The impact of positive performance of athletes on the stock price of their sponsor

An application to Formula 1 racing

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Thesis MSc Marketing 2016-2017

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Date: 27-6-2017

Abstract

The evaluation of investments in sport sponsoring is often an issue. Recent literature stresses the importance of the use of financial measures in evaluation of marketing activities such as sport sponsoring. The aim of this research is to see whether the performance of an athlete positively impacts the stock price of the athlete's sponsor. The author performs an event study to estimate the abnormal returns of this performance effect after races in Formula 1. The author uses a random effects model to test if the performance effect depends on moderating variables such as the type of sponsor, the finishing position and a world title win. The results show that an athlete finishing in the top three leads to positive cumulative average abnormal returns of 0.168% on the sponsor's stock in the first two days after the race. This research finds no differences between the abnormal returns of sport and non-sport related sponsors. Furthermore, the findings show no significant effect of the finishing position of the athlete or the win of a world title on the abnormal returns. The managerial implications of this study include recommendations for investors, athletes, sport teams and marketing managers.

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1. Introduction

The projected global sponsoring spending for 2017 is 62.8 billion, of which around 70% is used for sport sponsoring (Statista, 2017). However, there are few measurements of the effectiveness of sport sponsoring. In fact, measurement of the effectiveness of marketing activities is often a problem. Most of the time, measures such as brand recall, brand awareness and brand attitude are used (Keller & Lehmann, 2006). However, using these measures for monetary evaluation is not possible. This research will address the problem of evaluating a marketing activity (sport sponsoring) with financial measures.

In a paper from 1993, Keller sets up conceptual model in which he defines (customer-based) brand equity as the differential effect of brand knowledge on the consumer response to the marketing efforts of that brand. He presents the concepts of brand attitude, brand associations and brand awareness (Keller, 1993). These concepts can be used to evaluate marketing activities. However, more recently, Lehmann stated at the Marketing Meets Wall Street Conference that financial measurements for marketing activities are becoming increasingly important. Marketing can have a big influence on the financial valuation of the firm. Furthermore, Lehmann mentions that marketing needs to link their marketing effort to financial performance to keep "a seat at the table in important business decisions" (Lehmann, 2004). Otherwise, when marketing departments keep focusing on measures they are more comfortable with (brand attitude, awareness), they will lose ground to other departments such as product development. It is hard to express brand attitude and brand awareness in monetary values and many decisions in companies are being made based on monetary evaluations.

Therefore, this research focuses on the financial effects of marketing, and to be more specific, the financial effects of sport sponsoring. The research examines the impact of a positive performance of athletes on the stock price of their main sponsors. As mentioned before, financial measures are becoming increasingly important for evaluating marketing activities, and therefore this research examines the existence of abnormal returns on stocks after a sport event. Hence, this research lies in the marketing-finance interface. The purpose of this research is to formulate an answer to the following research question:

What is the effect of performance of an athlete on the stock price of their main sponsor?

This research has an application in Formula 1 racing. It focuses on the racing seasons 2011-2016. Testing multiple seasons is important to eliminate a bias caused by a single driver dominating a season. The research tests for the moderating effect that the type of sponsor has. The research also incorporates the effect for drivers finishing second and third, since literature found evidence for differences in sentiment between finishing first, second and third (Medvec, Madey, & Gilovich , 1995). In addition, this research examines if there is an extra effect for a race in which the driver wins the world title. An industry background is provided to give the reader insight in the ranking system of Formula 1 Grand Prix races and specific jargon. Interesting findings includes significant positive cumulative average abnormal returns the in the first two days after a race. The results section also presents an in-depth comparison of the abnormal returns between sport and non-sport related sponsors and between different finishing positions.

1.1 Academic relevance

This research contributes to existing literature in three ways. First, it contributes to stream in the literature investigating the financial effectiveness of (athlete) endorsement as a marketing communication tool. Companies sometimes use celebrities as endorsers for their brand. Sponsoring athletes (such as Formula 1 drivers), is also celebrity endorsement. Previous research shows a positive impact of celebrity endorsement announcements on the stock prices of the endorsed firms (Agrawal & Kamakura, 1995). This thesis adds to this stream of research, because it focuses on the period after the celebrity endorsement announcement, and investigates whether the behaviour (performance) of the celebrity has an impact on the stock prices of the sponsor. Empirical evidence of the golf industry shows that celebrity endorsement effects of Tiger Woods increased the golf ball sales of his sponsor Nike (Chung et al., 2013). That research determines that in the period 2000-2010 Nike made an additional 103 million dollar profit through the additional sales of Tiger Woods endorsement effect.

Second, this research contributes to a stream in the literature that investigates the influence of mood changes caused by sport events on the stock market. Previous research investigates the stock market reaction to mood changes caused by sport sentiment (Edmans, et al., 2007). The researchers find a significant negative effect on the national stock market of the losing country of a World title football match, the day after the game. Other research shows positive abnormal returns on the stocks of football clubs after a win in the national competition (Palomino et al., 2009). These researches indicate that sports outcomes can influence the stock market via mood changes. This thesis investigates these results in another sport, and zooms in on the stock price of the sponsor.

Third, this research contributes to a field of research which focuses on the match-up hypothesis. The match-up hypothesis implies fit between the endorser and his sponsor. This thesis examines if there is a difference between the abnormal returns of the stock of sport related sponsors and non-sport related sponsors. Previous research demonstrates the importance of fit between an endorser and the sponsor (Till & Busler, 2000). The brand attitude and the purchase intent of consumers is compared for four different endorsement combinations. The highest values for the variables brand attitude and purchase intent are found when a congruent endorsement combination is used. A better brand fit will enhance the endorsement effect. Another research shows a similar effect but in the cosmetic industry (Kamins, 1990). This thesis investigates the effects of the fit between a brand and an endorser further, and examines a difference between the effect on the stock price of a sport related sponsor and a non-sport related sponsor.

1.2 Managerial relevance

This thesis can be useful for managers in two ways.

First, investors can use the findings of this thesis to have a better idea of the causes influencing stock prices. A recent article mentions the process in which reading habits of investors influence stock prices (Fedyk, 2016). To be more specific, the article is about the publications of news and how this influences stock prices. Publications of news are the cause of many stock price fluctuations. For example, when a breakthrough in cancer research by Entremed (biotech firm) was announce in the news, the stock price of Entremed saw an increase of 30%. If a similar effect is found after the win of a Mercedes driver in formula 1 on the stock price of Mercedes, this can be valuable information for both the company itself and investors. An increasing stock price can give investors an incentive to invest in the firm, since the investors might be able to profit from the increasing stock price.

Second, the findings can valuable for firms to see the positive outcomes of all the money they put in sponsoring. The Formula 1 races are followed by over 400 million people worldwide, and are broadcasted in more than 200 countries (Sylt, 2016). Since Formula 1 is such a big sport, it attracts a lot of sponsoring. Estimates suggest that the teams collectively earn around 750 million dollars from sponsoring (Allen, 2016). This is only the team sponsoring and does not include the general sponsoring on Formula 1 circuits or broadcasts. However, has this sponsoring any effect? Research shows evidence that Olympic Sponsoring leads to a 50% higher consideration rate of consumers for the largest brands (Macdonald, 2012). In addition, Macdonald shows other positive effects for a brand, but all brand related. Evaluating sport sponsoring activities by examining the stock price of the sponsor, can be a new evaluation method for sponsorship effectiveness.

1.3 Structure of this thesis

The literature review gives insight in the reason why this thesis uses financial methodology to evaluate marketing activities such as sport sponsoring. Subsequently, the literature review describes the findings of previous literature on endorsement announcements and the effects of endorser performance. Thereafter, a table gives an overview of the most relevant literature for this thesis. Next, the hypotheses are developed and substantiated with theory using prior literature. Then, data section gives background knowledge about Formula 1 racing and describes the way in which the data are collected by hand. The methodology section first describes the event study methodology, after which it explains the regression methodology with the random effects model. Next, the first part of the results section presents the findings related to the event study and thereafter the second part presents the findings of the regression. Finally, the conclusion section gives a summary of this thesis and its findings and describes three managerial implications and the main limitations of this research.

2. Literature review

2.1 Structure of the literature review

The literature review of this thesis is divided in several parts. The first part describes the reasoning behind the use of financial measures for a marketing related subject. The next part focuses on literature about the effect of marketing activities on stock prices, which is important since this thesis uses stock prices as financial measure. After this part, existing literature on sport sponsoring provides insight in sport sponsoring as a marketing communication tool. Thereafter, the following part discuses literature covering celebrity endorsement (such as sponsoring). The subsequent part describes the existing literature of performance effects of celebrity endorsers on financial measures. In the end, a table gives an overview of the main findings in the existing literature.

2.2 Evaluating marketing activities with financial measures

First, it becomes increasingly important for marketers to use financial measures as a measure for the performance of their marketing activities (Lehmann, 2004). A stream in literature calls for marketing accountability (the so called marketing metrics), since more and more firms make decisions exclusively on the monetary evaluations of (marketing) strategies (Srinivasan & Hanssens, 2009; Gupta et al., 2004).

As firms adapt to shareholders value-based measures, marketing should extend its way of evaluating to financial measures in order to align with the marketing-finance interface (Srivastava, Shervani, & Fahey, 1998). Srivastava, Shervani and Fahey (1998) argue that the traditional assumption of the objective of marketing (creating value for consumers) is contested by an emerging new assumption. This new assumption states that the main objective of marketing is to create and manage market-based assets, in order to create shareholder value. Market-based assets include customer relationships, channel relationships, and partner relationships (e.g. sponsoring sports). This emerging assumption stimulates the use of financial measures for marketing evaluation instead of traditional measures such as brand awareness and purchase intention. The distinction between financial measures and traditional measures is easy. Financial measures (such as stock price fluctuations and sales) allow the marketer to express the evaluation of a marketing program in monetary terms. This is not possible with traditional measures (such as brand awareness).

In line with this movement, Srivastava, Shervani and Fahey (1998) develop a framework. This framework proposes that market-based assets increase shareholder value by enhancing cash flows, and lowering the volatility and vulnerability of those cash flows. This framework demonstrates the influence of marketing on shareholders' value.

Second, marketing is concerned with the growth of sales, and in this way with future cash flows. Customer satisfaction can be linked with shareholders value (Anderson et al., 2004). The goal of marketing is influencing customer satisfaction, which in its turn influences customer behaviour. A positive change in customer behaviour leads to an increase of future cash flows. Future cash flows influence the market value of a firm and its stock price. Financial theories are also concerned with future cash flows. The efficient market hypothesis states that the price of a firm's security (e.g. a stock price) is the present value of all the accumulated future cash flows of that firm (Fama, 1970). The price of a stock reflects all the relevant information about the firm to which it is related. The link between marketing strategy and future cash flows allows research to test the effect of marketing strategies by examining the changes in stock prices.

2.3 The effect of marketing activities on the stock price of a firm

Previous research shows evidence for stock market reactions to brand extension announcements (Lane & Jacobson, 1995). Additionally, it shows that the stock market reaction interacts with the brand attitude and familiarity. Other research shows the influence of perceived quality perception on the stock price of firms (Aaker & Jacobson, 1994). This research suggests that firms should express information such as brand's quality image to the stock market when they make long-term prospects of the firm.

Advertising has an effect on the long-term valuation of a firm (Joshi & Hanssens, 2010). Joshi and Hanssens (2010) investigate the relationship between advertising spending and market capitalization, and argue that advertising has an impact on valuation. Advertising's main goal is to create brand equity, and they hypothesize a spill-over effect between the brand equity created for consumers and the investor behaviour. Their empirical results show a positive impact of advertising on the firms' own market valuation. Other researchers indicate a similar effect of marketing on firm valuation (Pauwels et al., 2004). However, they find different effects for different marketing strategies. In the short term, new product introductions and promotion incentives have a positive effect on the valuation. However, in the long-term, new product price promotion incentives have a negative effect. They conclude that discounting is a negative signal in the long-term.

Other research also finds differences between marketing strategies, such as a research on the difference of a firms' valuation between different branding strategies (Rao, et al., 2004). Corporate branding is associated with a higher market value. The opposite holds for mixed branding strategies, which leads to a lower market value. Most firms that took the wrong branding approach could have a higher market value if they had decided to pick another branding strategy.

2.4 Sponsoring as marketing tool

Sport sponsoring is a widely used marketing communication tool. The main goal of corporate sport sponsoring is to use the exploitable commercial potential in a sport-property (Meenaghan, 1991). Like most marketing tools, determining the effect of sponsoring is not easy. Research has shown that only 54% of the companies set specific objectives for their sponsoring expenditures (Chadwick & Twaithes, 2005). Eight out of the nine objectives that are described in that research cannot be measured with financial performance measures (e.g. objectives such as increasing brand awareness and enhancing business relationships). According to the emerging assumption mentioned in chapter 2.2 (marketing activities should be evaluated with financial measures) only one of those objectives (increasing sales leads) can be used for the evaluation of a marketing program. The other objectives cannot be measured with financial measures.

