummy variable "Country", illustrating the generated abnormal return when Ferrari races at their home track in Italy. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. "Coef." represent the estimated effect of each independent variable on the dependent variable. The standard errors indicate the uncertainty in the coefficients, and the t-values and p-values are used to test whether the coefficients are significantly different from zero. The R-squared value is a measure of the amount of variance in the dependent variable that is explained by the independent variables. The F-test and Prob > F values are used to test the overall fit of the model. The symbols "***", "**", and "*" indicates if the coefficient is significant at the respective 10%, 5% and 1% level.

arshell	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
win	.003	.002	1.53	.125	-.001	.006	
lowwin	0	.002	-0.03	.975	-.003	.003	
middle	.008	.003	2.44	.015	.002	.014	**
o	0	.	.	.	.	.	
o	0	.	.	.	.	.	
dnf	-.003	0	-7.96	0	-.004	-.003	***
italy	.01	.003	3.02	.003	.004	.017	***
Constant	0	0	-0.82	.414	-.001	0	

Mean dependent var	-0.000	SD dependent var	0.012
R-squared	0.009	Number of obs	901
F-test	22.997	Prob > F	0.000

**** p<.01, ** p<.05, * p<.1*

Table 15: Linear regression Renault including country dummy
This table presents the abnormal return of Renault in three consecutive seasons from f2017 to 2019, including the dummy variable "Country", illustrating the generated abnormal return when Renault races at their home track in France. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. "Coef." represent the estimated effect of each independent variable on the dependent variable. The standard errors indicate the uncertainty in the coefficients, and the t-values and p-values are used to test whether the coefficients are significantly different from zero. The R-squared value is a measure of the amount of variance in the dependent variable that is explained by the independent variables. The F-test and Prob > F values are used to test the overall fit of the model. The symbols "***", "**", and "*" indicates if the coefficient is significant at the respective 10%, 5% and 1% level.

arrenault	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
O	0	.	.	.	.	.	
O	0	.	.	.	.	.	
Middle	.003	.003	1.05	.293	-.002	.008	
highlose	.007	.005	1.57	.117	-.002	.017	
lose	.004	0	7.83	0	.003	.004	***
dnf	.003	.003	0.99	.321	-.003	.009	
france	-.014	.005	-2.93	.003	-.023	-.005	***
Constant	-.001	0	-2.37	.018	-.002	0	**

Mean dependent var	-0.001	SD dependent var	0.014
R-squared	0.010	Number of obs	915
F-test	.	Prob > F	.

**** p<.01, ** p<.05, * p<.1*

Table 16: Linear Regression Williams including country dummy
This table presents the abnormal return of Williams in three consecutive seasons from 2017 to 2019, including the dummy variable "Country", illustrating the generated abnormal return when William races at their home track in England. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. "Coef." represent the estimated effect of each independent variable on the dependent variable. The standard errors indicate the uncertainty in the coefficients, and the t-values and p-values are used to test whether the coefficients are significantly different from zero. The R-squared value is a measure of the amount of variance in the dependent variable that is explained by the independent variables. The F-test and Prob > F values are used to test the overall fit of the model. The symbols "***", "**", and "*" indicates if the coefficient is significant at the respective 10%, 5% and 1% level.

arwilliams	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lowwin	-.002	0	-4.87	0	-.003	-.001	***
middle	.003	.004	0.67	.503	-.005	.011	
highlose	.004	.002	1.91	.056	0	.008	*
lose	.003	.003	0.91	.361	-.003	.009	
dnf	-.001	.002	-0.48	.631	-.004	.003	
uk	-.007	.013	-0.55	.582	-.034	.019	
Constant	-.001	0	-1.08	.278	-.002	0	
Mean dependent var		-0.000	SD dependent var			0.014	
R-squared		0.004	Number of obs			908	
F-test		.	Prob > F			.	