Previous research shows the effectiveness of sport sponsoring to marketing aims as sport sponsoring increases brand recall and increases brand awareness (Cornwell et al., 2006; Irwin et al., 1999). The fit between the athlete and the sponsor influences the effectiveness of these aims (Cornwell et al., 2016). A better fit results in a better brand recall. Articulation can compensate for the lack of fit (e.g. by emphasizing the relationship between the sponsor and the event/athlete during an event). The importance of fit between the sponsor and the endorser is confirmed in multiple industries (Till and Bussler, 2000; Kamis, 1990). This effect is called the match-up hypothesis. This thesis investigates the importance of fit in sport sponsoring evaluation with financial measures.

2.5 Celebrity endorsement effects

Sponsoring athletes and sport teams is a form of celebrity endorsement. Prior literature on celebrity endorsement mainly focuses on celebrity endorsement as a tool for firms to differentiate their brand from the brand of competitors. Research shows that having the perfect endorser can give firms a competitive advantage over firms who do not have an endorser (Erdogan et al., 2001).

Research indicates that a celebrity endorser is more effective than other endorsers such as a student, a professional expert or the CEO of a firm (Friedman et al., 1976). It also indicates an effect an effect of endorsement on the purchase intent, as well as on the probable taste (of wine, which is the product used in the research). On the other hand, other research indicates that endorsement effects are stronger for experts oppose to celebrities (Biswas et al., 2006). The effect of expert endorsers is even stronger for more technological products. The differences between the findings of those papers can come from the products they used for their research. Friedman, Termini and Washington (1976) use wine as the endorsed product, which is a low-technological product. Biswas, Biswas and Das (2006) find a weaker difference for low technological products.

Additionally, Biswas, Biswas and Das (2006) indicate that the difference between the effect of celebrity endorsers and expert endorsers can be neutralized if there is a strong fit between the celebrity endorser and the product. Regarding to athlete endorsement such as Formula 1 driver sponsoring, most drivers are celebrities. However, for some products, they are experts as well. For example, in the case of Mercedes sponsoring the world champion of 2016 Nico Rosberg, Rosberg is an expert about cars and racing. This is not the case for Max Verstappen, whose main sponsor is Redbull energy drink (being a good Formula 1 driver does not imply having knowledge about energy drinks). On the other hand, other research shows that celebrity endorsement (oppose to argument quality of the ad) is more effective for low involvement products (Petty et al., 1983). Therefore, the celebrity aspect of some Formula 1 drivers could play a role in the endorsement of products like energy-drink (which are low involvement products).

Since there is academic evidence for endorsement effects resulting in positive outcomes for the firm/endorsee, one could argue that investors react positively on the announcement of a celebrity endorser. After all, the celebrity endorser can provide a stream of future cash flows. An event study investigates the presence of abnormal returns on the days around a celebrity endorsement announcement of a firm (Agrawal & Kamakura, 1995). The results indicate that existence of abnormal returns of +0.44% on the announcement day. Furthermore, the researchers suggest that celebrity endorsements are considered a worthwhile investment by investors. Another event study does not show significant abnormal returns on and around the announcement date (Ding et al., 2011). Their results indicate positive abnormal returns on the announcement day and the days after this date, but those results fail to reach the significance level of 5%. Next, they investigate if the existence of abnormal returns depends on characteristics of the firm and the celebrity. They find significant abnormal returns for the announcements of endorsers from technology industry products. Additionally, they find weak evidence of the match-up hypothesis.

2.6 Performance effects of athlete endorsement

The period after the announcement of an endorser is the period that shows if the contract of the endorser is worth the investment. For athlete endorsers, being worth the investment implies performing well, since there is no point in sponsoring an athlete that does not hit the news with good performance. The effect that the performance of an athlete has on the sponsor is called the performance effect. There has not been a lot of literature covering the performance effects of athlete sponsoring. In general, literature covering the performance effects of the athlete endorsement can be divided in two streams. One stream focuses on continuous performance of an athlete and looks at the rankings of an athlete during a sport season. The literature in this stream focuses mainly on sales as dependent variable. The other stream focuses on the performance effects of the performance of athletes on certain moments in time (major matches or races). Therefore, it makes sense that this stream does not focus on something continuous as sales per month, but on financial measures that are sensible to sudden unexpected events (e.g. a stock price). The research in this thesis belongs to the second stream.

As mentioned before, the first stream mainly focuses on the impact of the endorser's performance effect on the sales of the sponsor. Chung, Derdenger and Srinivasan (2013) investigate the impact of the world golf ranking of Tiger Woods on the sales of Nike golf balls. They indicate that in the period of 2000-2010 Nike gained an additional profit of 103 million dollar through the performance endorsement effect of Tiger Woods. Tiger Woods' good performance in the golf ranking resulted in 9.9 million additional 12-pack golf ball sales. They estimate that around 57% of the investment of Nike in Tiger Woods was recovered just by additional golf ball sales alone. The impact of good performance of the sponsored athlete on the sales of the sponsor is also tested in basketball and tennis (Elberse & Verleun, 2012). This research indicates that the average increase of the sales caused by the endorsement effect is 200,000 dollar per week. Furthermore, they expect the weekly sales to increase with approximately 70,000 dollar as a result of good performance.

The second stream of literature investigates the performance effect after the performance of an athlete in a specific event. As mentioned before, this stream is mainly concerned with financial measures that react relatively quickly to these events (e.g. a stock price). Research indicates significant negative abnormal returns on the National Index of countries after a lost World title football match (Edmans et al., 2007). The researchers state that this effect is caused by the (negative) sport sentiment that investors have after a loss of their country of origin in an import match. Other research finds positive abnormal returns on the stock of football clubs, the day after a won match (Palomino et al., 2009). Furthermore, other research by Mathur, Mathur and Rangan (1997) shows that after the successful return of Michael Jordan in 1995 the stock values of all the endorsed firms had increased with 1.016 billion. Michael Jordan endorsed companies such as Nike, McDonald's and General Mills.

2.7 Overview of important findings regarding sponsoring and endorsement

This section of the literature review gives an overview of relevant existing literature, organized across two dimensions. All the relevant literature is ordered in table 1. Each paper is ordered on characteristics of the research that the paper describes.

The first dimension is whether the dependent variable (measure) used in the research is financial or traditional (see section 2.2). In addition, the table shows the dependent variable.

The second dimension is the type of endorsement effect. This dimension categorizes three types of effects: an announcement effect (see section 2.5), a performance effect (see section 2.6), or a general endorsement effect. "General endorsement effect" refers to research which is not focused on the announcement of the endorsement nor on the performance of the endorser. In addition a distinction is made between performance effects that are event specific (endorsement effect immediately after a sport event), and not event specific (endorsement effect caused by the general performance over a sport season).

As can be seen in table 1, there has not been research on event specific performance effects of athletes on the stock price of their sponsor. This thesis focuses on that area.

Author	**Dependent Variable**	**Type of Effect**	**Main findings**
Cornwell, Humphreys, Maguire, Weeks, & Tellegen (2006)	Traditional; brand recall and brand awareness	General endorsement effect	Sponsorship increases brand recall and awareness. However, articulation and brand-fit influence the strength of the increase.
Till & Bussler (2000)	Traditional; brand attitude, purchase intent, brand belief	General endorsement effect	Paper provides evidence for the Match-up hypothesis. A better fit leads to an improvement in brand attitude and purchase intent.
Friedman, Termini, & Washington (1976)	Traditional; purchase intent, probable taste, credibility, expected selling price	General endorsement effect	Research shows that celebrity endorsement is more effective than expert, student or CEO endorsement. Wine is used as the endorsed product.
Biswas, Biswas, & Das (2006)	Traditional; consumer knowledge; customer orientation cycle	General endorsement effect	Research shows that expert endorsement is more effective than celebrity endorsement. The effect is even stronger for technological products.
Petty, Cacioppo, & Schumann (1983)	Traditional; advertising effectiveness	General endorsement effect	Research finds that celebrity endorsement is more effective than arguments about quality for low involvement products.
Agrawal & Kamakura (1995)	Financial; stock price of sponsor	Announcement effect	Event study shows +0.44% abnormal returns of the endorsed firm on the day of a celebrity endorsement announcement.
Ding, Molchanov, & Stork (2011)	Financial; stock price of the sponsor	Announcement effect	Event study shows no significant abnormal returns after a celebrity endorsement announcement. However, significant abnormal returns for technological products and weak evidence for the Match-up hypothesis are found.
Chung, Derdenger, & Srinivasan (2013)	Financial; sales of sponsor	Performance effect; not event specific	Authors estimate that the endorsement effect of Tiger Woods performance resulted in 103 million dollar additional profit for Nike (on the sales of Nike golf balls).
Elberse & Verleun (2012)	Financial; sales of sponsor	Performance effect; event specific (and not event specific)	Empirical research (in tennis and basketball) shows that the endorsement effect could increase the weekly sales of the endorsed firm with 200,000 dollar. In addition, an extra increase in weekly sales of 70,000 after good performance of the endorser is found.
Edmans, García, & Oyvind (2007)	Financial; price of national index	Performance effect; event specific	Event study indicates significant negative abnormal returns on the National Index of countries after a lost World title football match (caused by negative sentiment of investors).
Palomino, Renneboog, & Zhang (2009)	Financial; stock price of sport club	Performance effect; event specific	Event study indicates positive returns on the stock price of football clubs, the day after a won match.
Mathur, Mathur, & Rangan (1997)	Financial; stock price of sponsor	Performance effect; not event specific	Research shows that after the successful return of Michael Jordan in 1995 the stock values of all the endorsed firms had increased with 1.016 billion.

Table 1: Overview of previous literature on endorsement effects.

3. Hypothesis development

Previous literature shows evidence of performance effects of endorsers. However, previous research either focuses on the effect of event specific performance on the sales of the sponsor (Chung et al., 2013), or on the effect of general performance over a sport season (not event specific) on the stock price of the sponsor (Elberse et al., 2012; Mathur et al., 1994). This thesis investigates the effect of performance in a sport event on the stock price of the sponsor, immediately after the event. A successful athlete creates future cash flows for the endorsed firm, for example by increasing the sales through an endorsement effect (Chung et al., 2013). People see the athlete perform well (due to the help of the sponsor products) and buy the sponsors products because they think it will influence their performance in a positive way. The stock price of a firm is a reflection of the future cash flows of that firm, because (according to the efficient market hypothesis) the stock price of a firm incorporates all available information (Fama, 1970). Therefore, performance of an athlete may lead to positive abnormal returns of the stock price of his sponsor. The first hypothesis tests this relationship.

H1*: The performance of an athlete (i.e. finishing first, second or third) positively impacts the abnormal returns of the stock price of the athlete's* sponsor.

Furthermore, there is a difference in sentiment that athletes experience after finishing second or third (Medvec, Madey, & Gilovich , 1995). Medvec, Madey and Gilovich mention that research in counterfactual thinking theorizes that the emotional responses of people to events can be influenced by thinking about "what might have been" (Kahneman & Miller, 1986). An athlete finishing the second is objectively better off than an athlete finishing the third. However, the findings indicate that bronze medal winner is on average happier than a silver medal winner. They assume this phenomenon is occurs because the most counterfactual alternative for an athlete finishing second is finishing first, and for the bronze medal winner finishing without a medal. The investing behaviour of investors can be influenced by the outcomes of sport events (Edmans et al., 2012; Bernile & Lyandres, 2011). Investors may also be influenced by this counterfactual thinking bias, since they experience sentiment after a sport event (similarly to athletes). Investors may feel disappointment after a second place (the athlete could have been first) or satisfaction after a third place (the athlete won a price instead of winning nothing) and react emotionally on the outcomes by selling or buying stocks. Therefore, the second hypothesis tests the relationship between the finishing position of an athlete and the height of the abnormal returns of the stock price of a sponsor.

H2: *The finishing position of an athlete moderates the performance effect stated in H1, in such a way that the second position has a smaller effect on the abnormal returns than the first and third position.*

The endorsement effect of endorsers is stronger when there is a fit between the endorser and the sponsor (Till & Bussler, 2000). One could argue that fit between an athlete and its sponsor influences the abnormal returns of the stock of the sponsor. First, a fit between an endorser and a sponsor increases the credibility of the endorsement, which leads to additional sales (Kamis, 1990). People tend to trust endorsements more when an endorser is an expert in the endorsed product.

Second, beliefs about the future cash flows of a firm result in a change of the stock price, because investors sell or buy the stock. A change in a stock price is usually caused by a change the beliefs of investors about the future cash flows of firms. Therefore, the type of sponsor may influence the abnormal return.

Sport related sponsors directly invest in things that are necessary for the athlete to perform and have a main business which is related to the sport (e.g. Renault making the car engine). Sport related sponsors have a fit with the athlete (they are they are related to a part of the sport). Non-sport related sponsors have a main business which is non-sport related (e.g. Santander Bank when it sponsors money for the Ferrari team). Non-sport related sponsors do not have a fit with the sport. The third hypothesis tests the relationship between the type of sponsor and the abnormal returns on the stock price of the sponsor.

H3: *The type of sponsor moderates the effect stated in H1, in such a way that the athlete's performance effect on the stock price of the sponsor is larger for sport related sponsors than for non-sport related sponsors.*

Abnormal returns on national stock indices are higher after outcomes of more important sport events oppose to less important events. For example in football, abnormal returns on national stock indices are higher for knock-out matches (in world championships) oppose to friendly matches or qualification matches (Edmans et al., 2007; Ashton et al., 2003). National indices are a reflection of the most important stock prices of a country (a collection of individual stocks). A similar effect could occur on individual stock level. An event in which an athlete becomes world champion may be valued more by investors than a normal sport event. This might happen because for less important sport events only limited new information will be provided to the public (therefore, the performance receives less attention). Important sport events may receive more media attention. The fourth hypothesis tests if the abnormal returns on the stock price of the sponsor after an event in which an athlete becomes world champion are higher than after a normal event.

H4: *The win of a world title moderates the effect stated in H1, in such a way that the abnormal returns of the stock price of an athlete's sponsor after an event are higher when the athlete wins the world title in that specific event.*

4. Conceptual map

The conceptual map in figure 1 gives an overview of the hypotheses.

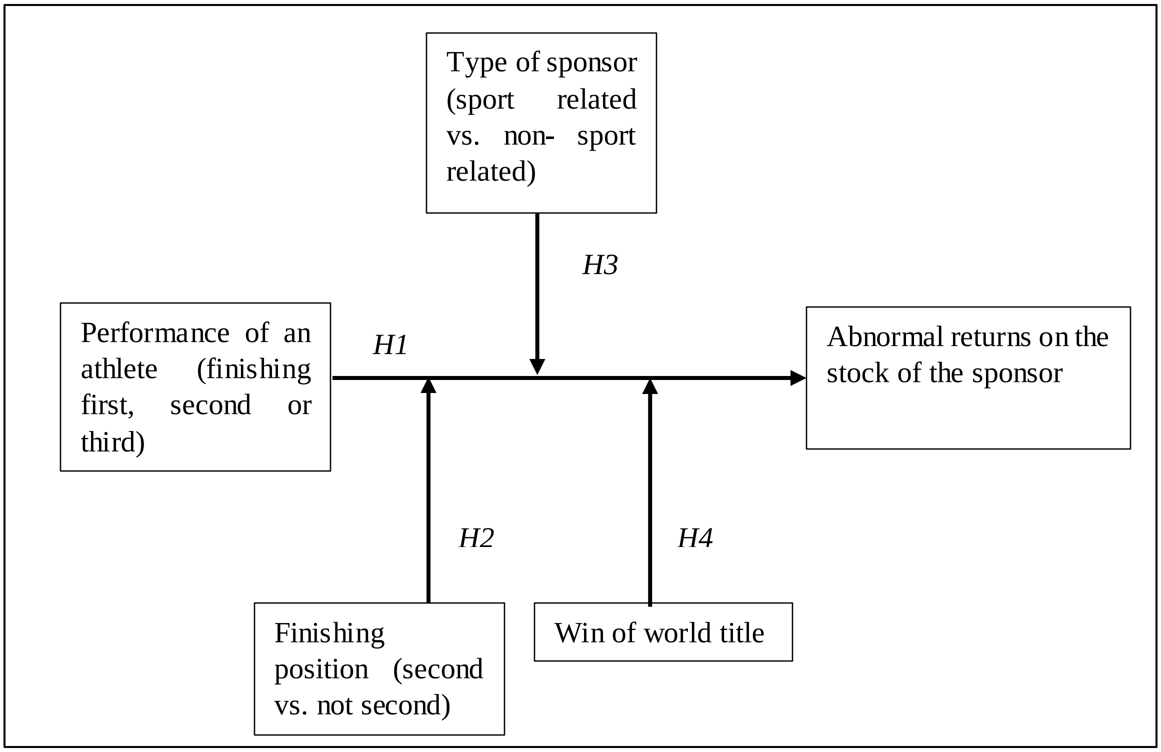

Figure 1: Conceptual map.

5. Data

5.1 Industry background

The application of this thesis is in Formula 1 racing. This section provides the background knowledge about Formula 1 racing that is necessary to understand the methodology. According to recent estimates, Formula 1 racing is followed by 400 million people worldwide. In 2016, the most watched race (the U.S. Grand Prix) had almost 100 million people tuned in live (Sylt, 2016). Therefore, Formula 1 is one of the most popular sports around the globe. Like most popular sports, Formula 1 attracts sponsoring. Estimates suggests that in 2016 around 2 billion dollars was used for sponsoring Formula 1 (Smith, 2016).

Each Formula 1 season consists of about 20 races (Formula One World Championship Limited, 2017). Each race is called a Grand Prix. The Grand Prix's are organized all over the world and each circuit is different. For example, in Monaco the race is organized on a street circuit many tight corners. Another famous circuit is the Autodromo di Monza in Italia with only 11 corners, which allows drivers to reach a high speed (around 320km/h). Furthermore, according to the designer, the Baku City Circuit in Azerbaijan in 2016 is the fastest street circuit with maximum speeds of around 340km/h (Formula One World Championship Limited, 2016). The results of each race differ, since some drivers are better on curvy circuits while other drivers are better on more straight tracks.

There is a qualification race the day before each race. The outcome of this qualification determines the position in which the driver starts during the Grand Prix. The fastest driver in the qualification starts in the first position (pole position), the second fastest driver in the second position, the third fastest in third position, etcetera. Starting in front of other drivers gives the driver an advantage at the start of the race. The drivers have fair chances for each Grand Prix (because the starting position is not depending on their ranking, but on the qualification results).

At the end of the Grand Prix race, the top ten drivers score points towards the World Championships. The driver that has the most points at the end of the seasons wins the World Title. Table 2 shows the awarded points for the first ten finishing positions in a Grand Prix (this system is used since 2010).

Position	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**10th**
Points	25	18	15	12	10	8	6	4	2	1

Table 2: Awarded points for the first ten finishing positions in a Grand Prix.

It happens often that a driver does not finish the race. For example, Michael Schumacher finished 77.2% of his total 323 Grand Prix races, Sebastian Vettel finished 84.15% of his races, and Romain Grosjean only 68.22%. Not finishing a race could be because of engine failure, flat tires, or a crash. In order to be classified (and earn points), a driver must at least complete 90% of the winners race distance. After each Grand Prix, the top three is awarded in a ceremony and receives a lot of media attention.

Each driver competes for his team (each team consists of two drivers). The teams are sponsored by different kinds of companies. Some companies are sport related, such as car manufacturers (Ferrari or Renault), while other companies are non-sport related (Redbull, Vodafone). In this thesis, a sport related sponsor is a company whose main business is related to something that the athletes use to perform their sport (e.g. a car engine developed by Ferrari). Ferrari can gain prestige when an athlete finishes first in a car made by Ferrari (people think Ferrari must know how to build good cars, otherwise they won't win a Formula 1 race). A non-sport related sponsor has a main business which is not related to the sport. Most teams are sponsored by a variety of sponsors, but this thesis focuses only on the main sponsors because they receive the most attention. The name of the sponsors is printed on the racing cars.

5.2 Data collection

The data on the performance of Formula 1 drivers, the exact finishing position and the win of a world championship are derived from the official Formula 1 results website (Formula One World Championship Limited, 2017). This research investigates the sport seasons 2011-2016. It is important to investigate multiple seasons to avoid bias caused by one driver dominating a season, because this bias can lead to an evaluation of only one stock. 301 athlete performance events are initially used for this research. For each of the athlete performance events the main sport related sponsor and the main non-sport related sponsor is used for the analysis. Therefore, the total number of event dates is 301×2 = 702. The data consist of 234 first finishing position events, 234 second finishing position events and 234 third finishing position events. The whole data set is made by hand because there was no data set available in which the main sponsors are already linked to the athletes. The main sponsors are found via search engines and the Formula 1 website.

Next, each of the event dates is checked for other intervening events that could cause the stock price to move. For example, a company announces a dividend pay-out or a company issues additional shares on the day of the race. Not taking into account these events could cause bias in the results, because the estimated abnormal returns may be influenced by these intervening events. To exclude such influences, the event dates that are close to possible intervening events are deleted from the data. The check is done by scanning each of the 702 event dates with Factiva (a news database) and Google News. Not just the event date, but also the week before and after the event is checked for intervening events. Every event date was double checked. This process was very time consuming and had to be done by hand. Since it was done manually, it cannot be guaranteed that every used event date is free of intervening events. However, it is very unlikely that such an intervening event would move the stock price, because that specific event is likely to be very small or hidden (otherwise it would show up on Factiva and Google News). After the check, 498 events appear to be useful for further analysis. Respectively 181, 163 and 154 of these 498 events are of an athlete finishing first, second and third.

The data on the stock prices of the sponsoring companies are derived for Datastream. This is a large financial database. If the main sponsoring company is not listed on the stock market, the second largest main sponsor is chosen. For the selection of the main sponsors, figure 6 in the appendix is used. For the classification of the sponsors (sport related versus non-sport related), figure 7 in the appendix is used. Sometimes the main sponsor was listed on the market under the name of the parent company, and in that case the stock of the parent company was used (e.g. for Rexona, Unilever was used). The stock price data is linked to the athlete data for the regression analysis (the type of sponsor, the finishing position, and the win of a world title).

5.3 Variables

5.3.1 Dependent variable

The dependent variable used in this thesis is the abnormal return of the stock price of the sponsor. Examining the abnormal return on stock gives insight in the stock market reaction to the performance of the athletes. This variable is a continuous variable.

5.3.2 Independent variables

The first and main independent variable used in this thesis is performance of the athlete. An athlete delivers good performance when he finishes first second or third in a Grand Prix race. This variable is used in the estimation of the abnormal returns. All the events in the data are events in which a driver finished among the top three in a race.

The second independent variable used in this thesis is the finishing position of the athlete. This variable includes finishing second or finishing either first or third. This variable is a moderator variable on the effect that good performance has on abnormal returns. The values of this variable are “second” and “first or third”. This variable is coded as a dummy variable in which the value “second” is coded as 1 and “first or third” as 0.

The third independent variable used in this thesis is type of sponsor. This variable is used as a moderator variable on the effect that good performance has on abnormal returns. The sponsors are categorized in two classes: sport related and non-sport related. Sponsors whose main business is related to something the athletes use to perform in their sport are classified as sport related. Sponsors whose main business is not related to something used in the sport are classified as non-sport related. As mentioned before, for the classification of the sponsors, figure 7 in the appendix is used. For example, using the figure, Mercedes is classified as a sport related sponsor (Mercedes provides the car engine). Similarly, Santander bank is classified as a non-sport related sponsor (Santander bank does not provide products or services used in Formula 1). This variable is coded as a dummy variable in which sport related is coded as 1 and non-sport related as 0.

The fourth independent variable used in this thesis is win of the world title. This variable is expected to moderate the effect that performance has on abnormal returns. This variable can have two values: “no world title” and “world title”. The variable is coded as dummy variable. The value world title is coded as 1 and the value no world title as 0.

5.3.3 Control variable

To control for effects of different sport seasons, a control variable “sport season” is used. As mentioned before, this research uses events from six different sport seasons (2011-2016). This variable is coded as a dummy variable with the season 2011 as baseline value. Excluding the dummy variable for 2011 is necessary because entering all of the seasons in the analysis at the same time leads to a multicollinearity bias.

5.3.4 Overview of the variables

Table 3 provides an overview of the variables. It also provides a short explanation of each variable and the data source for each variable.

Conceptual variable	Measured variable	Data source
Dependent variable		
Abnormal return of stock price of sponsor	The return of a stock that is different from the expected return	- Datastream
Independent variable		
Performance of the athlete	The first three finishers in Grand Prix races	- Formula1.com
Finishing position	A dummy for the finishing position of the athletes used in this reseach (finishing second or finishing first or third)	- Formula1.com
Type of sponsor	A dummy for a sponsor being sport related or non-sport related (for the selection and the classification of the main sponsors, see figure 6 and 7 in the appendix)	- Search engines - Formula1.com - Factiva
World title	A dummy for the race in which the athlete wins the world title	- Search engines
Control variable		
Sport season	A dummy for the sport season in which the event takes place (2011, 2012, 2013, 2014, 2015, or 2016), 2011 is used as baseline value	- Formula1.com

Table 3: Overview of the used variables.