**** p<.01, ** p<.05, * p<.1*

Table 17: Linear regression UPS including country dummy
This table presents the abnormal return of UPS, the sponsoring team of Ferrari in three consecutive seasons from 2017 to 2019, including the dummy variable "Country", illustrating the generated abnormal return when Ferrari races at their home track in Italy. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. "Coef." represent the estimated effect of each independent variable on the dependent variable. The standard errors indicate the uncertainty in the coefficients, and the t-values and p-values are used to test whether the coefficients are significantly different from zero. The R-squared value is a measure of the amount of variance in the dependent variable that is explained by the independent variables. The F-test and Prob > F values are used to test the overall fit of the model. The symbols "***", "**", and "*" indicates if the coefficient is significant at the respective 10%, 5% and 1% level.

arups	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
win	0	.002	0.04	.964	-.005	.005	
lowwin	0	.002	0.28	.781	-.003	.004	
middle	.013	.003	4.52	0	.007	.018	***
dnf	-.006	.002	-2.98	.003	-.009	-.002	***
italy	.012	.003	3.86	0	.006	.018	***
Constant	-.001	0	-1.38	.168	-.001	0	
Mean dependent var		-0.000	SD dependent var			0.011	
R-squared		0.018	Number of obs			901	
F-test		10.048	Prob > F			0.000	

**** p<.01, ** p<.05, * p<.1*

Table 18: The result from the "VIF" test.

This table presents the strength of multicollinearity in our regression model and states if it appears strong correlation among the predictor variables.

```
    Variable |       VIF       1/VIF
-------------+----------------------
      Lowwin |      1.00    0.998973
         Win |      1.00    0.999082
    Highlose |      1.00    0.999237
      Middle |      1.00    0.999263
         Dnf |      1.00    0.999751
        Lose |      1.00    0.999760
-------------+----------------------
    Mean VIF |      1.00
```

Table 19: Linear regression Williams

This table presents the abnormal return generated for William Grand Prix holding according to their performance in Formula One based on three consecutive seasons from 2017 to 2019. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. The dependent variable "ARwilliams" is explained by the dummy variables. The dummy variables are taking a value of 1 if the event did happen, or 0 if it did not happen.

Arwilliams	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Lowwin	-.002	0	-4.87	0	-.003	-.001	***
middle	.003	.004	0.67	.502	-.005	.011	
highlose	.003	.002	1.38	.166	-.001	.008	
lose	.003	.003	0.91	.361	-.003	.009	
dnf	-.001	.002	-0.48	.631	-.004	.003	
Constant	-.001	0	-1.09	.278	-.002	0	
Mean dependent var		-0.000	SD dependent var			0.014	
R-squared		0.003	Number of obs			908	
F-test		.	Prob > F			.	

**** p<.01, ** p<.05, * p<.1*

Table 20: Linear regression UPS.

This table presents the abnormal return generated for UPS, the sponsor of Ferrari, according to their performance in Formula One based on three consecutive seasons from 2017 to 2019. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. The dependent variable "ARups" is explained by the dummy variables. The dummy variables are taking a value of 1 if the event did happen, or 0 if it did not happen. The dummy variables "Highlose" and "Lose" are omitted. They are therefore removed from the regression table due to Ferrari didn't place below seven place in the three consecutive seasons.

ARups	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
win	.001	.003	0.34	.731	-.004	.006	
lowwin	.001	.002	0.66	.51	-.002	.005	
middle	.013	.003	4.52	0	.007	.018	***
dnf	-.006	.002	-2.98	.003	-.009	-.002	***
Constant	-.001	0	-1.38	.168	-.001	0	
Mean dependent var		-0.000	SD dependent var			0.011	
R-squared		0.015	Number of obs			901	
F-test		7.659	Prob > F			0.000	

**** p<.01, ** p<.05, * p<.1*

Table 21: Linear regression Renault.
This table presents the abnormal return generated for Renault according to their performance in Formula One based on three consecutive seasons from 2017 to 2019. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. The dependent variable "ARrenault" is explained by the dummy variables. The dummy variables are taking a value of 1 if the event did happen, or 0 if it did not happen. The dummy variables "Win" and "Lowwin" are omitted. They are therefore removed from the regression table due to Renault didn't place above fourth place in the three consecutive seasons.