6. Methodology

6.1 Event study methodology

Similar studies use event study methodology (Agrawal & Kamakura, 1995; Edmans et al., 2007; Palomino et al., 2009). Event study methodology measures the effect that an (unanticipated) event has on the value of a firm that is associated with that event. In this research the events are the outcomes of the Formula 1 races. Event study methodology is based on the theory of Fama about the efficient market hypothesis (Fama, 1970). This hypothesis states that the price of a security (in this case a stock) is the present value of all the accumulated future cash flows of that specific asset of a firm. This price will reflect all the possible information about the current and future profitability of a firm. Following this theory, it is possible to say that if the performance of an athlete has influence on the value of a firm, this is reflected in the stock price. The change in the stock price after an event (relatively to the pre-event price), shows the markets unbiased estimate of the economic value of that specific event (Brown & Warner, 1985).

An event study examines the abnormal returns of a stock. An event study estimates the difference between the actual return and the expected return of a stock. In this research uses the market model to calculate the return of the stock. The MSCI ACWI index is used as benchmark for estimation of the stock returns (the market index). The MSCI ACWI index captures all sources of equity returns in 23 developed and 24 emerging markets worldwide. The market model is defined in the following way (Dyckman et al., 1984):

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \quad (1)$$

$R_{i,t}$ is the return of stock of the *i*th company at time *t*. $R_{m,t}$ is the return of the market index *m* at time *t*. $\varepsilon_{i,t}$ is the abnormal return of the *i*th company at time *t*. Therefore, the equation of the abnormal return (AR_i) for the stock of the *i*th company at time *t* can be obtained as:

$$AR_i = \varepsilon_{i,t} = R_{i,t} - (\alpha_i + \beta_i R_m) \quad (2)$$

The abnormal return of a stock is a random variable with an arithmetic mean equal to 0 (Fama, 1970). Abnormal returns are present when the random variable is systematically different from 0. To answer the research question, the returns after each event are examined in this way.

An estimation window of [-130,-10] is used for the estimation of the expected return for each stock for each event (Brown & Warner, 1985). The estimation window should not include the event window, because that could influence the estimation of the parameters. Most event studies use an estimation window of at least 120-200 days (Agrawal & Kamakura, 1995; MacKinlay, 1997; Edmans et al., 2007). For the event window [-130,-10] the stock price history should go back at least 130 trading days (which is around 26 weeks). This is feasible for all of the stocks used in this research.

An event window of [0,+4] is used for the estimation of the abnormal returns of each event (Brown & Warner, 1985). An event window is the period of trading days over which the abnormal returns are calculated. Most events take place on Sunday, therefore the next trading day (Monday) is used as event day (event day 0). Often, the next race takes place within a week of the previous race. Therefore, the last day of the event window is +4. Choosing a longer event window could lead to a bias in the calculated abnormal return, because the next event would influence the abnormal returns of the previous event. Since most event studies find abnormal returns on the event day its self or the day directly after, special attention is paid in this research to event day 0, event day 1 and the event window [0,+1].

Then, the average abnormal returns (AAR) are calculated for all the firms for all days in the event window. This shows the average abnormal return caused by the performance effect on a specific day. The average abnormal return of the stock of the *i*th company is calculated as (with N being the number of events in the dataset):

$$AAR_i = \frac{1}{N}\sum_{i=1}^{N} A_{it} \quad (3)$$

Next, the cumulative average abnormal returns (CAAR) are calculated for different event windows. This shows the behavior of a stock in an event window (Aharony & Swary, 1980; Brown & Warner, 1985). The cumulative average abnormal return of the stock of the *i*th company in event window t=[tx,ty] is calculated as:

$$CAAR_{i,\,tx,\,ty} = \sum_{t=tx}^{ty} AAR_{it} \tag{4}$$

6.2 Regression analysis methodology

A regression is performed in order to assess if the abnormal returns depend on any of the independent variables stated in section 5.3.2. In order to control for unobserved heterogeneity, a random effects model is used. In a random effects model, individual parameters are viewed as random draws from the whole population. It is based on the random effects assumption that individual specific effects are uncorrelated with the independent variables (Allenby & Rossi, 1998). This model is extensively used in economic and marketing research (Kamakura & Russell, 1989; Chintagunta et al., 1991). The random effects model estimates the abnormal return of the *i*th company (with z different independent variables) at time *t* in the following way:

$$AR_{i,t} = \beta_0 + \beta_{1,i,t}X_{1,i,t} + \ldots + \beta_{z,i,t}X_{z,i,t} + \alpha_i + \varepsilon_{i.t} \tag{5}$$

$\beta_{k,i,t}$ is the sensitivity of the abnormal return of the stock of the *i*th company to independent variable k at time t, where k varies from 1 to z. α_i is the company-specific random effect, which measures the difference between the average abnormal return of the *i*th company and the average abnormal return of the sample population. $\varepsilon_{i.t}$ is the error term of the regression, which is the idiosyncratic error. The error term is assumed to be uncorrelated with the independent variables and the company-specific random effect. The error term is assumed to be normally distributed and is cross-sectional- and time-variant.

To estimate equation 5, the assumption is made that individual effects are uncorrelated with the independent variables. However, it could be that the individual effects are correlated with the independent variables (in this case, a fixed effect model would be appropriate). This research uses the Hausman test to test the appropriateness of a random effect model.

Furthermore, it is important to check for multicollinearity. This is done by using the variance inflator factor (VIF). A low VIF shows a low degree of multicollinearity. A VIF higher than 5 could indicate the presence of high multicollinearity.

$$VIF = \frac{1}{1-R^2} \tag{6}$$

7. Results

7.1 Event study results

7.1.1 Event study results for hypothesis 1

To test hypothesis 1, first the average abnormal returns for each event window are analyzed for all of the 498 performance events. As mentioned before in chapter 6.1, the main focus of the analysis lies on the event day 0 and event day +1. Figure 3 shows the distribution of the average abnormal returns on event day 0. To test the significance of the average abnormal returns, the parametric t-test and the non-parametric Wilcoxon signed rank test are used. The parametric t-test makes an assumption about the distribution of the abnormal returns, therefore, the non-parametric Wilcoxon signed rank test is used to confirm the t-test statistic. Table 4 shows the (cumulative) average abnormal returns for different event dates. On event day 0, the percentage of positive abnormal returns is 54.4%. The analysis shows that the average abnormal returns on event day 0 are positive (0.080%), but not significant. The average abnormal returns on event day +1 are positive (0.088%), but also not significant. Another finding is that the average abnormal returns on the event day +2 are significant at the 0.01 level. Surprisingly, the abnormal returns appear to be negative on event day +2 (-0.185%). The main focus of this research, however, lies on event day 0 and +1, therefore these results are not used to reject or support hypothesis 1.

Second, the cumulative average abnormal returns are analyzed for each possible event window (within the [0,+4] event window). Table 5 shows the results. As shown in table 4, on their own the average abnormal of the event days in the [0,+1] window fail to reach the significance level. Together, however, the cumulative average abnormal returns in the [0,+1] event window are significant at the 0.1 level, according to the parametric t-test. This could indicate an endorsement effect in the first days after a race. This finding supports hypothesis 1, that performance of an athlete (finishing first) positively impacts the stock price of his sponsor. Hypothesis 1 is supported.

Other findings are significant cumulative average abnormal returns in the event windows [+2,+3] (at the 0.01 level) and [+2,+4] (at the 0.05 level). The non-parametric test also shows significant results in the event window [+2,+3] (at the 0.01 level). The returns in the event windows [+2,+3] and [+2,+4] are respectively -0.245% and -0.251%. The significant event day +2 and the significant event windows [0,+1], [+2,+3] and [+2,+4] are used in the regression analysis to test hypothesis 2, 3 and 4.

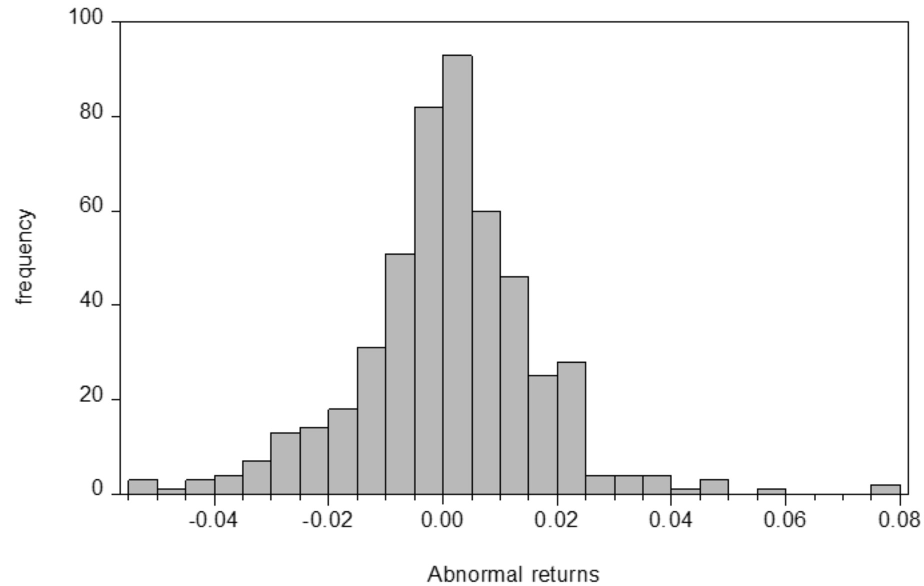

Figure 3: The distribution of the abnormal returns of 498 performance events on event day 0.

Event day	AAR	Parametric t-test statistic	P-value	Wilcoxon signed rank test value	P-value	CAAR	% of AR positive
0	0.080%	1.1154	0.2652	1.6047	0.1085	0.080%	54.4%
+1	0.088%	1.2712	0.2043	0.4360	0.6628	0.168%	46.6%
+2	-0.185%	-2.6651***	0.0079	1.8021*	0.0715	-0.017%	48.2%
+3	-0.060%	-0.8685	0.3855	1.0078	0.3136	-0.077%	47.4%
+4	-0.006%	-0.0876	0.9302	0.1099	0.9125	-0.083%	50.8%

***Statistically significant at the 0.01 level.
* Statistically significant at the 0.1 level.
Table 4: The (cumulative) average abnormal returns ((C)AAR) of 498 performance events for each event day.

Event window	CAAR	Parametric t-test statistic	P-value	Wilcoxon signed rank test value	P-value
[0,+1]	0.168%	1.7095*	0.0880	1.1777	0.2389
[0,+2]	-0.017%	-0.1352	0.8925	0.4603	0.6453
[0,+3]	-0.077%	-0.5566	0.5781	0.9038	0.3661
[0,+4]	-0.083%	-0.5219	0.6020	0.8768	0.3806
[+1,+2]	-0.097%	-0.9780	0.3285	1.3831	0.1666
[+1,+3]	-0.157%	-1.3486	0.1781	1.4404	0.1498
[+1,+4]	-0.163%	-1.1467	0.2521	1.1678	0.2429
[+2,+3]	-0.245%	-2.7479***	0.0062	2.4803**	0.0131
[+2,+4]	-0.251%	-2.0820**	0.0379	1.9499*	0.0512
[+3,+4]	-0.066%	-0.6659	0.5058	1.0728	0.2833

*** Statistically significant at the 0.01 level.
** Statistically significant at the 0.05 level.
* Statistically significant at the 0.1 level.
Table 5: The cumulative average abnormal returns (CAAR) of 498 performance events for each possible event window.

7.1.2 Event study results for hypothesis 2

The (cumulative) average abnormal returns for each finishing position are analyzed in a similar way as in chapter 7.1.1. Table 7 in the appendix shows the (cumulative) average abnormal returns for the events in which an athlete finished first. The average abnormal returns on event day 0 are positive and significant at the 0.1 level, according to the non-parametric test. The average abnormal returns on event day 0 are 0.178%. Next, the cumulative average abnormal returns of all possible event windows are tested (within the [0,+4] event window). Table 8 in the in the appendix presents the results. According to the parametric t-test cumulative average abnormal returns in the event windows [+2,+3] and [+2,+4] are significant at the 0.1 level. These cumulative abnormal results are negative (respectively -0.243% and -0.375%).

Next, the average abnormal returns are estimated for the events in which an athlete finished second. Table 9 in the appendix shows the average abnormal returns of events in which an athlete finished second. Table 10 in the appendix shows the cumulative abnormal returns for different event windows of events in which an athlete finished second. For events in which athletes finished second, none of the average abnormal returns on the days following the event are significant. Furthermore, no event windows have significant cumulative average abnormal returns.

Thereafter, the average abnormal returns are estimated for events in which an athlete finished third. Table 11 in the appendix shows the (cumulative) average abnormal returns for events in which an athlete finished third. Table 12 in the appendix shows the cumulative average abnormal returns for different event windows after events in which an athlete finished third. No significant (cumulative) average returns are found on event day 0 and event day +1 or in the event window [0,+1]. Other findings are the significant average abnormal returns on event day +2 (at the 0.1 level). These average abnormal returns are negative (-0.234%). Furthermore, the analysis shows cumulative average abnormal returns in the event window [+2,+3] at the 0.1 level. These returns are also negative (-0.280%).

Before doing the regression analysis, the event study results can already give an idea of the impact of the finishing position on the abnormal returns. Figure 4 shows the development of the cumulative average abnormal returns for each of the finishing positions. In this graph, the first finishing position seems to have the highest cumulative average abnormal return up to event day +4. The Welch's F-test (unequal variances) and the ANOVA F-test (equal variances) are used to test for differences in the (cumulative) average abnormal return of the three finishing positions for every event day and event window. The Levene's test for equal variances is used to assess the equality of the variances and to choose the right test. The rejection criterion is a p-value of less than 0.05. The results are presented in table 13 in the appendix. None of the event days and event windows shows a significant difference in the mean of the finishing positions.

Hypothesis 2 states that the abnormal returns are lower when an athlete finishes second compared to finishing first or third. To test this, the abnormal returns of events in which an athletes finishes first and events in which an athlete finishes third are pooled and compared with the abnormal returns of the events in which an athlete finishes second. Table 14 in the appendix presents the results. The results show no significant difference between the (cumulative) average abnormal returns of both groups. Therefore, no evidence is found that supports hypothesis 2.

It could be that there are differences between two of the finishing positions. Therefore, the means of two finishing positions are compared with t-test (first versus second, first versus third and second versus third). In table 15 in the appendix, the (cumulative) average abnormal returns of the finishing positions first and second are compared. However, none of the (cumulative) average abnormal returns appear is significantly different between the finishing positions. Table 16 in the appendix shows the comparison of the (cumulative) average abnormal returns of the first and third finishing position. On the event day +4, the means of the abnormal returns appear to be significantly different from each other, in such way that the average abnormal return of the third finishing position is higher than that of the first finishing position. This is remarkable because one would expect that investors value a first position more than a third position. On the other event days and event windows the means do not have significantly differences. In table 17 in the appendix, the comparison of the mean of the abnormal returns of the finishing positions second and third is presented. There are no significant differences between the abnormal returns of these finishing positions.

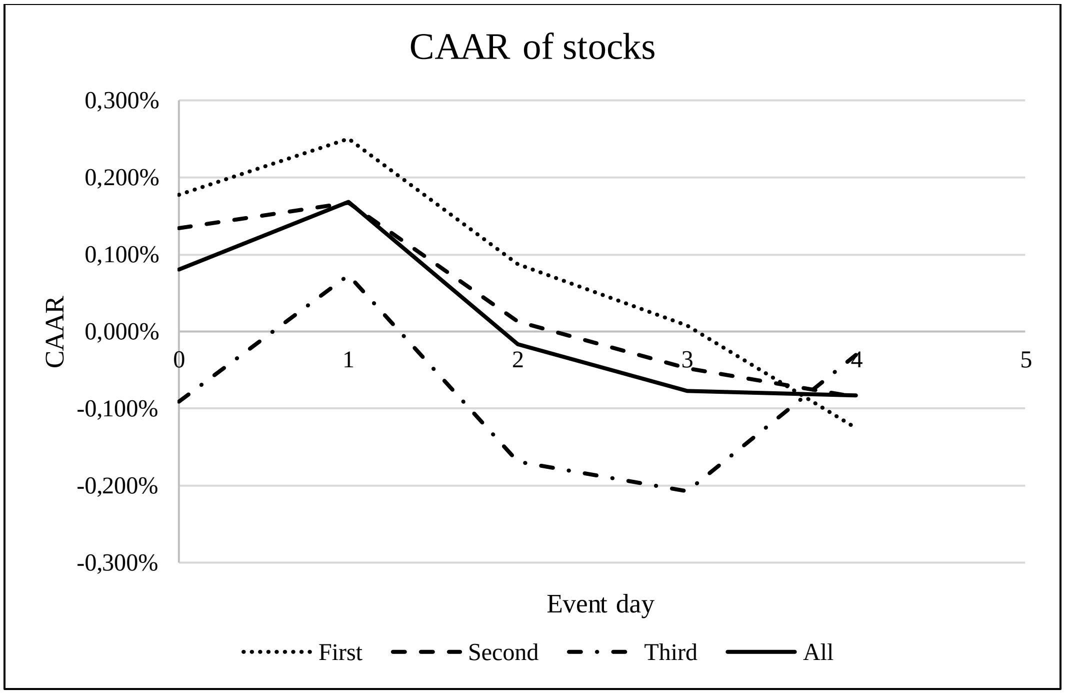

Figure 4: The development of the cumulative average abnormal returns (CAAR) of 498 performance events, catergorized by finishing position.

7.1.3 Event study results for hypothesis 3

The (cumulative) average abnormal returns for sport related sponsors and non-sport related sponsors are compared to generate insight in the importance of fit. Figure 5 shows the development of the cumulative average abnormal returns for sport related and non-sport related sponsors. The cumulative average abnormal returns appear to be higher for non-sport related sponsors oppose to sport related sponsors. This is the opposite of what is stated in hypothesis 3 (which states that the abnormal returns of sport related sponsors are higher than those of non-sport related sponsors). Table 18 in the appendix shows the comparision of the (cumulative) average abnormal returns for different event days and event windows. On event day 0 and the event day +1 there are no significant differences between the abnormal returns. On event day +2 there is a significant difference between the abnormal returns at the 0.05 level. The abnormal returns of non-sport related sponsors are significantly higher than those of the sport related sponsors. This difference at event day +2 also leads to significant higher cumulative abnormal returns in the event windows [0,+2] and [1,+2], repectively at the 0.1 level and at the 0.05 level. These findings do not support hypothesis 3.

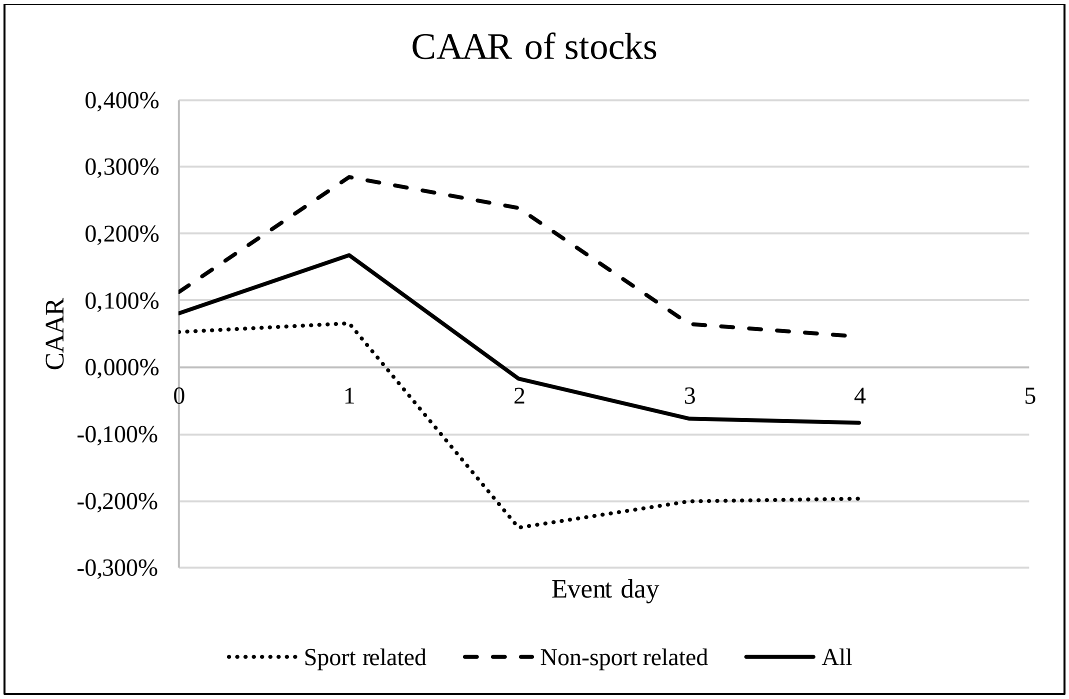

Figure 5: The development of the cumulative average abnormal returns (CAAR) of 498 performance events, catergorized by sport related and non-sport related sponsors.

7.2 Regression analysis results

7.2.1 Hausman test results

This research uses the random effects model to control for unobserved heterogeneity. The Hausman test tests the appropriateness of the random effects model. The null hypothesis of the Hausman test is that the random effect model is the appropriate model (oppose to a fixed effect model). Table 19 in the appendix shows the results of the Hausman test. It is not possible to reject the null hypothesis for all of the estimated regression models. Therefore, the random effect model is the appropriate model to use.

7.2.2 Variance inflator factor results.

The variables are checked for multicollinearity by examining the variance inflator factor (VIF). A VIF over 5 could indicate multicollinearity. Table 20 in the appendix presents the VIF values for every independent variable and control variable. All of the VIF values are below 5. The control variable for season 2014 has the highest VIF value (approximately 1.75). Since all the VIF values are low, there is no reason to expect multicollinearity.

7.2.3 Regression analysis results

As mentioned in chapter 7.1, the (cumulative) average abnormal returns of event day +2 and the significant event windows [0,+1], [+2,+3] and [+2,+4] are used for the regression analysis. As mentioned before, the main focus of this analysis is on the first two days after the event. Therefore, special attention is paid to the regression with event window [0,+1] as dependent variable. Table 6 shows all of the estimated regression models.

The beta coefficient of the finishing position variable second has a very small negative effect in the event window [0,+1] but is not significantly different from 0. There is no the effect of the finishing position on the abnormal returns. Therefore, the finishing position of the athlete does not moderate the effect of performance of an athlete on the stock price of the sponsor. The beta coefficient of the variable second are also not significant in the regressions which use event day +3 and event windows [+2,+3] and [+2,+4] as dependent variables. These results do not support hypothesis 2. Hypothesis 2 is rejected.

In all of the four estimated models, the dummy variable “sport related” has a negative effect. However, the beta coefficient are not significantly different from 0. There is no effect of the type of sponsor on the abnormal returns found. The type of sponsor does not moderate the effect that performance of an athlete has on the stock price of the sponsor. The results do not support hypothesis 3. Hypothesis 3 is rejected.

Winning the world title has a positive effect in event window [0,+1], as well as in the other regression models. However, the beta coefficient of the variable “world title” is not significantly different from 0 in any of the models. Winning the world title does not moderate the effect of performance of an athlete on the stock price of the sponsor. The results do not support hypothesis 4. Hypothesis 4 is rejected.

The adjusted R^2 is very low in the regression model of event window [0,+1]. The adjusted R^2 is negative in the other regression models. A negative adjusted R^2 indicates that the variation in the values around the model prediction is larger than the total variance. A negative or a very low adjusted R^2 is often an indication that the model is over parameterized. Some independent variables or control variables may have a very low correlation with the abnormal returns. Table 21 in the appendix shows the correlation of the independent variables with the dependent variables that are used for the regression. None of the correlation coefficients is higher than 0.1. It appears that the independent variable for the second finishing position has very low or no correlation with the abnormal returns. The independent variable sport related has some correlation with the abnormal returns on event day +3 and the cumulative abnormal returns in event window [0,+1] (respectively -0.084 and 0.050). The independent variable world title has very little correlations with all the dependent variables (the highest being 0.041 with the cumulative abnormal returns in event window [+2,+3].

Next, the regression models are found with the highest possible adjusted R^2. To find these models, the correlation table is used in combination with an arbitrary process. Table 22 in the appendix presents the models. These models explain the data the best, without adding unnecessary extra parameters. An interesting finding is that the variable sport related is significant at the 0.1 level in the model which uses the event day +3 as dependent variable. The variable world title is significant in regression which uses the event window [+2,+3] as dependent variable.