ARrenault	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Middle	.003	.003	1.05	.293	-.002	.008	
Highlose	.006	.004	1.45	.146	-.002	.015	
Lose	.004	0	7.84	0	.003	.004	***
Dnf	.003	.003	0.99	.321	-.003	.009	
Constant	-.001	0	-2.37	.018	-.002	0	**
Mean dependent var		-0.001	SD dependent var			0.014	
R-squared		0.008	Number of obs			915	
F-test		.	Prob > F			.	

**** p<.01, ** p<.05, * p<.1*

Table 22: Linear regression Shell, sponsor of Ferrari
This table presents the abnormal return generated for Shell, the sponsor of Ferrari, according to their performance in Formula One based on three consecutive seasons from 2017 to 2019. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. The dependent variable "ARshell" is explained by the dummy variables. The dummy variables are taking a value of 1 if the event did happen, or 0 if it did not happen. The dummy variables "Highlose" and "Lose" are omitted. They are therefore removed from the regression table due to Ferrari didn't place below seven in the three consecutive seasons.

ARshell	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Win	.003	.002	1.81	.07	0	.007	*
Lowwin	.001	.002	0.30	.762	-.003	.004	
Middle	.008	.003	2.44	.015	.002	.014	**
Dnf	-.003	0	-7.97	0	-.004	-.003	***
Constant	0	0	-0.82	.413	-.001	0	
Mean dependent var		-0.000	SD dependent var			0.012	
R-squared		0.006	Number of obs			901	
F-test		23.486	Prob > F			0.000	

**** p<.01, ** p<.05, * p<.1*

Table 23: Linear regression Ferrari
This table presents the abnormal return generated for Ferrari according to their performance in Formula One based on three consecutive seasons from 2017 to 2019. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. The dependent variable "ARferrari" is explained by the dummy variables. The dummy variables are taking a value of 1 if the event did happen, or 0 if it did not happen. The dummy variables "Highlose" and "Lose" are omitted. They are therefore removed from the regression table due to Ferrari didn't place below seven in the three consecutive seasons.

ARferrari	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Win	0	.003	-0.14	.89	-.007	.006	
Lowwin	-.002	.002	-1.14	.254	-.007	.002	
Middle	.001	.007	0.18	.854	-.013	.015	
Dnf	.005	.009	0.51	.608	-.013	.022	
Constant	.001	0	2.83	.005	0	.002	***
Mean dependent var		0.001	SD dependent var			0.014	
R-squared		0.002	Number of obs			907	
F-test		0.407	Prob > F			0.803	

**** p<.01, ** p<.05, * p<.1*

Table 24: Linear regression Monster, sponsor of Mercedes.
This table presents the abnormal return generated for Monster, the sponsor of Mercedes, according to their performance in Formula One based on three consecutive seasons from 2017 to 2019. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. The dependent variable "ARmonster" is explained by the dummy variables. The dummy variables are taking a value of 1 if the event did happen, or 0 if it did not happen. The dummy variables "Lose" is omitted. It is therefore removed from the regression table due to Mercedes didn't place below 15th place in the three consecutive seasons.

ARmonster	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Win	-.002	.002	-0.80	.426	-.006	.003	
Lowwin	-.001	.002	-0.62	.536	-.005	.002	
Middle	.01	.005	2.16	.031	.001	.019	**
Highlose	.008	.001	14.29	0	.007	.009	***
Dnf	-.002	.001	-4.66	0	-.004	-.001	***
Constant	0	.001	-0.51	.608	-.001	.001	
Mean dependent var		-0.000	SD dependent var			0.015	
R-squared		0.003	Number of obs			901	
F-test		.	Prob > F			.	