	Abnormal returns on day +2		CAAR [0,+1]		CAAR [+2,+3]		CAAR [+2,+4]	
	Beta coefficient	*T-statistic*	*Beta coefficient*	*T-statistic*	*Beta coefficient*	*T-statistic*	*Beta coefficient*	*T-statistic*
C	0.00043	0.2175	0.00874	3.1838***	0.00052	0.1711	-0.00071	-0.1689
Sport related	-0.00253	-1.6450	-0.00226	-1.1405	-0.00113	-0.3423	-0.00197	-0.3956
Second	0.00052	0.3503	-0.00003	-0.0145	0.00054	0.2795	-0.00025	-0.0974
World title	0.00163	0.2932	-0.00470	-0.5984	0.00659	0.9226	-0.00194	-0.2036
2012	-0.00024	-0.0999	-0.00832	-2.4550**	-0.00218	-0.6940	0.00072	0.1708
2013	-0.00153	-0.6231	-0.00403	-1.1745	-0.00289	-0.8662	-0.00265	-0.5865
2014	-0.00094	-0.3895	-0.00814	-2.4337**	-0.00478	-1.4301	-0.00217	-0.4784
2015	-0.00431	-1.7140*	-0.00862	-2.4706**	-0.00522	-1.5033	-0.00173	-0.3691
2016	-0.00017	-0.0669	-0.00520	-1.5014	-0.00179	-0.5226	0.00419	0.9054
Observations	498		498		498		498	
Adjusted R^2	-0.00098		0.00657		-0.00715		-0.00875	

***Statistically significant at the 0.01 level.
** Statistically significant at the 0.05 level.
*Statistically significant at the 0.1 level
Table 6: Random effects model results for the significant AAR's and significant CAAR's

8. Conclusion

8.1 Summary

This research investigates if performance of an athlete influences the stock price of the athlete's sponsor. The effect that the endorsement of an athlete has on the sponsor or endorsee is called the endorsement effect. This research also investigates whether such endorsement effect depends on the fit that the sponsor has with the sport, the finishing position of the athlete and special events as winning a world title. The application of this research is in Formula 1 racing, since Formula 1 racing is a sport that is followed by half a billion people worldwide.

Marketing research used to concentrate on traditional measures such as brand attitude, purchase intent and brand association. These traditional measures cannot be expressed in monetary terms. Recently, a stream in literature calls for marketing accountability (marketing metrics) because firms today make most of their decisions based on the monetary evaluation of a (marketing) strategy. According to this stream, the marketing activities of companies should be expressed in shareholder value. This thesis is written in align with this stream of literature. Previous literature mainly focuses on the endorsement effects in two ways. First, it focuses on the stock market reactions to endorsements announcements. Second, it focuses on the continuous (not event specific) performance effect of athletes on the stock price or the sales of the sponsor. This thesis concentrates on the performance effect during the days directly after a race (event specific) and the influence of this performance effect on the stock price of the main sponsor.

This research uses a unique dataset of 498 performance events. All the event dates are manually screened for intervening events. The research uses event study methodology to calculate the abnormal return on the stock of the main sponsor of an athlete during the first week after the race. Most races take place on a Sunday, and therefore the event day is shifted to the next trading day (Monday). The main focus of this research is on the event day and the day thereafter (event day 0 and event day +1). Positive average abnormal returns are found on those days, but they are not significant. However, the cumulative average abnormal return in the event window [0.1] is significant, and therefore there is evidence that good performance of an athlete positively impacts the stock price of the sponsor. The cumulative average abnormal return is 0.168% during the first two days after the race. In addition, a significant abnormal return of 0.178% on the stock of the main sponsor is found on the day an athlete finished first.

At first sight, a comparison of the (cumulative) average abnormal returns shows no difference in the abnormal returns between sport related and non-sport related sponsors. Also, the comparison shows no significant difference found between the abnormal returns of different finishing positions.

This research performs a regression to test the effect of these moderator variables in detail. It uses a random effects model to control for unobserved heterogeneity between different the observations of each sponsor. In addition, it uses a control variable to control for effects of different sport seasons. The results show no significant impact of the sponsor type, the finishing position of the athlete, or the event in which the world title is won.

To conclude, there is a positive effect of good performance of an athlete on the stock price of his main sponsor during the first two days after the race. The cumulative average abnormal return over these first to days is 0.168%. For example, for a company such as Renault with 295.72 million outstanding shares trading at a price of 80 dollar, this leads to a temporarily increase in the market value of almost 40 million dollar (Bloomberg L.P., 2017). Moreover, when an athlete finishes first, the average abnormal return directly after the race is 0.178%. However, the abnormal returns of finishing second or third are not significantly lower than those of the first finishing position. Furthermore, the type of sponsor does not influence the abnormal returns. Finally, winning the world title does not influence the abnormal returns.

8.2 Managerial implications

The findings of this thesis can contribute to managerial decision making in three ways.

First, investors can use the results of this thesis for short-term investment strategies before sport events. If they invest in the sponsor of the athlete who is likely to do well and who is likely reach the top 3, they can profit from positive increase in the stock price the first two days after the race. This happens because, after the race, the athlete and the athlete's sponsor receive media exposure and other investors see the possible increase in future cash flows and invest in the sponsor (which increases the stock price). The investor should then sell his share in the sponsor's company and profit from the positive increase in the stock price. Therefore, the good performance of athletes can be a reason for those investors to invest in the sponsor. However, investors following this strategy should be careful because of two reasons. The first reason is that this thesis also indicates negative abnormal returns on the third day after the race. These negative abnormal return can dilute the unrealized profit if the investor holds the stock for more than two days after the race. The second reason is that betting on the outcome of a race by investing in the expected winner's sponsor is always risky since there is a change that the athlete may lose or not finished the race.

Second, being sponsored by companies is necessary for most sport teams and athletes to cover the costs of their sport. In addition, it can be a way for successful sport teams or athletes to earn money and leverage their media exposure. However, it can be hard for sport teams and athletes to attract sponsoring. The presence of positive abnormal returns after a race can be used by sport teams and athletes as a bargain instrument when they are trying to receive sponsoring of companies. The positive abnormal returns demonstrate that investors believe that the success of athletes can result in positive future cash flows for the sponsoring company. The presence of positive abnormal returns after good performance of an athletes could convince the companies to start sponsoring sport teams or athletes.

Third, this thesis uses a financial measure to determine the effectiveness of marketing activities. The findings of this thesis show the influence that sport performance has on the stock price of its sponsor. The presence of abnormal returns on the stock of a sponsor after sport events can be a reason to expect abnormal returns after other marketing activities as well. The same methodology could be used for other marketing activities. Marketing managers can use event study methodology to evaluate their investments in marketing and show their directors the added value of the investment. For example, one can think of examining the abnormal returns after an international gaming event on the stock price of game developers. Or similarly, examining the presence of abnormal returns on the stock of company after they launched a new tv-commercial. A positive reaction of the stock market to marketing activities can be used as evidence for the usefulness of those marketing activities, since investors seem to value them.

8.3 Limitations and future research

This research has three important limitations. The first limitation is that some main sponsors are listed on the stock market under the name of the parent company (e.g. Rexona is listed under Unilever and Mercedes is listed under Dailmer). It could be that the endorsement effect is not carried through to the parent company, since the daughter companies are often only a part of the parent company. In addition, this parent-daughter company problem could lead to extra intervening events. To minimize those intervening events both the news about the daughter company and the parent company is checked. In future research about the stock market reaction to the performance of marketing activities, one may want to exclude those companies or one may want to focus on financial measures that can be traced back to the daughter company (such as sales or profits). This can overcome the parent-daughter company problem that is related to stock price analyses.

The second limitation is the uncertainty about when investors react to sport events. Investors may react to the event on beforehand by using their own expectation of the outcome of the event. In this case, abnormal returns may occur the days before the race. It is hard to incorporate the expectance of a win in this analysis. This can be solved in two ways. First, in future research one may want to look at sport events which appear less frequently, to extend the event window to the days before the race. In Formula 1 racing, this is not possible because the next race is sometimes a week after the previous race. Therefore, using an event window which include the days before the race was not possible because then the previous race could influence the abnormal returns of the next race. Second, one could include the betting odds of major sport betting institutions in the regression analysis to control for the expectancy of a win. One limitation of using betting odds is that they change frequently in the days towards the sport event. Consequentially, it difficult to determine which odd to use in the analysis.

The third limitation is that this research only includes one financial measure (the change of stock price). Therefore, it is not possible to compare effectiveness of this financial measure for the evaluation of marketing activities with the effectiveness of other financial measures. One can think of other financial measures such as sales or revenue numbers to evaluate the effectiveness of sport sponsoring. In future research one may want to compare the use of a financial measure such as a change in stock price with a financial measure such as sales numbers. A comparison can show which of the financials measures yields more return. One limitation for such future research is that most sales and revenue numbers of companies are only publicly available on a monthly or yearly basis. One may need more detailed information about those numbers to compare them with the findings of this thesis, for example on weekly basis.

9. References

Aaker, D. A., & Jacobson, R. (1994, May). The Financial Information Content of Perceived Quality. *Journal of Marketing Research, 31*(2), 191-201.

Agrawal, J., & Kamakura, W. A. (1995, July). The Economic Worth of Celebrity Endorsers: An Event Study Analysis. *Journal of Marketing, 59*(3), 56-62.

Aharony, J., & Swary, I. (1980, March). Quarterly Dividend and Earnings Announcements and Stockholders' Returns: An Empirical Analysis. *The Journal of Finance, 35*(1), 1-12.

Allen, J. (2016, April 1). Formula One teams suffer sharp fall in sponsorship income. *Financial Times*.

Allenby, G. M., & Rossi, P. I. (1998, November). Marketing Models of Consumer Heterogeneity. *Journal of Econometrics, 89*(1-2), 57-78.

Anderson, E. W., Fornell, C., & Mazvancheryl, S. K. (2004, October). Customer Satisfaction and Shareholder Value. *Journal of Marketing, 68*(4), 172-185.

Ashton, J. K., Gerrard, B., & Hudson, R. (2003). Economic impact of national sporting success: evidence from the London stock exchange. *Applied Economics Letters, 10*(1), 783-785.

Bernile, G., & Lyandres, E. (2011, June). Understanding Investor Sentiment: The Case of Soccer. *Financial Management, 40*(2), 357-380.

Biswas, D., Biswas, A., & Das, N. (2006, July). The Differential Effects of Celebrity and Expert Endorsements on Consumer Risk Perceptions: The Role of Consumer Knowledge, Perceived Congruency, and Product Technology Orientation. *Journal of Advertising, 35*(2), 17-31.

Bloomberg L.P. (2017, June 27). *Bloomberg Markets*. Retrieved June 27, 2017, from Bloomberg: https://www.bloomberg.com/quote/RNO:FP

Brown, S. J., & Warner, J. B. (1985, March). Using Daily Stock Returns: The Case of Event Studies. *Journal of Financial Economics, 14*(1), 3-31.

Chadwick, S., & Twaithes, D. (2005, September). Managing Sport Sponsorship Programs: Lessons from a Critical Assessment of English Soccer. *Journal of Advertising Research, 45*(3), 328-338.

Chintagunta, P., Jain, D. C., & Vilcassim, N. J. (1991, November). Investigating Heterogeneity in Brand Preferences in Logit Models for Panel Data. *Journal of Marketing Research, 28*(2), 417-428.

Chung, K. Y., Derdenger, T. P., & Srinivasan, K. (2013, March). Economic Value of Celebrity Endorsements: Tiger Woods' Impact on Sales of Nike Golf Balls. *Marketing Science, 32*(2), 271-293.

Cornwell, T. B., Humphreys, M. S., Maguire, A. M., Weeks, C. S., & Tellegen, C. L. (2006, December). Sponsorship-Linked Marketing: The Role of Articulation in Memory. *Journal of Consumer Research, 33*(3), 312-321.

Ding, H., Molchanov, A. E., & Stork, P. A. (2011, June). The Value of Celebrity Endorsements: A Stock Market Perspective. *Marketing Letters, 22*(2), 147-163.

Dyckman, T., Philbrick, D., & Stephan, J. (1984). A Comparison of Event Study Methodologies Using Daily Stock Returns: A Simulation. *Journal of Accounting Research, 22*, 1-30.

Edmans, A., García, D., & Oyvind, N. (2007, August). Sports Sentiment and Stock Returns. *The Journal of Finance*, *62*(4), 1967-1998.

Elberse, A., & Verleun, J. (2012, June). The Economic Value of Celebrity Endorsement. *Journal of Advertising Research, 52*(2), 149-165.

Erdogan, B., Baker, M., & Tagg, S. (2001, May). Selecting Celebrity Endorsers: The Practicioner's Perspective. *Journal of Advertising Research, 41*(3), 39-48.

Fama, E. F. (1970, May). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, *25*(2), 383-417.

Fedyk, A. (2016, September 2). Research: How Investors' Reading Habits Influence Stock Prices. *Havard Business Review*.

Formula One World Championship Limited. (2016, March 25). *Baku will be 'world's fastest' street circuit*. Retrieved from Formula 1: https://www.formula1.com/en/latest/headlines/2016/3/f1-baku-worlds-fastest--street-circuit.html

Formula One World Championship Limited. (2017, March 7). *Formula 1*. Retrieved from Formula 1: https://www.formula1.com/en.html

Formula One World Championship Limited. (2017, March 29). *Formula 1 Results*. Retrieved from Formula 1: https://www.formula1.com/en/results.html/

Friedman, H. H., Termini, S., & Washington, R. (1976, May). The Effectiveness of Advertisements; Utilizing Four Types of Endorsers. *Journal of Advertising, 5*(3), 22-24.