*** *p<.01, ** p<.05, * p<.1*

Table 25: Linear regression Mapfre, sponsor of Williams
This tablpresentsnt the abnormal return generated for Mapfre, the sponsor of Williams, according to their performance in Formula One based on three consecutive seasons from 2017 to 2019. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. The dependent variable "ARmapfre" is explained by the dummy variables. The dummy variables are taking a value of 1 if the event did happen, or 0 if it did not happen. The dummy variables "Win" and "Lowwin" are omitted. They are therefore removed from the regression table due to Renault didn't place above fourth place in the three consecutive seasons.

Armapfre	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Middle	.001	.002	1.00	.319	-.001	.004	
Highlose	.002	.002	0.97	.33	-.002	.005	
Lose	0	0	0.81	.42	0	.001	
Dnf	-.002	.003	-0.69	.491	-.009	.004	
Constant	0	0	0.66	.507	0	.001	
Mean dependent var		0.000	SD dependent var			0.010	
R-squared		0.002	Number of obs			916	
F-test		.	Prob > F			.	

*** *p<.01, ** p<.05, * p<.1*

Table 26: Linear regression Mercedes
This table presents the abnormal return generated by the Mercedes-Benz Group according to their performance in Formula One based on three consecutive seasons from 2017 to 2019. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. The dependent variable "ARmercedes" is explained by the dummy variables. The dummy variables are taking a value of 1 if the event did happen, or 0 if it did not happen. The dummy variables "Lose" is omitted. It is therefore removed from the regression table due to Mercedes didn't place below 15th place in the three consecutive seasons.

ARmercedes	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Win	0	.002	-0.23	.821	-.003	.003	
Lowwin	-.001	.002	-0.71	.475	-.005	.002	
Middle	-.003	.004	-0.70	.486	-.011	.005	
Highlose	.002	0	8.21	0	.002	.003	***
Dnf	.014	0	47.65	0	.013	.014	***
Constant	0	0	-0.82	.413	-.001	0	
Mean dependent var		-0.000	SD dependent var			0.009	
R-squared		0.004	Number of obs			908	

F-test	.	Prob > F	.

**** p<.01, ** p<.05, * p<.1*

Table 27: Linear regression Ferrari including country dummy

This tablpresentsnt the abnormal return generated for Ferrari according to their performance in Formula One, based on three consecutive seasons from 2017 to 2019. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. The dependent variable "ARferrari" is explained by the dummy variables, including the dummy "country" taking the value of 1 if they race in their home country, or 0 if they do not. The dummy variables "Highlose" and "Lose" are omitted. They are therefore removed from the regression table due to Ferrari didn't place below seven in the three consecutive seasons.

ARferrari	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Win	0	.003	0.03	.978	-.006	.006	
Lowwin	-.002	.002	-0.92	.36	-.006	.002	
Middle	.001	.007	0.18	.854	-.013	.015	
Dnf	.005	.009	0.51	.608	-.013	.022	
Italy	-.007	.005	-1.33	.185	-.018	.003	
Constant	.001	0	2.83	.005	0	.002	***

Mean dependent var	0.001	SD dependent var	0.014
R-squared	0.002	Number of obs	907
F-test	0.788	Prob > F	0.558
Akaike crit. (AIC)	-5181.648	Bayesian crit. (BIC)	-5152.787

**** p<.01, ** p<.05, * p<.1*

Table 28: Linear regression Mercedes including country dummy

This table presents the abnormal return generated for Mercedes according to their performance in Formula One, based on three consecutive seasons from 2017 to 2019. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. The dependent variable "ARmerced" is explained by the dummy variables, including the dummy "country" taking the value of 1 if they race in their home country, or 0 if they do not. The dummy variables are taking a value of 1 if the event did happen, or 0 if it did not happen. The dummy variables "Lose" is omitted. It is therefore removed from the regression table due to Mercedes didn't place below 15th place in the three consecutive seasons.