Gupta, S., Lehmann, D. R., & Stuart, J. A. (2004, February). Valuing Customers. *Journal of Marketing Research, 41*(1), 7-18.

Irwin, R. L., Zwick, D., & Sutton, W. A. (1999). Assessing organizational attributes contributing to marketing excellence in American professional sport franchises. *European Journal of Marketing, 33*(3), 314-328.

Joshi, A., & Hanssens, D. M. (2010, January). Stock Market Reactions to Brand Extension Announcements: The Effects of Brand. *Journal of Marketing, 74*(1), 20-33.

Kahneman, D., & Miller, D. T. (1986, April). Norm Theory: Comparing Reality to Its Alternatives. *Psychological Review, 93*(2), 136-153.

Kamakura, W. A., & Russell, G. (1989, November). A Probabilistic Choice Model for Market Segmentation and Elasticity Structure. *Journal of Marketing Research, 26*(1), 379-390.

Kamins, M. A. (1990). An Investigation into the “Match-up” Hypothesis in Celebrity Advertising: When Beauty May Be Only Skin Deep. *Journal of Advertising, 19*(1), 4-13.

Keller, K. L. (1993, January). Conceptualizing, Measuring, and Managing Customer-Based Brand Equity. *Journal of Marketing, 57*(1), 1-22.

Keller, K. L., & Lehmann, D. R. (2006, November). Brands and Branding: Research Findings and Future. *Marketing Science, 25*(6), 740-759.

Lane, V., & Jacobson, R. (1995, January). Stock Market Reactions to Brand Extension Announcements: The Effects of Brand Attitude and Familiarity. *Journal of Marketing, 59*(1), 63-77.

Lehmann, D. R. (2004, October). Metrics for Making Marketing Matter. *Journal of Marketing, 68*(4), 73-75.

Macdonald, A. (2012, Augustus 6). Evidence that Olympic Sponsorship Can Work. *Harvard Business Review.*

MacKinlay, A. C. (1997, March). Event Studies in Economics and Finance. *Journal of Economic Literature, 35*(1), 13-39.

Mathur, L., Mathur, I., & Rangan, N. (1997, May). The Wealth Effects Associated With A Celebrity Endorser: The Michael Jordan Phenomenon. *Journal of Advertising Research*, 67-73.

Medvec, V., Madey, S. F., & Gilovich , T. (1995, October). When Less Is More: Counterfactual Thinking and Satisfaction Among Olympic Medalists. *Journal of Personality and Social Psychology, 69*(4), 603-610.

Meenaghan, T. (1991). The Role of Sponsorship in the Marketing Communications Mix. *International Journal of Advertising, 10*(1), 35-47.

Palomino, F., Renneboog, L., & Zhang, C. (2009, June). Information Salience, Investor Sentiment, and Stock Returns: The Case of British Soccer Betting. *Journal of Corporate Finance, 15*(3), 368-387.

Pauwels, K., Silva-Risso, J., Srinivasan, S., & Hanssens, D. M. (2004, October). New Products, Sales Promotions, and Firm Value: The Case of the Automobile Industry. *Journal of Marketing, 68*(4), 142-156.

Petty, R. E., Cacioppo, J. T., & Schumann, D. (1983, September). Central and Peripheral Routes to Advertising Effectiveness: The Moderating Role of Involvement. *Journal of Consumer Research*, *10*(2), 135-146.

Rao, V. R., Agarwal, M. K., & Dahlhoff, D. (2004, October). How Is Manifest Branding Strategy Related to the Intangible Value of a Corporation? *Journal of Marketing, 68*(4), 126-141.

Smith, C. (2016, December 1). Formula One's Most Valuable Teams. *Forbes*, pp. 1-2.

Srinivasan, S., & Hanssens, D. M. (2009, June). Marketing and Firm Value: Metrics, Methods, Findings, and Future Directions. *Journal of Marketing Research, 46*(3), 293-312.

Srivastava, R. K., Shervani, T. A., & Fahey, L. (1998, January). Market-Based Assets and Shareholder Value: A Framework for Analysis. *Journal of Marketing, 62*(1), 2-18.

Statista. (2017, January). *Global sponsorship spending from 2007 to 2017 (in billion U.S. dollars)*. Retrieved from Statista: https://www.statista.com/statistics/196864/global-sponsorship-spending-since-2007/

Sylt, C. (2016, June 17). US Grand Prix Is F1's Most-Watched Race. *Forbes*.

Till, B. D., & Busler, M. (2000, October). The Match-up Hypothesis: Physical Attractiveness, Expertise, and the Role of Fit on Brand Attitude, Purchase Intent and Brand Beliefs. *Journal of Advertising, 29*(3), 1-13.

10. Appendix

10.1 Selection and classification of sponsors

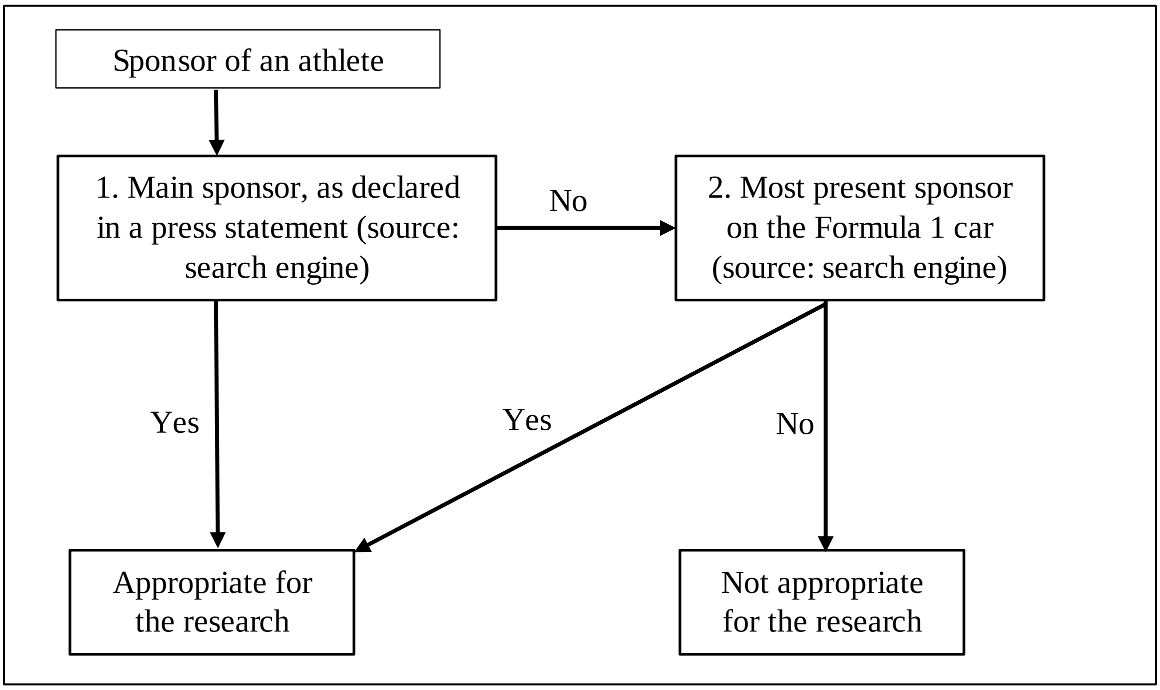

Figure 6: The selection process of appropriate sponsors for the research (following two steps).

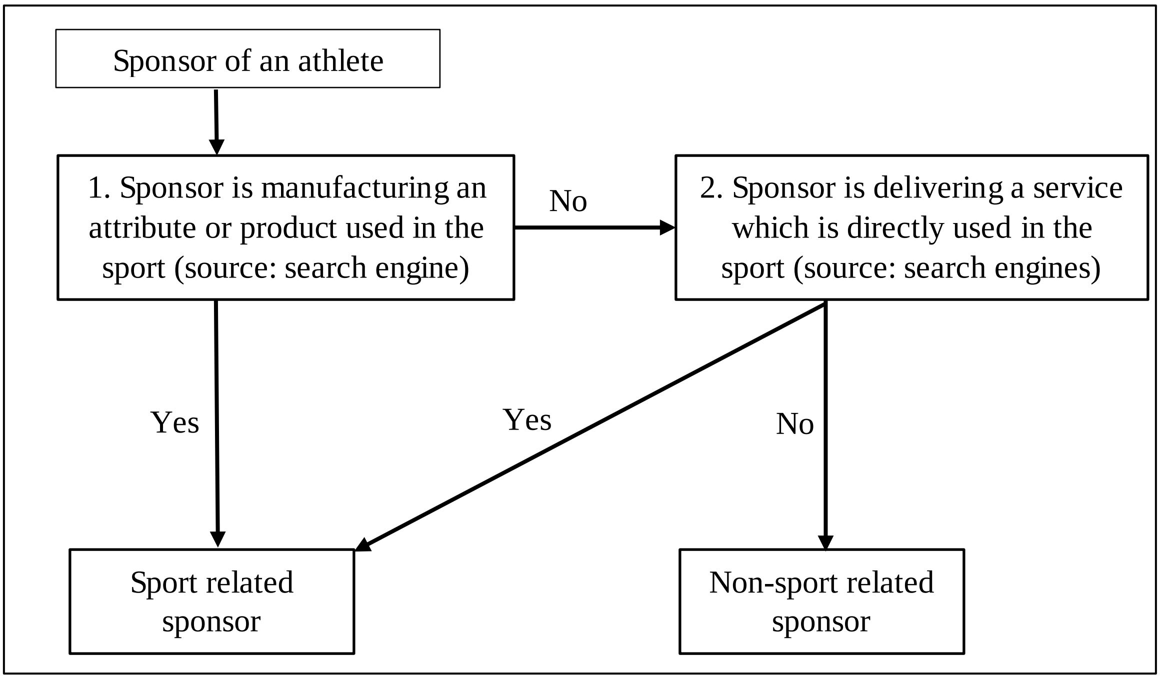

Figure 7: The classification of the (appropriate) sponsors in the categories sport related and non-sport related (following two steps).

10.2 Additional results tables

Event day	AAR	Parametric t-test statistic	P-value	Wilcoxon signed rank test value	P-value	CAAR	% of AR positive
0	0.178%	1.4577	0.1467	1.8148*	0.0696	0.178%	57.5%
+1	0.072%	0.6552	0.5132	0.4448	0.6564	0.250%	47.0%
+2	-0.163%	-1.4455	0.1501	0.6658	0.5055	0.087%	49.7%
+3	-0.080%	-0.7332	0.4644	0.7636	0.4451	0.007%	46.4%
+4	-0.133%	-1.1541	0.2500	0.4803	0.6310	-0.125%	50.8%

*Statistically significant at the 0.1 level

Table 7: The (cumulative) average abnormal returns for 181 performance events in which an athlete finished first, for each event day.

Event window	CAAR	Parametric t-test statistic	P-value	Wilcoxon signed rank test value	P-value
[0,+1]	0.250%	1.4617	0.1456	1.1178	0.2637
[0,+2]	0.087%	0.4216	0.6738	0.3188	0.7499
[0,+3]	0.007%	0.0320	0.9745	0.1955	0.8450
[0,+4]	-0.125%	-0.4924	0.6231	0.4519	0.6513
[+1,+2]	-0.091%	-0.5996	0.5495	0.7339	0.4630
[+1,+3]	-0.171%	-0.9439	0.3465	0.8458	0.3977
[+1,+4]	-0.303%	-1.3947	0.1648	0.9874	0.3234
[+2,+3]	-0.243%	-1.6913*	0.0925	1.4960	0.1346
[+2,+4]	-0.375%	-1.9180*	0.0567	1.4153	0.1570
[+3,+4]	-0.212%	-1.3074	0.1927	1.1574	0.2471

* Statistically significant at the 0.1 level.

Table 8: The cumulative average abnormal returns (CAAR) of 181 performance events in which an athlete finished first, for each possible event window.

Event day	AAR	Parametric t-test statistic	P-value	Wilcoxon signed rank test value	P-value	CAAR	% of AR positive
0	0.134%	1.0633	0.2892	1.2668	0.2052	0.134%	55.2%
+1	0.033%	0.3260	0.7448	0.1400	0.8886	0.167%	47.2%
+2	-0.155%	-1.4135	0.1594	1.2900	0.1971	0.012%	47.2%
+3	-0.060%	-0.4369	0.6628	0.3024	0.7623	-0.048%	49.1%
+4	-0.037%	-0.3242	0.7462	0.4366	0.6624	-0.085%	49.1%

Table 9: The (cumulative) average abnormal returns for 163 performance events in which an athlete finished second, for each event day.