ARmercedes	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Win	-.001	.002	-0.39	.695	-.004	.003	
Lowwin	-.001	.002	-0.71	.475	-.005	.002	
Middle	-.003	.004	-0.70	.486	-.011	.005	
Highlose	-.008	.002	-4.91	0	-.011	-.005	***
Dnf	.014	0	47.62	0	.013	.014	***
Germany	.01	.002	6.51	0	.007	.013	***
Constant	0	0	-0.82	.414	-.001	0	

Mean dependent var	-0.000	SD dependent var	0.009
R-squared	0.006	Number of obs	908
F-test	.	Prob > F	.
Akaike crit. (AIC)	-6075.038	Bayesian crit. (BIC)	-6055.793

**** p<.01, ** p<.05, * p<.1*

Table 29: Linear regression Mapfre including country dummy
This table presents the abnormal return generated for Mapfre, the sponsor of Renault, according to their performance in Formula One, based on three consecutive seasons from 2017 to 2019. The abnormal return is analyzed using Ordinary Least Square regression with robust standard errors. The dependent variable "ARmapfre" is explained by the dummy variables, including the dummy "country" taking the value of 1 if they race in their home country, or 0 if they do not. The dummy variables are taking a value of 1 if the event did happen, or 0 if it did not happen. The dummy variables "Win" and "Lowwin" are omitted. They are therefore removed from the regression table due to Renault didn't place above fourth place in the three consecutive seasons.

ARmapfre	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Middle	.001	.002	0.58	.564	-.002	.004	
Highlose	.002	.002	0.97	.33	-.002	.005	
Lose	0	0	0.81	.42	0	.001	
Dnf	-.002	.003	-0.69	.492	-.009	.004	
Uk	.004	.002	1.78	.075	0	.009	*
Constant	0	0	0.66	.507	0	.001	

Mean dependent var	0.000	SD dependent var	0.010
R-squared	0.002	Number of obs	916
F-test	.	Prob > F	.
Akaike crit. (AIC)	-5868.502	Bayesian crit. (BIC)	-5844.402

**** p<.01, ** p<.05, * p<.1*

Table 30: Linear regression Monster including country dummy

This table presents the abnormal return generated for Monster, the sponsor of Mercedes, according to their performance in Formula One, based on three consecutive seasons from 2017 to 2019. The abnormal return is calculated using Ordinary Least Square regression with robust standard errors. The dependent variable "ARmonster" is explained by the dummy variables, including the dummy "country" taking the value of 1 if they race in their home country, or 0 if they do not. The dummy variables are taking a value of 1 if the event did happen, or 0 if it did not happen. The dummy variables "Lose" is omitted. It is therefore removed from the regression table due to Mercedes didn't place below 15th place in the three consecutive seasons.

ARmonster	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Win	-.002	.002	-0.66	.509	-.006	.003	
Lowwin	-.001	.002	-0.62	.536	-.005	.002	
Middle	.01	.005	2.16	.031	.001	.019	**
Highlose	.018	.002	7.94	0	.014	.023	***
Dnf	-.002	.001	-4.65	0	-.004	-.001	***
Germany	-.011	.002	-4.75	0	-.015	-.006	***
Constant	0	.001	-0.51	.609	-.001	.001	

Mean dependent var	-0.000	SD dependent var	0.015
R-squared	0.003	Number of obs	901
F-test	.	Prob > F	.
Akaike crit. (AIC)	-4985.960	Bayesian crit. (BIC)	-4966.746

**** p<.01, ** p<.05, * p<.1*

Table 31: Result of "VIF" test for Mercedes, including Country variable "Germany", Drivers and Constructor.

This table presents the strength of multicollinearity in our regression model and states if it appears any strong correlation among the predictor variables.

```
Variable |       VIF       1/VIF
-------------+----------------------
     germany |      2.05    0.487647
    highlose |      2.03    0.493451
      Driver |      1.12    0.889767
      lowwin |      1.11    0.904976
      middle |      1.09    0.914197
 Constructor |      1.09    0.917564
         win |      1.05    0.954401
         dnf |      1.00    0.999921
-------------+----------------------
    Mean VIF |      1.32
```