Event window	CAAR	Parametric t-test statistic	P-value	Wilcoxon signed rank test value	P-value
[0,+1]	0.167%	1.0510	0.2948	1.0762	0.2818
[0,+2]	0.012%	0.0600	0.9523	0.0406	0.9676
[0,+3]	-0.048%	-0.2066	0.8366	0.2560	0.7979
[0,+4]	-0.085%	-0.3085	0.7581	0.5940	0.5525
[+1,+2]	-0.122%	-0.8114	0.4183	0.8757	0.3812
[+1,+3]	-0.182%	-0.9264	0.3556	0.8210	0.4116
[+1,+4]	-0.219%	-0.8943	0.3725	0.9337	0.3505
[+2,+3]	-0.215%	-1.3259	0.1867	1.4341	0.1515
[+2,+4]	-0.252%	-1.1702	0.2436	1.3579	0.1745
[+3,+4]	-0.097%	-0.5209	0.6031	0.8144	0.4154

Table 10: The cumulative average abnormal returns (CAAR) of 163 performance events in which an athlete finished second, for each possible event window.

Event day	AAR	Parametric t-test statistic	P-value	Wilcoxon signed rank test value	P-value	CAAR	% of AR positive
0	-0.092%	-0.7303	0.4663	0.3842	0.7008	-0.092%	50.0%
+1	0.165%	1.1093	0.2690	0.0920	0.9267	0.073%	45.5%
+2	-0.243%	-1.7363*	0.0845	1.2699	0.2041	-0.170%	47.4%
+3	-0.038%	-0.3297	0.7421	0.6837	0.4942	-0.207%	46.8%
+4	0.176%	1.4798	0.1410	1.2068	0.2275	-0.031%	52.6%

* Statistically significant at the 0.1 level

Table 11: The (cumulative) average abnormal returns for 154 performance events in which an athlete finished third, for each event day.

Event window	CAAR	Parametric t-test statistic	P-value	Wilcoxon signed rank test value	P-value
[0,+1]	0.073%	0.4037	0.6870	0.1605	0.8725
[0,+2]	-0.170%	-0.6912	0.4905	1.1960	0.2317
[0,+3]	-0.207%	-0.7873	0.4323	1.1581	0.2468
[0,+4]	-0.031%	-0.1035	0.9177	0.4708	0.6378
[+1,+2]	-0.078%	-0.3618	0.7180	0.7973	0.4253
[+1,+3]	-0.116%	-0.4953	0.6211	0.8262	0.4087
[+1,+4]	0.060%	0.2133	0.8314	0.0631	0.9497
[+2,+3]	-0.280%	-1.7473*	0.0826	1.4683	0.1420
[+2,+4]	-0.104%	-0.4778	0.6335	0.5610	0.5748
[+3,+4]	0.138%	0.8310	0.4073	0.1642	0.8696

* Statistically significant at the 0.1 level.

Table 12: The cumulative average abnormal returns (CAAR) of 154 performance events in which an athlete finished third, for each possible event window.

Event day/ event window	Welch's F-test (unequal variances)	ANOVA F-test (equal variances)	Levene's test
	P-value	*P-value*	*P-value*
0	-	0.2713	0.9932
+1	0.7635	-	0.0099
+2	0.8720	-	0.0087
+3	-	0.9702	0.3291
+4	-	0.1630	0.8724
[0,+1]	-	0.7637	0.9097
[0,+2]	-	0.6959	0.5129
[0,+3]	-	0.8101	0.7888
[0,+4]	-	0.9713	0.7633
[+1,+2]	0.9855	-	0.0106
[+1,+3]	-	0.9712	0.4997
[+1,+4]	-	0.5600	0.3185
[+2,+3]	-	0.9581	0.9516
[+2,+4]	-	0.6569	0.9630
[+3,+4]	-	0.3452	0.4000

Table 13: Comparison of the mean of the abnormal returns of an athlete finishing first, second and third.

Event day/ event window	(C)AAR finishing second	(C)AAR finishing first or third	T-test for equal mean with unequal variances *P-value*	T-test for equal mean with variances *P-value*	Levene's test *P-value*
0	0.134%	0.054%	-	0.6014	0.9619
+1	0.033%	0.115%	0.5449	-	0.0622
+2	-0.155%	-0.200%	0.7511	-	0.0191
+3	-0.060%	-0.060%	-	0.9977	0.1368
+4	-0.037%	0.009%	-	0.7461	0.8287
[0,+1]	0.167%	0.169%	-	0.9937	0.6487
[0,+2]	0.012%	-0.031%	-	0.8718	0.5926
[0,+3]	-0.048%	-0.091%	-	0.8830	0.7094
[0,+4]	-0.085%	-0.082%	-	0.9931	0.8988
[+1,+2]	-0.122%	-0.085%	-	0.8609	0.1441
[+1,+3]	-0.182%	-0.145%	-	0.8827	0.6657
[+1,+4]	-0.219%	-0.136%	-	0.7843	0.8304
[+2,+3]	-0.215%	-0.260%	-	0.8126	0.9686
[+2,+4]	-0.252%	-0.251%	-	0.9960	0.8121
[+3,+4]	-0.097%	-0.051%	-	0.8280	0.2812

Table 14: Comparison of the abnormal returns of an athlete finishing second and first or third.

Event day/ event window	(C)AAR finishing first	(C)AAR finishing second	T-test for equal mean with unequal variances *P-value*	T-test for equal mean with variances *P-value*	Levene's test *P-value*
0	0.178%	0.134%	-	0.8042	0.9389
+1	0.072%	0.033%	-	0.7916	0.5464
+2	-0.163%	-0.155%	-	0.9583	0.2527
+3	-0.080%	-0.060%	-	0.9106	0.2304
+4	-0.133%	-0.037%	-	0.5567	0.9483
[0,+1]	0.250%	0.167%	-	0.7225	0.6893
[0,+2]	0.087%	0.012%	-	0.7953	0.9752
[0,+3]	0.007%	-0.048%	-	0.8654	0.9657
[0,+4]	-0.125%	-0.085%	-	0.9145	0.8206
[+1,+2]	-0.091%	-0.122%	-	0.9227	0.9801
[+1,+3]	-0.171%	-0.182%	-	0.9655	0.8932
[+1,+4]	-0.303%	-0.219%	-	0.7982	0.6040
[+2,+3]	-0.243%	-0.215%	-	0.8976	0.9107
[+2,+4]	-0.375%	-0.252%	-	0.6721	0.7855
[+3,+4]	-0.212%	-0.097%	-	0.6416	0.5731

Table 15: Comparison of the abnormal returns of an athlete finishing first and second.

Event day/ event window	(C)AAR finishing first	(C)AAR finishing third	T-test for equal mean with unequal variances *P-value*	T-test equal mean with equal variances *P-value*	Levene's test *P-value*
0	0.178%	-0.092%	-	0.1261	0.9093
+1	0.072%	0.165%	0.6175	-	0.0285
+2	-0.163%	-0.243%	0.6590	-	0.0477
+3	-0.080%	-0.038%	-	0.7916	0.8969
+4	-0.133%	0.176%	-	0.0639	0.6738
[0,+1]	0.250%	0.073%	-	0.4786	0.9833
[0,+2]	0.087%	-0.170%	-	0.4205	0.3300
[0,+3]	0.007%	-0.207%	-	0.5363	0.5705
[0,+4]	-0.125%	-0.031%	-	0.8106	0.4737
[+1,+2]	-0.091%	-0.078%	-	0.9290	0.0138
[+1,+3]	-0.171%	-0.116%	-	0.8508	0.2876
[+1,+4]	-0.303%	0.060%	-	0.3017	0.1390
[+2,+3]	-0.243%	-0.280%	-	0.8612	0.7426
[+2,+4]	-0.375%	-0.104%	-	0.3549	0.8669
[+3,+4]	-0.212%	0.138%	-	0.1343	0.3944

Table 16: Comparison of the abnormal returns of an athlete finishing first and third.

Event day/ event window	(C)AAR finishing second	(C)AAR finishing third	T-test for equal mean with unequal variances *P-value*	T-test for equal mean with equal variances *P-value*	Levene's test *P-value*
0	0.134%	-0.092%	-	0.2058	0.9713
+1	0.033%	0.165%	0.4626	-	0.0047
+2	-0.155%	-0.243%	0.6222	-	0.0025
+3	-0.060%	-0.038%	-	0.9019	0.2045
+4	-0.037%	0.176%	-	0.1975	0.6133
[0,+1]	0.167%	0.073%	-	0.6958	0.7079
[0,+2]	0.012%	-0.170%	-	0.5656	0.3207
[0,+3]	-0.048%	-0.207%	-	0.6486	0.5388
[0,+4]	-0.085%	-0.031%	-	0.8953	0.6308
[+1,+2]	-0.122%	-0.078%	0.8666	-	0.0120
[+1,+3]	-0.182%	-0.116%	-	0.8274	0.3715
[+1,+4]	-0.219%	0.060%	-	0.4541	0.3490
[+2,+3]	-0.215%	-0.280%	-	0.7745	0.8498
[+2,+4]	-0.252%	-0.104%	-	0.6306	0.9223
[+3,+4]	-0.097%	0.138%	-	0.3488	0.1868

Table 17: Comparison of the abnormal returns of an athlete finishing second and third.

Event day/ event window	(C)AAR sport related	(C)AAR non-sport related	T-test for equal mean with unequal variances *P-value*	T-test for equal mean with variances *P-value*	Levene's test *P-value*
0	0.052%	0.113%	-	0.6722	0.0707
+1	0.015%	0.172%	-	0.2570	0.1467
+2	-0.307%	-0.046%	0.0567	-	0.0120
+3	0.040%	-0.175%	-	0.1204	0.9267
+4	0.005%	-0.018%	-	0.8684	0.8438
[0,+1]	0.066%	0.285%	-	0.2686	0.2022
[0,+2]	-0.240%	0.239%	-	0.0557	0.0874
[0,+3]	-0.200%	0.064%	-	0.3424	0.0865
[0,+4]	-0.196%	0.046%	-	0.4491	0.1616
[+1,+2]	-0.292%	0.126%	0.0346	-	0.0444
[+1,+3]	-0.252%	-0.049%	-	0.3868	0.1030
[+1,+4]	-0.247%	-0.067%	-	0.5280	0.2034
[+2,+3]	-0.267%	-0.221%	0.7984	-	0.0363
[+2,+4]	-0.262%	-0.239%	-	0.9237	0.2576
[+3,+4]	0.045%	-0.193%	-	0.2315	0.6303

Table 18: Comparison of the abnormal returns of sport related and non-sport related sponsors.

Event date/ event window	Chi-square statistic	P-value
+2	2.1060	0.9537
[0,+1]	3.8066	0.8018
[+2,+3]	3.2176	0.8642
[+2,+4]	8.9584	0.2557

Table 19: The Hausman test results for each of the significant event dates and event windows.

Independent variable	VIF
Sport related	1.00429
Second	1.00328
World title	1.00663
2012	1.69353
2013	1.66247
2014	1.75398
2015	1.66926
2016	1.67932

Table 20: Variance inflation factor for each of the independent variables and control variables.

Independent variable	AR at event day +3	CAR in event window [0,+1]	CAR in event window [+2,+3]	CAR in event window [+2,+3]
Sport related	-0.084	-0.050	-0.011	-0.004
Second	0.014	0.000	0.011	0.000
World title	0.017	-0.020	0.041	-0.013
2012	0.030	-0.050	0.011	0.032
2013	-0.012	0.035	0.004	-0.051
2014	0.007	-0.051	-0.043	-0.040
2015	-0.092	-0.057	-0.057	-0.022
2016	0.026	0.009	0.030	0.079

Table 21: The correlation between independent variables and the dependent variables used in the regression.

	Abnormal returns on day +2		CAAR [0,+1]		CAAR [+2,+3]		CAAR [+2,+4]	
	Beta coefficient	*T-statistic*	*Beta coefficient*	*T-statistic*	*Beta coefficient*	*T-statistic*	*Beta coefficient*	*T-statistic*
C	0.00009	0.0821	0.00558	3.1524***	-0.00144	-1.1059	-0.00279	-1.2704
Sport related	-0.00253	-1.8146*	-0.00227	-1.1475	-	-	-	-
Second	-	-	-	-	-	-	-	-
World title	-	-	-	-	-	-	-	-
2012	-	-	-0.00517	-1.8831*	-	-	-	-
2013	-	-	-	-	-	-	-	-
2014	-	-	-0.00510	-1.8880*	-0.00289	-1.1914	-	-
2015	-0.00381	-1.9823**	-0.00553	-1.9258*	-0.00354	-1.3526	-	-
2016	-	-	-	-	-	-	0.00558	1.6580*
Observations	498		498		498		498	
Adjusted R^2	0.01100		0.00886		0.00133		0.00348	

***Statistically significant at the 0.01 level.
** Statistically significant at the 0.05 level.
*Statistically significant at the 0.1 level

Table 22: The random effects models with the highest possible adjusted R^2, for the significant event day and significant event windows.